National MATHEMATICS Textbook

Grade 5

Papua New Guinea
Department of Education

From
the People of Japan

JICA

QUIS-ME

'FREE ISSUE
NOT FOR SALE'

Issued free to schools by the Department of Education

First Edition

Published in 2020 by the Department of Education, Papua New Guinea.

ISBN 978-9980-905-11-6

Acknowledgements

The Grade 5 National Mathematics Textbook was developed by the Curriculum Development Division in partnership with the Mathematics specialists from Japan through the **Project for Improving the Quality of Mathematics and Science Education** known as **QUIS-ME Project**.

The Mathematics curriculum officers, textbook writers, pilot teachers from NCD and Central Provinces and the Subject Curriculum Group (SCG) are acknowledged for their contribution in writing, piloting and validating this textbook.

The Curriculum Panel (CP) members, members of the Subject Advisory Committee (SAC) and the Basic Education Board of Studies (BEBoS) are also acknowledged for their advice, recommendation and endorsement of this Textbook.

A special acknowledgement is given to the People and the Government of Japan for the partnership and support in funding and expertise through Japan International Cooperation Agency (JICA) - QUIS-ME Project with Curriculum Development Division (CDD).

National Mathematics Textbook

Grade 5

Papua New Guinea
Department of Education

From
the People of Japan

Minister's Message

Dear Grade 5 Students,

I am honoured to give my message in this National Mathematics Textbook.

The Government of Papua New Guinea through The Department of Education has been working to improve students' learning of Mathematics. This textbook was developed by our dedicated Curriculum Officers, Textbook Writers and Pilot Teachers, who have worked collaboratively with Japanese Math specialists for three years. This is the best textbook for grade 5 students in Papua New Guinea and is comparable to international standards. In its development I would like to thank the Government of Japan for its support in improving the quality of learning for the children of Papua New Guinea.

I am excited about this textbook because it covers all topics necessary for learning in grade 5. You will find many photographs, illustrations, charts and diagrams that are interesting and exciting for learning. I hope they will motivate you to explore more about Mathematics.

Students, Mathematics is a very important subject. It is also very interesting and enjoyable to learn. Do you know why? Because mathematics is everywhere in our lives. You will use your knowledge and skills of Mathematics to calculate cost, to find time, distance, weight, area and many more. In addition, Mathematics will help you to develop your thinking skills, such as how to solve problems using a step-by-step process.

I encourage you to be committed, enjoy and love mathematics, because one day in the future you will be a very important person, participating in developing and looking after this very beautiful country of ours and improving the quality of living.

I wish you a happy and fun learning experience with Mathematics.

Hon. Joseph Yopyyopy, MP

Minister of Education

Message from the Amassador of Japan

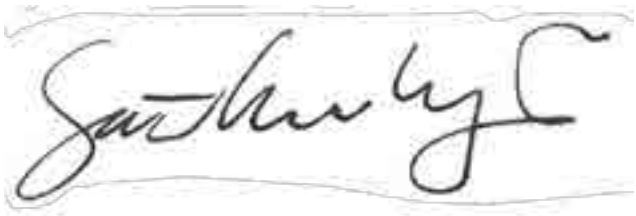
Greetings to Grade 5 Students of Papua New Guinea!

It is a great pleasure that the Department of Education of Papua New Guinea and the Government of Japan worked together to publish national textbooks on mathematics for the first time.

The officers of the Curriculum Development Division of the Department of Education made full efforts to publish this textbook with Japanese math experts. To be good at mathematics, you need to keep studying with this textbook. In this textbook, you will learn many things about mathematics with a lot of fun and interest and you will find it useful in your daily life. This textbook is made not only for you but also for the future students.

You will be able to think much better and smarter if you gain more knowledge on numbers and diagrams through learning mathematics. I hope that this textbook will enable you to enjoy learning mathematics and enrich your life from now on. Papua New Guinea has a big national land with plenty of natural resources and a great chance for a better life and progress. I hope that each of you will make full use of knowledge you obtained and play an important role in realising such potential.

I am honoured that, through the publication of this textbook, Japan helped your country develop mathematics education and improve your ability, which is essential for the future of Papua New Guinea. I sincerely hope that, through the teamwork between your country and Japan, our friendship will last forever.



Satoshi Nakajima

Ambassador of Japan to Papua New Guinea

Mathematics

Share ideas with your friend!

Let's learn Mathematics, it's fun!

Secretary's Message

Dear students,

This is your Mathematics Textbook that you will use in Grade 5. It contains very interesting and enjoyable activities that you will be learning in your daily Mathematics lessons.

In our everyday lives, we come across many Mathematical related situations such as buying and selling, making and comparing shapes and their sizes, travelling distances with time and cost and many more. These situations require mathematical thinking processes and strategies to be used.

This textbook provides you with a variety of mathematical activities and ideas that are interactive that will allow you to learn with your teacher or on your own as an independent learner. The key concepts for each topic are highlighted in the summary notes at the end of each chapter. The mathematical skills and processes are expected to be used as learning tools to understand the concepts given in each unit or topic and apply these in solving problems.

You are encouraged to be like a young Mathematician who learns and is competent in solving problems and issues that are happening in the world today. You are also encouraged to practice what you learn everyday both in school and at home with your family and friends.

I commend this Grade 5 National Mathematics Textbook as the official textbook for all Grade 5 students for their Mathematics lessons throughout Papua New Guinea.

I wish you all the best in studying Mathematics using this textbook.

Dr. Uke Kombra, PhD
Secretary for Education

Friends learning together in this textbook


Mero


Naiko


Sare


Gawi


Kapi
(Kapul)


Kekeni

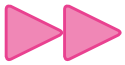

Ambai


Vavi


Yamo


Koko
(Kokomo)

Symbols in this textbook



- Ice breaking activity as the lead up activity for the chapter.

- Discovered important ideas.

- Important definition or terms.

- What we will do in the next activity?

- When you lose your way, refer to the page number given.

- You can use your calculator here.

- Practice by yourself. Fill in your copy.

- New knowledge to apply in daily life.

- Let's do the exercise.

- Let's do mathematical activities by students.

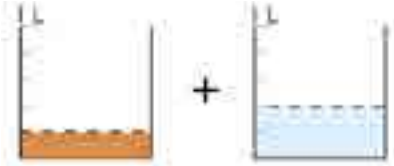
$6 = \square \times \square$

- Let's fill numbers in and complete the expression to get the page number.

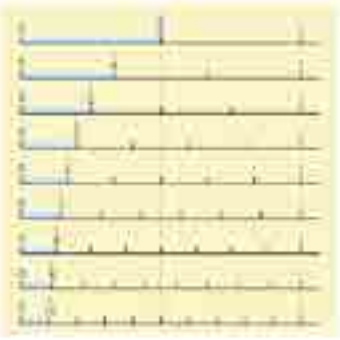
What We Learned in Grade 4

The sum of 1 L and $\frac{1}{3}$ L is written as $1\frac{1}{3}$ L and is read as "one and one third litres".
It is also written as $\frac{4}{3}$ L and is read as "four thirds litres" or "four over three litres".

$1\frac{1}{3}=\frac{4}{3}$



$\frac{1}{5}+\frac{2}{5}=$



Decimal Numbers

How to Multiply 2.3×4 in Vertical Form

$2.3 \times 4 \rightarrow 2.3 \times 4 \rightarrow 2.3 \times 4 \rightarrow 2.3 \times 4 = 9.2$

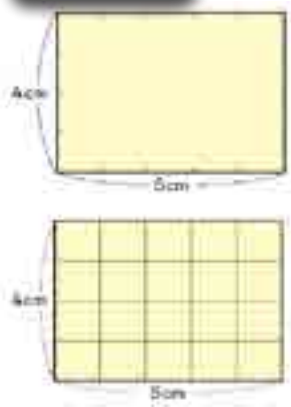
Line up 3 and 4.

Multiply in the same way as with multiplication for whole numbers.

Number of digits after the decimal point is 1.
Number of digits after the decimal point is 1.

Put the decimal point of the product in the same place as the decimal of the multiplicand.

Area



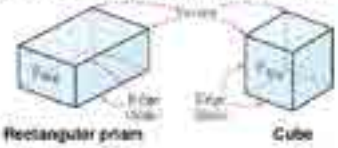
The area of a square with 1 cm sides is called **one square centimetre** and is written as 1 cm^2. The unit cm^2 is a unit of area.

$1cm^2$

The area of any rectangle is expressed as
Area of a rectangle = length × width.
This mathematical sentence like this is called a **formula.**
The area of a rectangle is also expressed as **width × length.**

Rectangular Prisms & Cubes

A shape covered only by rectangles or by squares and rectangles is called **rectangular prism.**
A shape covered only by squares is called **cube.**



A flat face like the faces of a rectangular prism and cube is called plane.

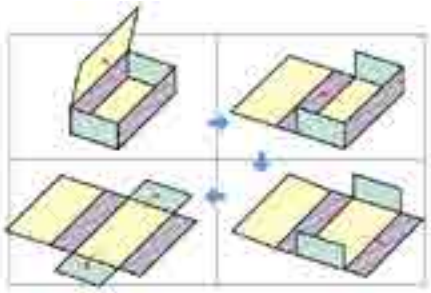
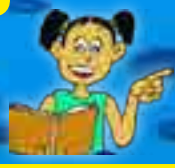


Table of Contents

Number and Operation

Geometric Figures



Grade 6

(1) Symmetry
(2) Mathematical Letters and Expressions
(3) Multiplication of Fractions
(4) Division of Fractions
(5) Multiples and Rates
(6) Operation of Decimals and Fractions
(7) Calculating the Area of Various Figures
(8) Orders and Combinations
(9) Speed
(10) Volume
(11) Ratio and its Application
(12) Enlargement and Reduction of Figures
(13) Proportion and Inverse Proportion
(14) How to Explore Data
(15) Quantity and Unit
(16) Summary of Grade 3 to Grade 6 Mathematics

Measurement

Data and Mathematical Relations

Grade 4

(1) Large Numbers
(2) Division
(3) Thinking about How to Calculate
(4) Angles
(5) Division by 1-digit Numbers
(6) Quadrilaterals
(7) Division by 2-digit Numbers
(8) Line Graph
(9) Decimal Numbers 1
(10) Round Numbers
(11) Expressions and Calculations
(12) Area
(13) Decimal Numbers 2
(14) Thinking about How to Calculate
(15) Arrangement of Data
(16) Multiplication and Division of Decimal Numbers
(17) Fractions
(18) Rectangular Prisms and Cubes
(19) Quantities Change Together
(20) Summary of Grade 4

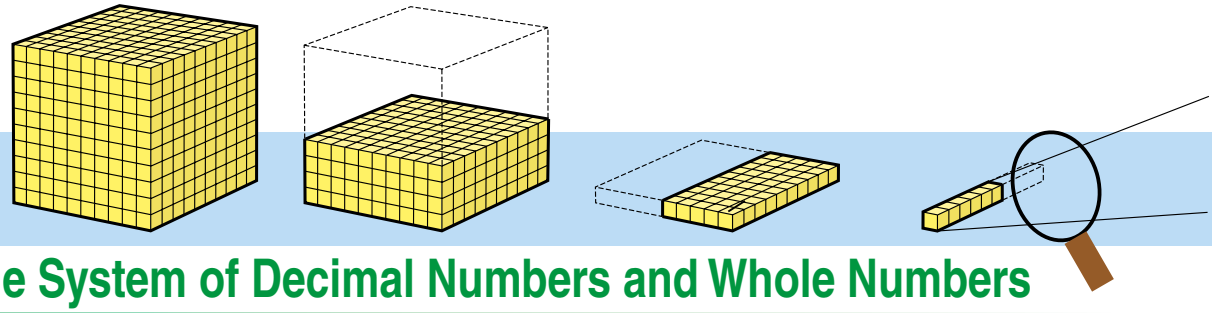
1 Decimal Numbers and Whole Numbers

Simbu Province

The altitude of Kundiawa town is 1456 m above sea level.

1456 m

One set of ☐ | ☐ sets of ☐ | Five sets of ☐ | ☐ sets of ☐



1 The System of Decimal Numbers and Whole Numbers

1 Let's compare the two numbers in the pictures, 1456 and 1.456

1. Fill the ☐ with set of numbers as above.
2. Look at the pictures of the blocks and discuss what you have noticed with your friends.
3. Express each number by the expressions as shown below.

$1456 = 1000 + 400 + 50 + 6$

$= 1000 \times \square + 100 \times \square + 10 \times \square + 1 \times \square$

$1.456 = 1 + 0.4 + 0.05 + 0.006$

$= 1 \times \square + 0.1 \times \square + 0.01 \times \square + 0.001 \times \square$

We can say that 1.456 is made up from ☐ set of 1, ☐ sets of $\frac{1}{10}$, ☐ sets of $\frac{1}{100}$ and ☐ sets of $\frac{1}{1000}$.

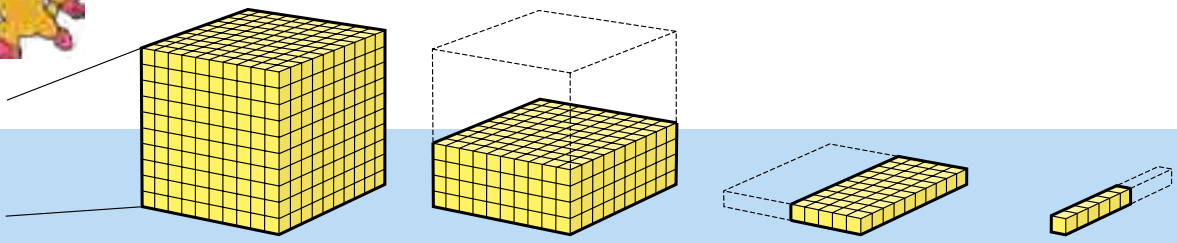
Ambai

The length of the laplap (material) is 1.456 m.

Let's enlarge to see one piece of a block!

1.456 m

One set of ☐ | Four sets of ☐ | ☐ sets of ☐ | 6 sets of ☐



4 Write each number in the table below.

Place Value Table

					$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
	Thousands	Hundreds	Tens	Ones	Tenths	Hundredths	Thousandths
Altitude of Kundiawa							m
Length of laplap							m

5 Compare the systems of decimal numbers and whole numbers and discuss what you have noticed with your friends.

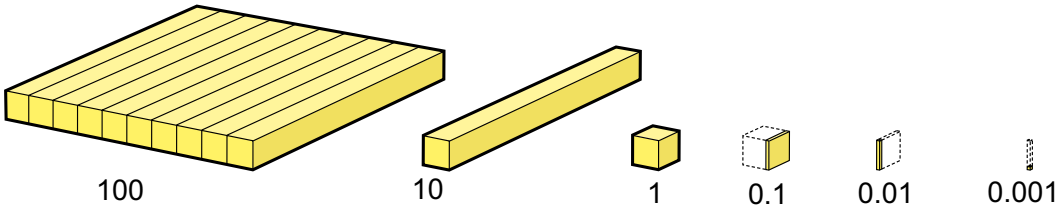
The systems are similar to each other.

Gawi

For both systems, when there are 10 sets in a place…

Kekeni

2 Let's think about the system of numbers.



1. For whole numbers, how many numbers are needed in a place for it to shift to the next higher place? Also, how many equal parts must a number be divided for it to shift to the next lower place?
2. For decimal numbers, how many numbers are needed in a place for it to shift to the next higher place? Also, how many equal parts must a number be divided for it to shift to the next lower place?

For both whole and decimal numbers, a number is shifted to the next higher places when multiplied by 10 in every place and a number is shifted to the next lower places when it is divided by 10 (multiplied by $\frac{1}{10}$). This is the basic idea of the place value system.
By using the place value system, any whole or decimal number can be expressed using the ten digits 0, 1, 2, …, 9 and a decimal point.

3 Let's compare the calculations 132 + 47 and 1.32 + 4.7

132 + 47 is a calcualtion of whole numbers in vertical form as shown below.

$$\begin{array}{r} 132 \\ +\ 47 \\ \hline \end{array}$$

Similarly, 1.32 + 4.7 can be calculated in vertical form.

$$\begin{array}{r} 1.3\ 2 \\ +\ 4.7 \\ \hline \end{array}$$

Yamo

I think, this calculation is wrong. Because...

Mero

What do you think of Yamo's way of calculating? Explain your opinions to your friends.

Exercise

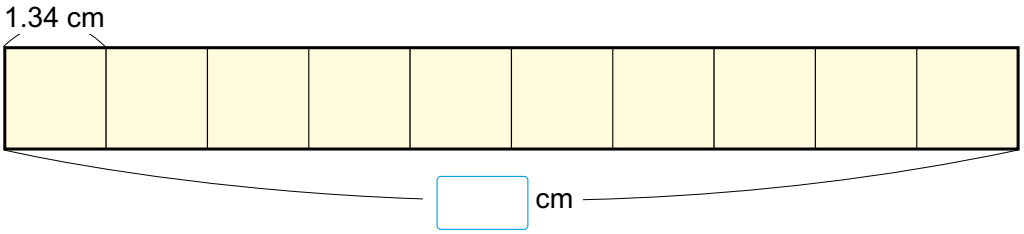
Let's make numbers using the ten digits from 0 to 9 once each time and a decimal point.

Write the smallest number. Write a number that is smaller than 1 and is nearest to 1.

10 Times and 100 Times of a Number

4 Let's consider numbers multiplied by 10 and 100.

1 There are 10 stickers, each one is 1.34 cm wide and are lined up as shown below. How many centimetres (cm) is the total length?



Just add ten of 1.34 together.

Kekeni

It's a lot of work to do repeated addition of 1.34 ten times.

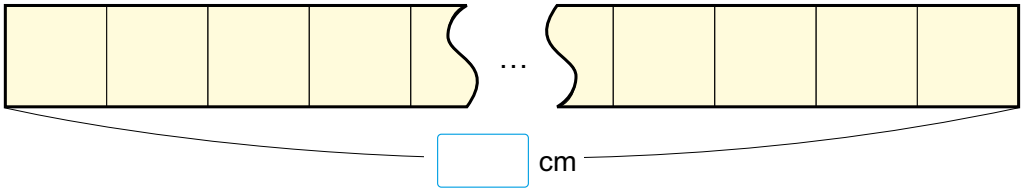
Sare

Vavi's Idea

It is ten times of 1.34, so we can solve it by doing $1.34 \times 10 =$ ☐.

$$\begin{array}{r} 1.34 \\ \times \quad 10 \\ \hline \end{array}$$

2 There are 100 stickers, each one is 1.34 cm wide and are lined up. How many cm is the total length?



3 Write the total lengths when there are 10 stickers and 100 stickers in the table below.

			$\frac{1}{10}$	$\frac{1}{100}$
Hundreds	Tens	Ones	Tenths	Hundredths
		1	3	4

times 10
10 times of 1.34

times 10
100 times of 1.34

× 10

× 100

4 What rules are there?

5 Write in the decimal points when 1.34 is multiplied by 10 and 100.

1 . 3 4

1 □ 3 □ 4 □

1 □ 3 □ 4 □

× 10

× 100

If a number is multiplied by 10, the decimal point moves 1 place to the right.
If a number is multiplied by 100, the decimal point moves to 2 places to the right.

Exercise

Let's answer the following questions.

① Write the numbers when 23.47 is multiplied by 10 and 100.

② How many times of 8.72 are 87.2 and 872?

$\frac{1}{10}$ and $\frac{1}{100}$ of a Number

5 Let's consider the numbers that are $\frac{1}{10}$ and $\frac{1}{100}$ of a number.

① Calculate $\frac{1}{10}$ and $\frac{1}{100}$ of 296 and write the answers in the table below.

$\frac{1}{10}$ of 296 → $\frac{1}{10}$
$\frac{1}{100}$ of 296 → $\frac{1}{10}$

Hundreds	Tens	Ones	$\frac{1}{10}$	$\frac{1}{100}$
2	9	6		

$\frac{1}{10}$, $\frac{1}{100}$

$\frac{1}{10}$ of 296 is as follows:
$\frac{1}{10}$ of 200 is 20
$\frac{1}{10}$ of 90 is 9
$\frac{1}{10}$ of 6 is 0.6
20 + 9 + 0.6 = 29.6
then, $\frac{1}{10}$ of 296 is 29.6

② What rules are there?

③ Write the decimal points of numbers that are $\frac{1}{10}$ and $\frac{1}{100}$ of 296 in the ☐ below.

$\frac{1}{10}$, $\frac{1}{10}$

2 9 6
2☐9☐6☐
2☐9☐6

$\frac{1}{10}$, $\frac{1}{100}$

$\frac{1}{10}$ of a number moves the decimal point 1 place to the left.
$\frac{1}{100}$ of a number moves the decimal point 2 places to the left.

Exercise

Let's answer the following questions.

① Write the numbers that are $\frac{1}{10}$ and $\frac{1}{100}$ of 30.84

② What are 6.32 and 0.632 as a multiple of 63.2?

EXERCISE

1 Let's fill the ☐ with numbers. Page 2

① 86.1 = ☐ × 8 + ☐ × 6 + ☐ × 1

② 0.0072 = ☐ × 7 + ☐ × 2

2 Let's summarise the common features with both decimal numbers and whole numbers. Page 4

① For both whole numbers and decimal numbers, when there are ☐ sets of a number, it is shifted one place higher.
When a number is divided into ☐ parts, it is shifted one place lower. Whole and decimal numbers are both, based on the place value system.

② Any whole or decimal number can be expressed by using the ☐ digits from 0 to 9 and a decimal point. Pages 6 and 7

3 Let's write numbers that are 10 times and 100 times of 36.05 and numbers that are $\frac{1}{10}$ and $\frac{1}{100}$ of 36.05

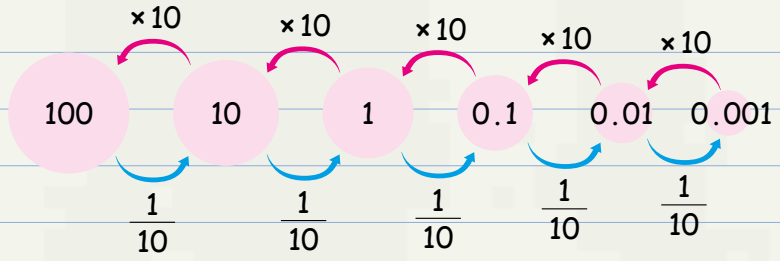
Summarise what you have learned on your exercise book.

Red and blue arrows are used to show what we've understood.

1. Decimal numbers and whole numbers

(1) What I understood.

For both whole numbers and decimal numbers, when there are 10 sets of a number, it is shifted to the next higher place value.



(2) Some interesting facts.

A number that is 10 times or $\frac{1}{10}$ of a number can be made by moving a decimal point.

10 times 1.34 is 13.4 and $\frac{1}{10}$ of 1.34 is 0.134

PROBLEMS 1

1 Express the following quantities by using the units written in the ( ).

● Changing denominations by using decimal numbers.

① 8695 g (kg)　② 320 mL (L)　③ 3.67 km (m)　④ 67.2 m (cm)

2 Let's answer the following questions.

● Understands numbers that are 10 times, 10 es, $\frac{1}{10}$, $\frac{1}{100}$ of a number.

① Times 0.825 by 10.　② Times 5.67 by 100.

③ $\frac{1}{10}$ of 72.3　④ $\frac{1}{100}$ of 45.2

3 Let's find given numbers.

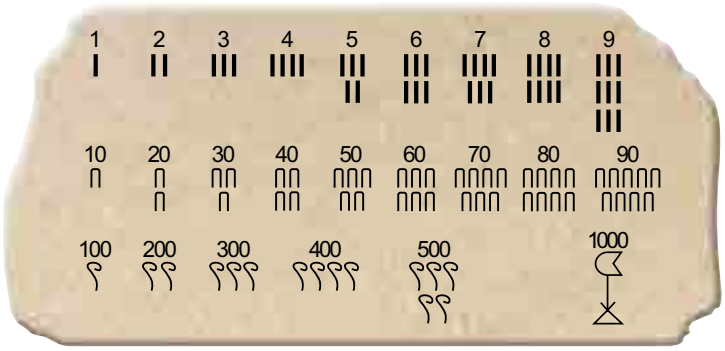
● Understands the relationship between decimal numbers and times 10, times 100, $\frac{1}{10}$ and $\frac{1}{100}$.

① When a given number was multiplied by 10 and further multiplied by 100, it became 307.4

② When a given number was multiplied by 100 and further divided by $\frac{1}{10}$, it became 20.5

③ When a given number was divided by $\frac{1}{10}$ and further divided by $\frac{1}{100}$, it became 0.175

PROBLEMS 2



Egyptian numeral system

1 When 176 is expressed in Egyptian numerals, it is as written below.

● Able to investigate the system of whole numbers.

① Write  as a whole number.

② Let's compare the way of Egyptian numeral to the way you have learned to express numbers and write them down.

③ Let's calculate $\begin{array}{r} 176 \\ +\ 244 \\ \hline \end{array}$ in Egyptian numerals.

3 Multiplication of Decimal Numbers

1 Operation of Whole Numbers × Decimal Numbers

Moris is thinking about wrapping a present box with a ribbon around it. He needs 2.4 m of ribbon.

1 The price of the ribbon is 80 toea per 1 m.
Let's find out how much it would cost for 2.4 m.

1 Draw a number line with a tape diagram.

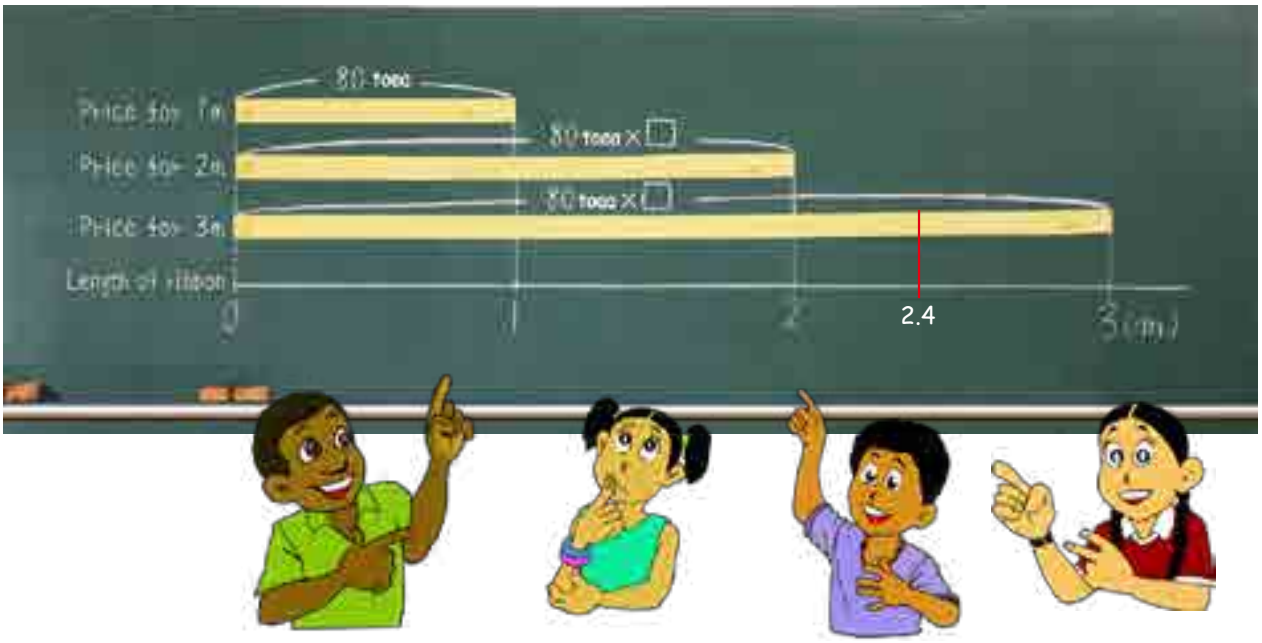
2 Write a mathematical expression.

Price (toea)	80	?
Length of ribbon (m)	1	2.4

× □ (above the table)
×2.4 (below the table)

Expression: ☐

3 Approximately, how much would the cost be?



It's more expensive than the price for 2 m and cheaper than the price for 3 m, so it would be around 200 toea (K2).

It should be less than the price between 160 toea (K1.60) and 240 toea (K2.40).

2.4 m is about a half of 5 m and 5 m costs 400 toea (K4), so half of it would be around K2.

As shown with the length of the ribbon, when the multiplier is a decimal number instead of a whole number, the expression is the same as for multiplication of whole numbers.

4 Let's think about how to calculate.

Activity

5 Let's explain the ideas below.

Kekeni's Idea

Firstly, I thought about the price of 0.1 m.

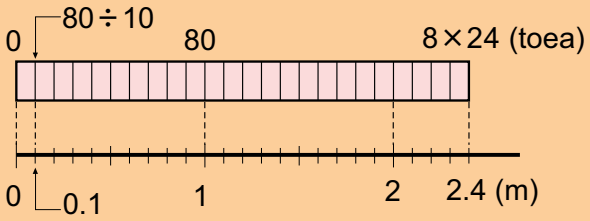
1 m = 80 toea

Price of 0.1 m $80 \div 10 = 8$ (toea)

2.4 m is 24 of 0.1 m, so,

Price of 2.4 m

$8 \times$ ☐ = ☐ (toea)



		$\frac{1}{10}$	× ☐
Price (toea)	80	8	?
Length (m)	1	0.1	2.4
		$\frac{1}{10}$	× 24

Vavi's Idea

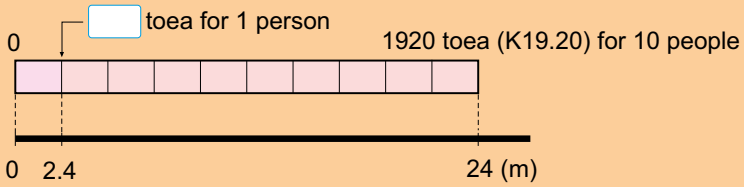
I used the rules of multiplication for multiplying by whole numbers.

Suppose 2.4 m is needed to wrap 1 box, then 24 m is needed for wrapping 10 boxes.

Cost for 1 ribbon $80 \times 2.4 =$ ☐

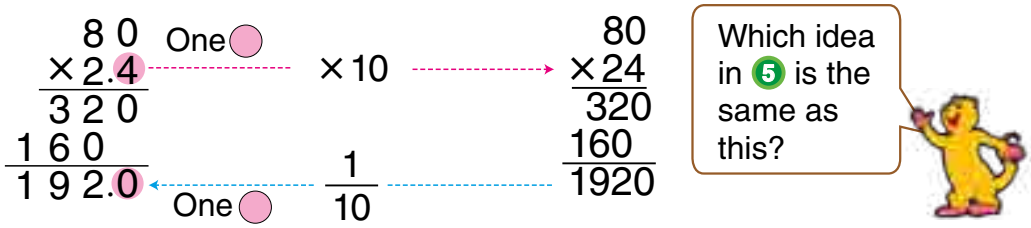
× 10 ↓ ↑ $\frac{1}{10}$

Cost for 10 ribbons $80 \times 24 = 1920$



× 10 means 10 times and $\frac{1}{10}$ means $\frac{1}{10}$ of a number.

6 Let's explain how to multiply 80×2.4 in vertical form.



Which idea in 5 is the same as this?

Multiplicaiton Algorithm of Decimal Numbers in Vertical Form

① We ignore the decimal points and calculate as whole numbers.

② We put the decimal point of the product in the same position from the right as the decimal point of the multiplier.

$$\begin{array}{r} 80 \\ \times\ 2.4 \\ \hline 320 \\ 160 \\ \hline 192.0 \end{array}$$

…Number of digits after the decimal point is 1.

…Number of digits after the decimal point is 1.

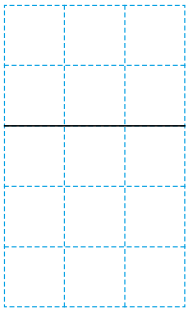
2 What is the area in m² of a rectangular flowerbed that is 3 m wide and 2.5 m long?

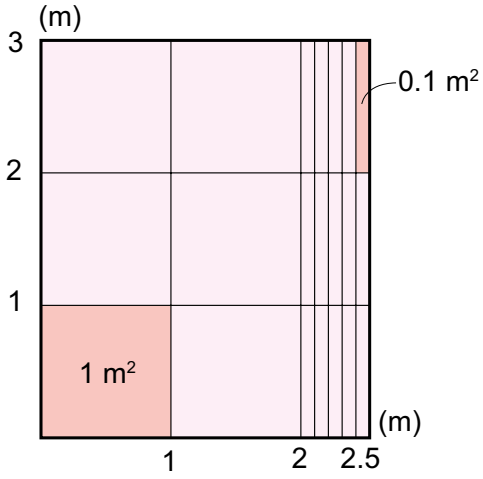
1 Write a mathematical expression.

2 Approximately what is the area in m²?

I am thinking it should be greater than 3×2=6 m².

3 Calculate the answer in vertical form.





6 of 1 m² is ☐ m²

15 of 0.1 m² is ☐ m²

Total ☐ m²

Exercise

Let's multiply in vertical form.

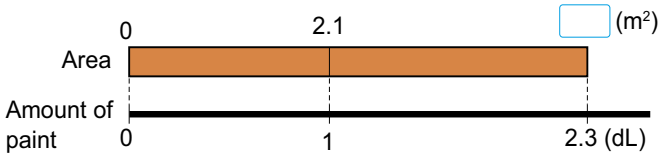
① 60×4.7　② 50×3.9　③ 7×1.6

④ 6×2.7　⑤ 24×3.3　⑥ 13×2.8

2 Operation of Decimal Numbers × Decimal Numbers

1 Hiro can paint 2.1 m² of wall with 1 dL paint. How many m² of wall can he paint with 2.3 dL?

1 Let's draw a tape diagram and then write a mathematical expression.



Area able to paint (m²)	2.1	?
Amount of paint (dL)	1	2.3

× □ (above the table)
×2.3 (below the table)

Mathematical expression. □ × □

□: Area able to paint with 1 dL
□: Amount of paint (dL)

2 Let's think about how to calculate.

Sare's Idea

We learned how to calculate (Decimal number) × (Whole number), thus using the rule of multiplication.

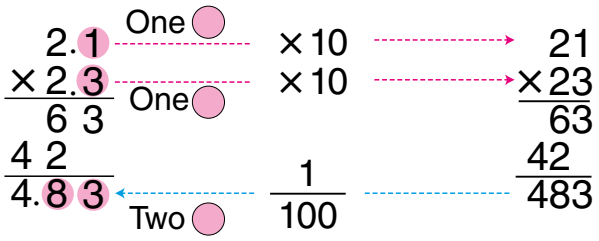
2.1 × 2.3 = □
× 10 ↓, ↑ $\frac{1}{10}$
2.1 × 23 = □

Yamo's Idea

Then, it's better to change it into (Whole number) × (Whole number).

2.1 × 2.3 = □
× 10 ↓, × 10 ↓, ↑ $\frac{1}{100}$
21 × 23 = □

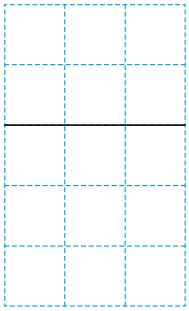
③ Let's explain how to multiply 2.1×2.3 in vertical form.

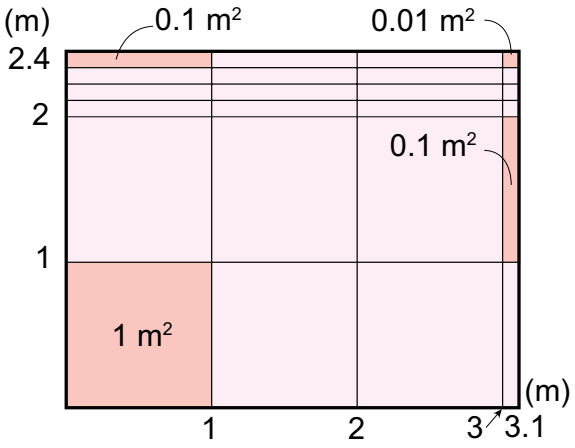


2 What is the area in m² of a rectangular flowerbed that is 2.4 m wide and 3.1 m long?

① Let's write a mathematical expression.

② Let's multiply in vertical form.





6 of 1 m² is ☐ m²

14 of 0.1 m² is ☐ m²

4 of 0.01 m² is ☐ m²

Total ☐ m²

The area of rectangles can be calculated by using the formula even if the lengths of the sides are decimal numbers.

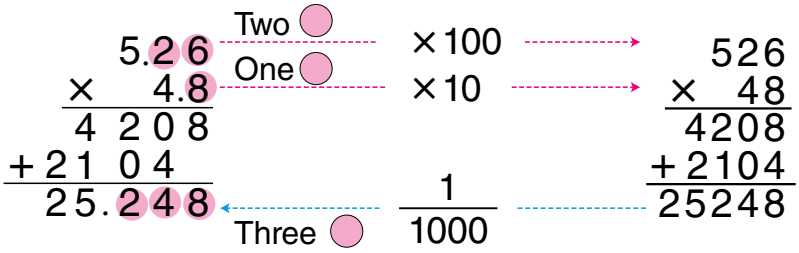
Exercise

Let's multiply in vertical form.

① 1.2×2.4　② 8.6×1.3　③ 6.4×3.5

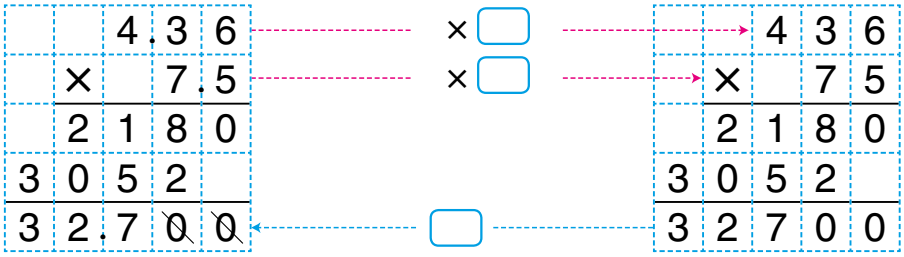
④ 2.5×2.8　⑤ 0.2×1.6　⑥ 0.8×2.5

3 Let's think about how to multiply 5.26×4.8 in vertical form.



When multiplying in vertical form, place the decimal point on the product by adding the number of digits after the decimal point of the multiplicand and the multiplier and count from the right end of the product.

4 Let's think about how to multiply 4.36×7.5



5 Let's put decimal points on the products for the following calculations.

① 5.6 × 4.3 = 2408

② 3.27 × 1.2 = 3924

③ 1.48 × 2.5 = 3700

Exercise

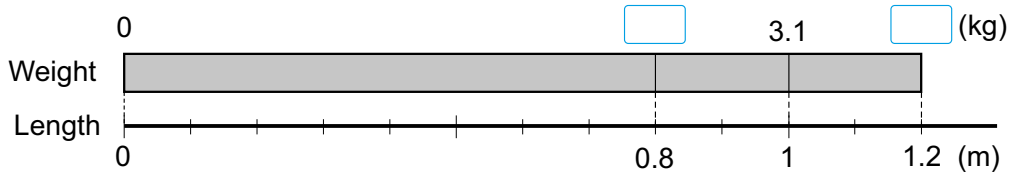
Let's multiply in vertical form.

① 3.14×2.6 ② 4.08×3.2 ③ 7.24×7.5

④ 1.4×4.87 ⑤ 4.8×2.87 ⑥ 8.2×2.25

Multiplication of Decimal Numbers Smaller than 1

6 There is a metal bar that weighs 3.1 kg per metre.
What is the weight of 1.2 m and 0.8 m of this bar respectively?



Weight (kg)	?	3.1	?
Length (m)	0.8	1	1.2

× ☐ (0.8) × ☐ (1.2)

$$\begin{array}{r} 3.1 \\ \times\ 1.2 \\ \hline \end{array}$$

1. Let's find the weight of 1.2 m metal bar.
2. Let's find the weight of 0.8 m metal bar.
3. Let's compare the sizes of the products and the multiplicands.

When the multiplier is a decimal number smaller than 1, the product becomes smaller than the multiplicand.
If the multiplier is a decimal number larger than 1,
Multiplicand < Product.
If the multiplier is a decimal number less than 1,
Multiplicand > Product.

7 Put decimal points on the products and compare the products and the multiplicands.

1. $\begin{array}{r} 25 \\ \times\ 6 \\ \hline 150 \end{array}$ $\begin{array}{r} 25 \\ \times\ 0.6 \\ \hline 150 \end{array}$

2. $\begin{array}{r} 0.25 \\ \times\ 6 \\ \hline 150 \end{array}$ $\begin{array}{r} 0.25 \\ \times\ 0.6 \\ \hline 150 \end{array}$

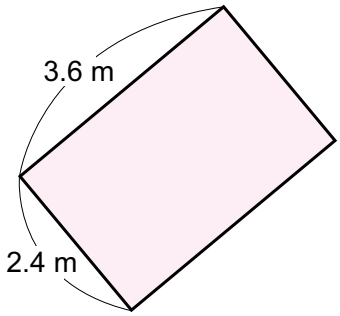
Exercise

Let's multiply in vertical form.

① 4.2×0.7 ② 6.8×0.4 ③ 0.8×0.3
④ 2.17×0.6 ⑤ 0.14×0.5 ⑥ 0.07×0.2

3 Rules for Calculation

1 Vavi and Kekeni calculated the area of the rectangle on the right.
Compare their answers.



Vavi's Idea

$3.6 \times 2.4 =$ ☐ (m^2)

Kekeni's Idea

$2.4 \times 3.6 =$ ☐ (m^2)

2 Problems Ⓐ and Ⓑ were calculated easily. Explain the reason why the right hand side methods are appropriate.

Ⓐ $3.8+2.3+2.7 \rightarrow 3.8+(2.3+2.7)$

Ⓑ $1.8 \times 2.5 \times 4 \rightarrow 1.8 \times (2.5 \times 4)$

Calculation Rule (1)

Addition

① When 2 numbers are added, the sum is the same even if the order of the numbers added is reversed.

■ + ▲ = ▲ + ■

② When 3 numbers are added, the sum is the same even if the order of addition is changed.

(■ + ▲) + ● = ■ + (▲ + ●)

Multiplication

① When 2 numbers are multiplied, the product is the same even if the multiplicand and the multiplier are reversed.

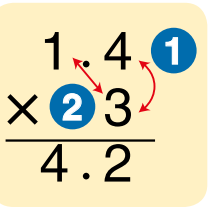
■ × ▲ = ▲ × ■

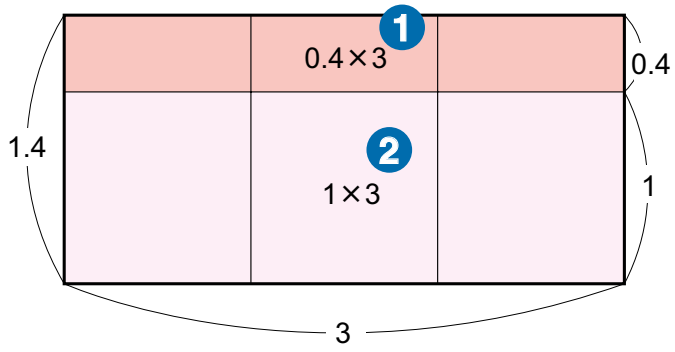
② When 3 numbers are multiplied, the product is the same even if the order of multiplication is changed.

(■ × ▲) × ● = ■ × (▲ × ●)

3 The answer to 1.4×3 can be calculated by thinking as follows. Let's explain the method by using this diagram.

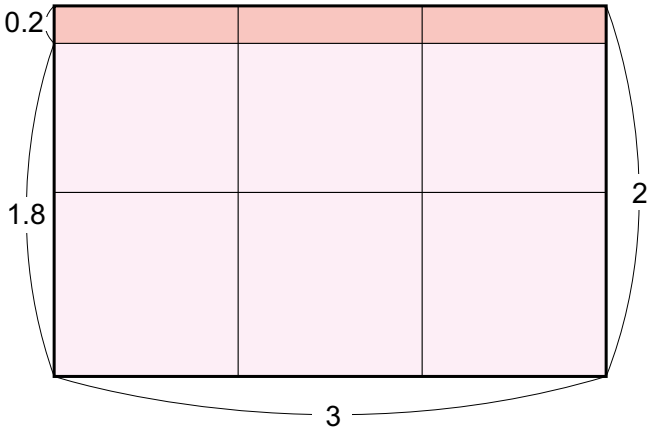
$$1.4\times3=(1+0.4)\times3$$
$$=1\times3+0.4\times3$$





4 The answer to 1.8×3 can be calculated by thinking as follows. Let's explain the method by using this diagram.

$$1.8\times3=(2-0.2)\times3$$
$$=2\times3-0.2\times3$$



Calculation Rule (2)

$(\square+\triangle)\times\bigcirc=\square\times\bigcirc+\triangle\times\bigcirc$

$(\square-\triangle)\times\bigcirc=\square\times\bigcirc-\triangle\times\bigcirc$

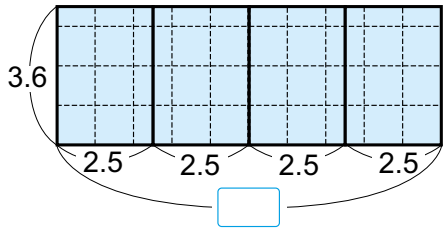
5 Let's explain how the calculation rules are used for easier calculations.

1 $3.6\times2.5\times4$

$=3.6\times(\square\times\square)$

$=3.6\times\square$

$=\square$

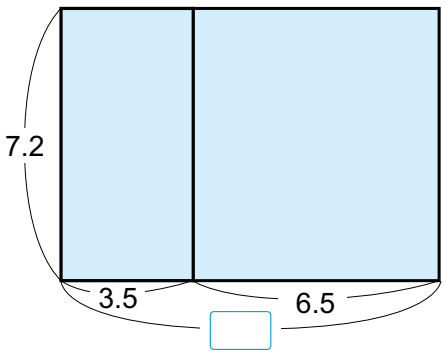


2 $7.2\times3.5+7.2\times6.5$

$=7.2\times(\square+\square)$

$=7.2\times\square$

$=\square$



It is useful to remember the multiplications that have products such as 1 and 10.

$0.25\times4=\mathbf{1}$ $1.25\times8=\mathbf{10}$ $2.5\times4=\mathbf{10}$

Exercise

Let's calculate using the calculation rules. Write down how you calculated.

① $6.9\times4\times2.5$ ② $3.8\times4.8+3.8\times5.2$

③ $0.5\times4.3\times4$ ④ $3.6\times1.4+6.4\times1.4$

EXERCISE

1 Let's multiply in vertical form.

Pages 29 to 33

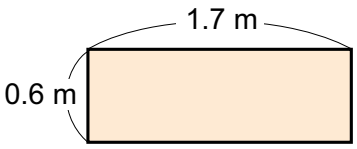
① 50×4.3　② 6×1.8　③ 26×3.2　④ 3×1.4

⑤ 31×5.2　⑥ 62×0.7　⑦ 0.6×0.8　⑧ 3.5×0.9

⑨ 1.5×3.4　⑩ 0.3×0.25　⑪ 1.26×2.3　⑫ 4.36×1.5

2 Let's find the area of the rectangle.

Pages 33 and 34



3 There is a wire that weighs 4.5 g per 1 m.
Let's find the weight of 8.6 m and the weight of 0.8 m of this wire.

Page 31

4 Let's fill the ☐ with equal or inequality signs.

Page 31

① 3.5×3.5 ☐ 3.5　② 3.5×0.1 ☐ 3.5

③ 3.5×0.9 ☐ 3.5　④ 3.5×1 ☐ 3.5

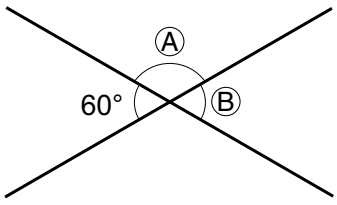
5 Choose numbers from the ☐ below and make problems for multiplications of decimal numbers.
Exchange your problems with your friends and solve.

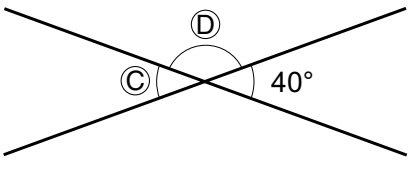
Page 34

1.5	7	0.8	30	2.3	5

Grade 4
Do you remember?

Find the sizes of the following angles Ⓐ to Ⓓ.





PROBLEMS

1 Summarize how to calculate with decimal numbers.

● Understanding how to calculate with decimal numbers.

To calculate 2.3×1.6 first multiply 2.3 by ☐ and multiply 1.6 by ☐, then calculate ☐×☐ and then the answer is ☐ of 368.

2 Let's multiply in vertical form.

● Multiplying decimal numbers in vertical form.

① 28×1.3　② 19×1.2　③ 3.2×1.8

④ 0.4×0.6　⑤ 3.5×0.7　⑥ 7.6×0.5

⑦ 2.87×4.3　⑧ 1.08×2.1　⑨ 0.07×0.8

3 There is a copper wire that costs 90 kina per 1 m.

● Estimating the product with multiplier should be larger or smaller than 1.

① How much will it cost for 3.2 m?

② How much will it cost for 0.6 m?

4 Let's calculate in easier ways. Show how you calculated.

● Using the calculation rules.

① 0.5×5.2×8　② 2.8×15

5 Let's put decimal points on the products for the following calculations.

● Using operations of decimal numbers × decimal numbers

①
$$\begin{array}{r} 0.15 \\ \times\ 2.8 \\ \hline 120 \\ 30 \\ \hline 420 \end{array}$$

②
$$\begin{array}{r} 6.43 \\ \times\ 2.4 \\ \hline 2572 \\ 1286 \\ \hline 15432 \end{array}$$

Mathematics Practices in Papua New Guinea

Topic 1: Counting to ten in three counting systems in PNG

Today in our modern society, we have the number system and standard units of measurement for mathematical practices and applications in daily life.
For example, we use digits from 0 to 9 to count and express quantities.
For measuring we use rulers, tape measures, scales and many more.
These systems are world wide and adopted from the western societies. Do you think in PNG, our ancestors used mathematical practices and applications?
Yes, traditionally, our ancestors used various ways of counting and expressing quantities in their vernacular. They also used various oblects and methods to measure. We have been practicing mathematical applications in our daily lives.
Let's discover counting systems from the Wuvulu Island (East Sepik Province), Motuan villages (Central Province) and Unggai area (Eastern Highlands Province).

1. The Wuvulu counting system

Number	Word
1	eai
2	guai
3	olumanu
4	obao
5	eipana
6	eipana ma eai
7	eipana ma guai
8	eipana ma olumanu
9	eipana ma obao
10	hefua

The word 'pana' (number 5) represents one hand therefore every number that succeeds 5 is one hand and that number. e.g. The number 6 exceeds 5 by 1 so that means that it is one hand and one. Hence, it is true to say that Wuvulu counting system uses base 5 which corresponds to one hand.

2. Motu counting system

Number	Word
1	ta
2	rua
3	toi
4	hani
5	ima
6	taura toi
7	taura hani
8	taura hanita
9	hitu
10	gwauta

In the Motuan culture, the counting system is base 10 but every ten has a name of its own. It depends on what you are counting.
For example, counting fish, coconuts, and shell money is different from counting money, stones, heads and sticks. The 'rabu' is the word for 10 when counting shell money or coconuts and 'ituri' is the word for 10 when counting fish.

3. Unggai counting system

Number	Word
1	mako
2	lowe
3	loweki mako
4	loweki loweki
5	ade mako
6	ade makoki mako
7	ade makoki lowe
8	ade makoki loweki mako
9	ade makoki loweki loweki
10	ade lowe

The base used in Unggai usually changes after every 5 count. The word for 5, 'ade' means one whole hand. Ade lowe (10) means two hands. Further counting uses feet.
For example, the expression for 15 is 'ade loweki ika mako', meaning two hands and one foot. 20 can be expressed in two ways; either 'ade loweki ika lowe' (2 hands and 2 feet), or 'we mako' ('we' means 'person'), that is to say, 2 hands and 2 feet make one whole person.

Ethnomathematical Lessons for PNG by Mathematics students of UPNG-Goroka campus, 1993

2 Amount per Unit Quantity

- Every child in the classroom trained for the school carnival. They ran around the field after class.
  Sam and Yapi made tables of the number of laps they ran around the field last week.
- Sam trained for all 5 days and Yapi was sick on Friday so he ran for 4 days only.

Number of Laps Sam Ran

Days	Mon	Tue	Wed	Thu	Fri	Total
Number of laps	9	7	11	6	7	40

Number of Laps Yapi Ran

Days	Mon	Tue	Wed	Thu	Total
Number of laps	10	8	6	12	36

Who is more prepared for the sports carnival?

Is it Sam or Yapi?

Naiko

If you look at the total, Sam ran more.

But can we compare by the total laps if the number of days are different?

Kekeni

If Yapi was not sick on Friday, how many laps would he have done?

Yamo

If Yapi ran 4 laps on the absent day, then the total would have been 40 laps, which is the same as Sam's total.

Sare

Ph ra se

"If ~, then ~."

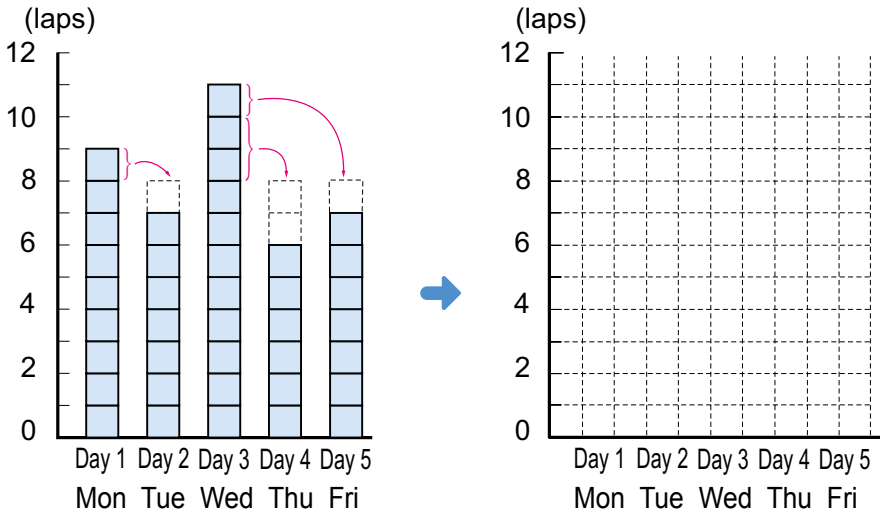
These terms are used when something is assumed or estimated.

They are often used in mathematics when the conditions are changed to get the conclusion.

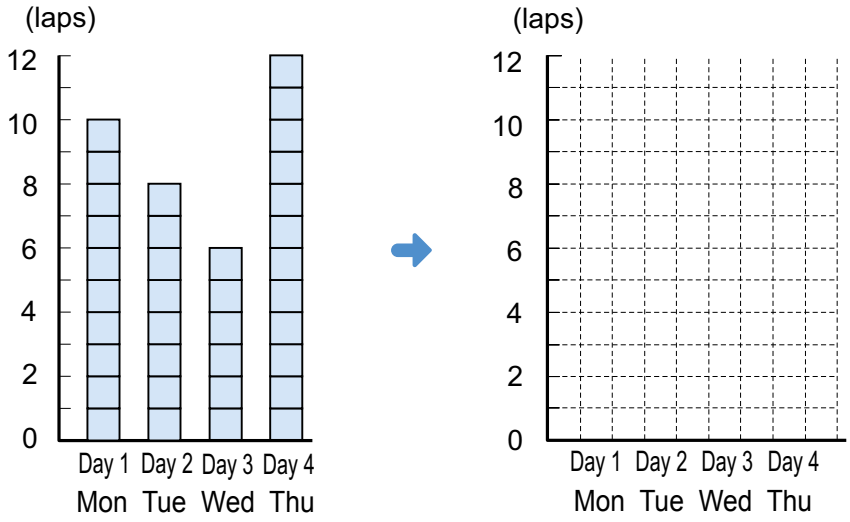
1 Mean

1 If Sam and Yapi ran the same number of laps every day, how many laps would it be per day?

1 Sam ran the same total number of laps as last week, how many laps would he have run per day if he ran the same number of laps everyday?



2 Yapi ran the same total number of laps as last week, how many laps would he have run per day if he ran the same number of laps everyday?

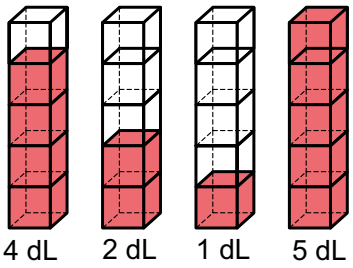


3 Which of them trained more?

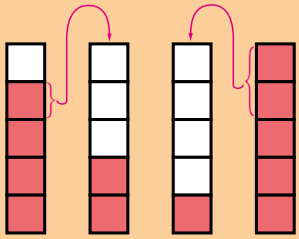
The process of making different sized measurements to the new measure evenly or equally is called **averaging**.

2 There are some juice in the containers on the right.

1 Let's average them so that each container has the same amount of juice.



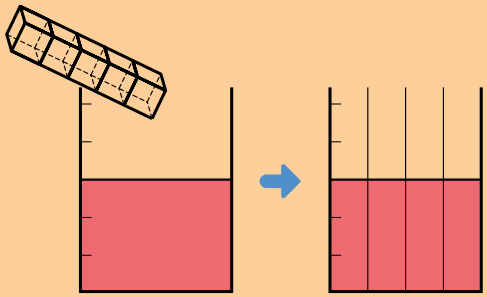
Kekeni's Idea



Move from larger to smaller amounts of juice.

Mero's Idea

Pour all the juice together and then divide the juice among the containers.



2 Think about how to calculate the averaged measure.

$(4+2+1+5) \div 4 = \square$

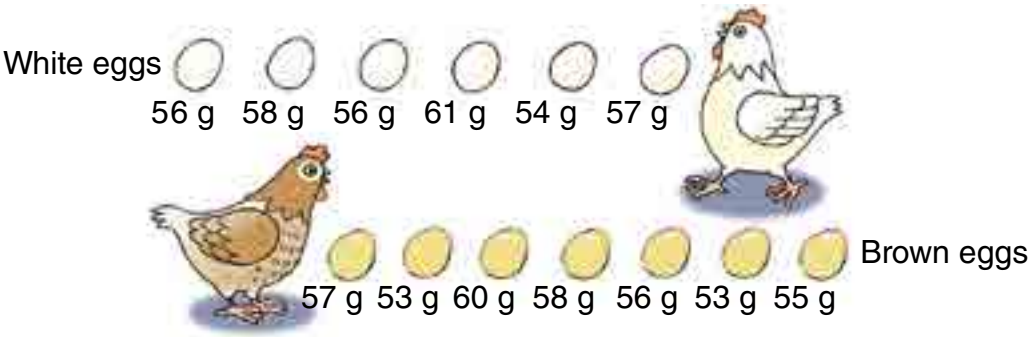
Total juice in 4 containers | Number of containers | Averaged juice per container

To average the measure for 4 containers, we divide the total amount of juice equally in all containers by the number of containers.

The same number or measure which is averaged from some numbers or measures is called **mean** of the original numbers or measures.

Mean = total ÷ number of items

3 There were 2 chickens, one laid brown and the other laid white eggs. The weights are shown below.
Which of the eggs are heavier? Compare by calculating the mean weight of their eggs.



Even for things that cannot be averaged in real life, if the number and amount is known, the mean can be calculated.

4 The table below shows the number of books 5 students read in August. What is the mean number of books read by the 5 students?

Number of Books Read

Name	Boni	Yata	Ken	Sawa	Yaling
Number of books read	4	3	0	5	2

Even for things that are impossible to be expressed in decimal numbers, like number of books, the mean can be expressed in decimal numbers.

2 Amount per Unit Quantity

1 Students are standing on the mats. Each mat is of the same size. Which one of Ⓐ, Ⓑ and Ⓒ is more crowded?

Ⓐ 2 mats, 12 students.
Ⓑ 3 mats, 12 students.
Ⓒ 3 mats, 15 students.

Ⓐ 2 mats, 12 students.

Ⓑ 3 mats, 12 students.

Ⓒ 3 mats, 15 students.

Let's think about how to compare crowdedness.

1 Let's compare which one is more crowded?

	Number of mats	Number of students
Ⓐ	2	12
Ⓑ	3	12
Ⓒ	3	15

Ⓐ or Ⓑ → ☐

When the number of students are the same, the one with ☐ mats is more crowded.

Ⓑ or Ⓒ → ☐

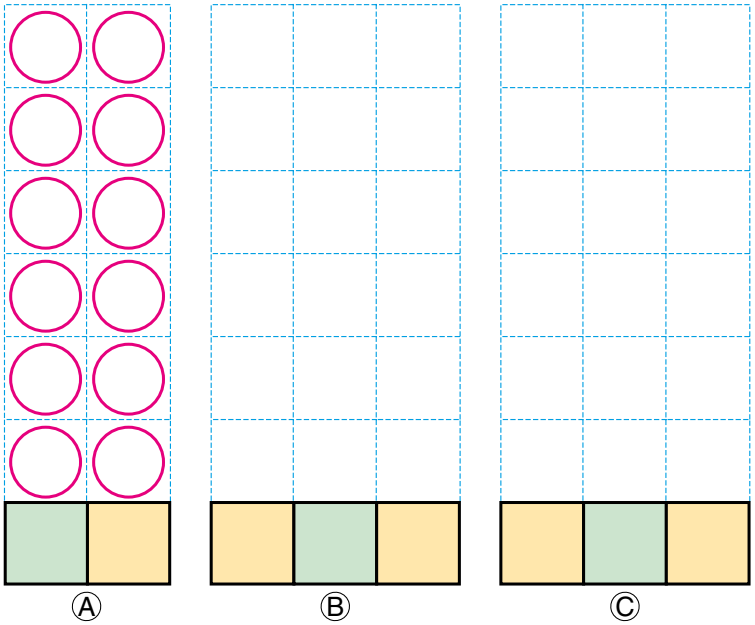
When the number of mats are the same, the one with ☐ students is more crowded.

Compare Ⓐ or Ⓒ → ☐

Both the number of mats and students are different.

If we make the number of mats equal…

2 Let's find out how many students are on each of the mats.



③ The area of 1 mat is 1 m².

How many students are there in per 1 m² ?

Ⓐ 12 ÷ 2 = ☐

Ⓑ 12 ÷ 3 = ☐

Ⓒ 15 ÷ 3 = ☐

Number of students | Area (m²) | Number of students per 1 m²

The level of crowding is expressed by 2 measures, the number of students and the area.
Usually we compare the level of crowding by using the same unit, such as **1 m²** or **1 km²**.
When people are not grouped in an organised way, the number of people per 1 m² expresses the mean of crowding.

Exercise

① Two groups of children are playing in two different garden shelters. One group has 10 children playing in a 8 m² garden shelter and the other group has 13 children playing in a 10 m² garden shelter. Which garden shelter is more crowded?

② There are two communities. Samuel's community with 7 km² and 1260 people and Robert's community with 10 km² and 1850 people. Which community is more populated?

2 The table on the right shows the population and the area of East Town and West Town.

1 Let's calculate the number of people per 1 km². Which one is more crowded?

Population and Area

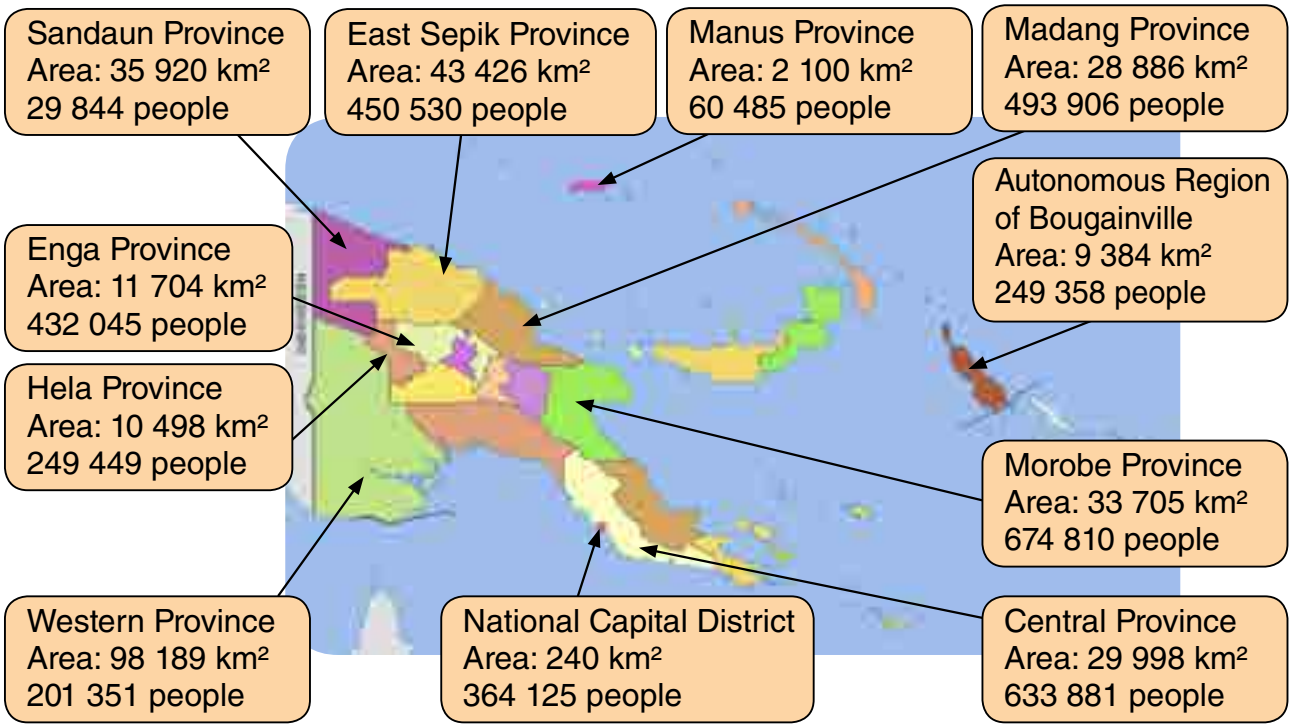
	Population (people)	Area (km²)
East Town	273 600	72
West Town	22 100	17

The population per **1 km²** is called **population density**.
The crowdedness of the number of people living in a country or province is compared using population density.

Number of people ÷ Area (km²) = Number of people per 1 km²

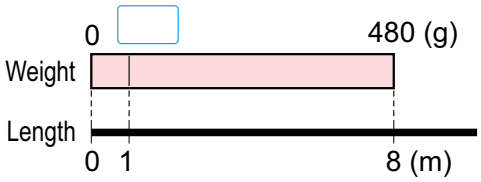
2 Let's calculate the population density of each province and make a table. Round the first decimal place and give the answers in whole numbers. Find the relationship between population density and area?

Province	Population Density



3 A wire is 8 m long and weighs 480 g.

1 How many grams (g) does this wire weigh per 1 m? Let's find the relationship of the numbers from the diagram and the table.



Weight (g)	?	480
Length (m)	1	8

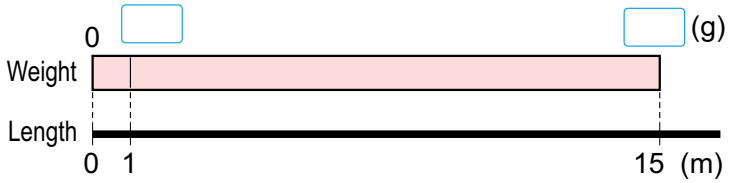
÷8 ÷8

To make 8 into 1, we divide it by 8.
So we can get the answer by 480 ÷ 8.

Expression :

2 How many g will 15 m of that wire weigh?

Let's develop an expression by drawing a diagram and a table.



Weight (g)		?
Length (m)	1	15

× ×15

Expression :

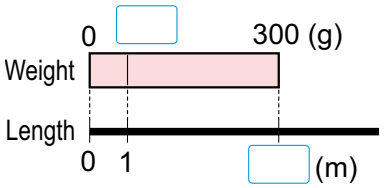
We know the weight of 1 m from question **1**.

How are the numbers we already know related to each other?

3 We cut part of the wire and it weighed 300 g.

How many metres (m) long is this piece of wire?

Let's develop an expression by drawing a tape diagram and a table.



Weight (g)		300
Length (m)	1	?

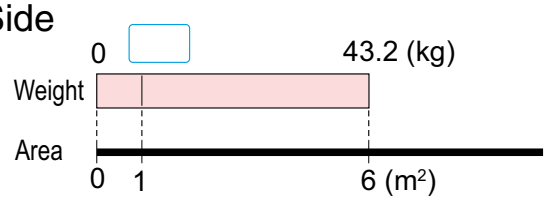
÷ ÷

Expression :

Population density and weight per 1 m are called **amount per unit quantity**.

4 Ayleen's family grew sweet potatoes in their garden. They harvested 43.2 kg of sweet potatoes from a 6 m² at east side and 62.1 kg sweet potatoes from a 9 m² at west side. Which side of the garden is good harvest? Compare by using the number of sweet potatoes per 1 m².

East Side



Weight (kg)	?	43.2
Area (m²)	1	6

÷6 ÷6

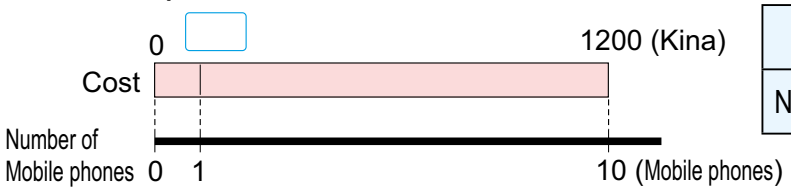
West Side

Weight (kg)	?	62.1
Area (m²)	1	9

÷9 ÷9

5 There are two brands of mobile phones. Brand A phone costs 1200 kina for 10 mobile phones. Brand B phone costs 1040 kina for 8 mobile phones. Which one is more expensive? Compare the cost per mobile phone.

Brand A phone



Costs (Kina)	?	1200
Number of Mobile phones	1	10

÷10 ÷10

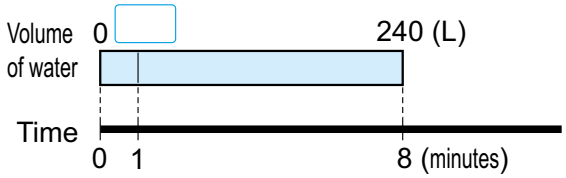
Brand B phone

Costs (Kina)	?	1040
Number of Mobile phones	1	8

÷8 ÷8

6 Brand A machine can pump 240 L of water in 8 minutes and Brand B machine can pump 300 L of water in 12 minutes.
Which machine pumps more water per minute?

Brand A



Volume of water (L)		
Time (min)		

Brand B

Volume of water (L)		
Time (min)		

7 Copier Ⓐ copies 300 sheets of paper in 4 minutes and copier Ⓑ copies 380 sheets of paper in 5 minutes.

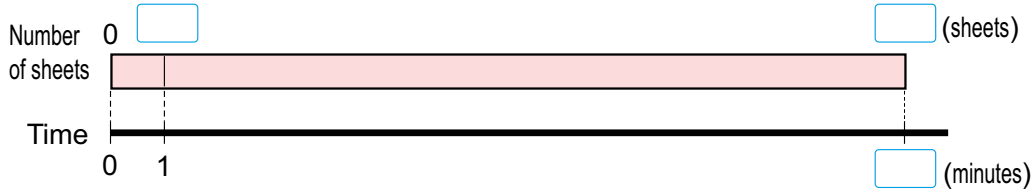
1. Which copier is faster?
2. How many sheets of paper can copier Ⓐ copy in 7 minutes?
3. How many minutes does it take for copier Ⓑ to copy 1140 sheets of paper?

Ⓐ

Number of sheets		
Time (min)		

Ⓑ

Number of sheets		
Time (min)		



Exercise

A small tractor ploughs 900 m² in 3 hours.
How many square metres (m²) can it plough in 8 hours?

EXERCISE

1 The table below shows the number of empty cans Anita collected in 5 days. What is the mean number of cans she collected per day?

Page 14

Number of Empty Cans Collected

Days	Day 1	Day 2	Day 3	Day 4	Day 5
Number of cans	6	7	5	8	8

2 There are two schools with same size classrooms. Which school Ⓐ or Ⓑ is more crowded?

Pages 15 to 17

Ⓐ 1080 students in 6 classes.
Ⓑ 1640 students in 8 classes.

3 A shop sells colour paints. The black paint costs 600 kina for 12 tins and the white paint costs 440 kina for 8 tins. Which colour paint is more expensive?

Page 19

4 A 180 m² plantation produced 432 kg cocoa. How many kilograms (kg) of cocoa were harvested per 1 m²?

Page 20

Grades 3 and 4
Do you remember?

Let's calculate.

① 52×27　② 86×67　③ 35×78
④ 154×48　⑤ 565×64　⑥ 927×32
⑦ 5.4×4　⑧ 6.2×9　⑨ 2.5×8

PROBLEMS

1 The population of a district in PNG is about 39 000 people and the area is about 50 km². Calculate the population density of this district.

● Understanding how to calculate the population density.

2 An optical fiber cable costs 480 kina per 4 m.

● Understanding the meaning of measurements per unit.

① How much does 1 m of this cable cost?

② How much does 5 m of this cable cost?

③ A company IC Net bought the cable worth 1440 kina.
How many metres did the company buy?

3 A printer can print 350 sheets of paper in 5 minutes.

● Understanding the meaning of amount of work per unit.

① How many sheets of paper can it print in 1 minute?

② How many sheets of paper can it print in 8 minutes?

③ How many minutes will it take to print 2100 sheets of paper?

4 Anton's goal is to read 25 pages of a book per day.
He read an average of 23 pages for 6 days from Sunday to Friday.
To reach his goal over the 7 days from Sunday, how many pages must he read on Saturday?

● Understanding the relationship between mean, total and number of item.

5 The table below shows the duration of handstand and number of grade 5 students at Joyce's school. From this table, let's calculate the average duration of handstand per student in grade 5.

● Understanding the meaning of mean and measurement per unit and applying it to solve problems.

Duration of Handstand and the Number of Grade 5 students

Duration of handstand (second)	0	1	2	3	4	5	6	7	8	9	10
Number of students	3	0	2	4	5	16	9	10	4	6	1

4 Congruence and Angles of Figures

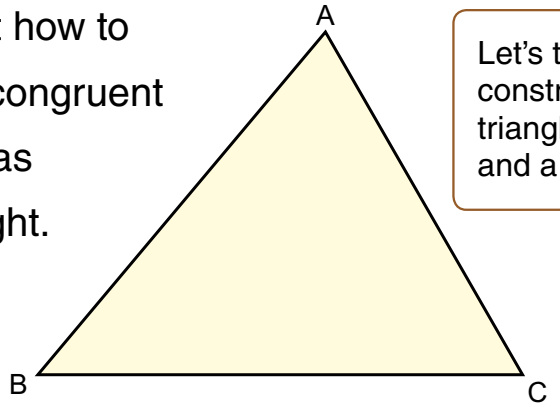
Is it possible to tell the shape only by words?
Joyce drew a triangle on a 1 cm grid sheet.
In order for her friends to draw the same figure,
she is explaining the shape only by words on the board.

Let's draw triangle ABC with the following:
1. BC is 3 cm long.
2. Perpendicular line from A to BC is 2 cm long.

Two figures are congruent if they fit by lying on top of one another.

1 Congruent Figures

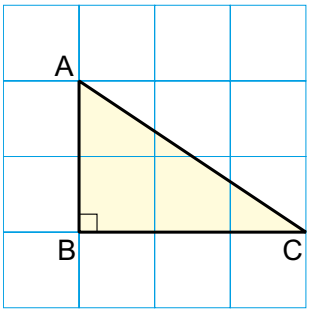
1 Let's think about how to draw a triangle congruent to triangle ABC as shown on the right.



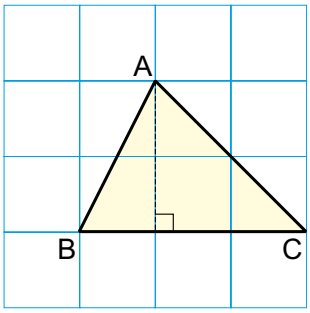
Let's think about constructing a congruent triangle with a compass and a protractor.

Let's explore how to draw congruent figures and their properties.

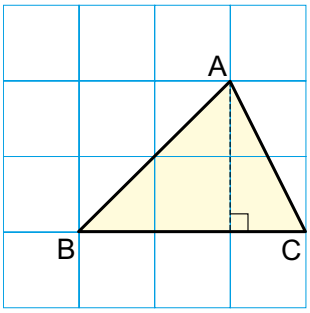
What kinds of triangle can you draw from Joyce's explanation?



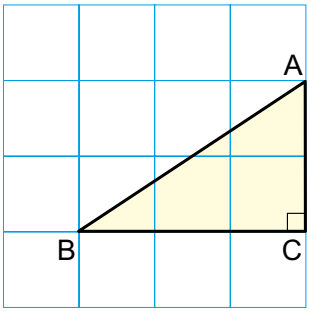
Ambai



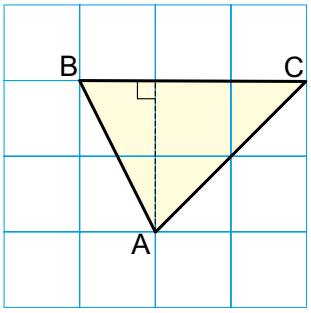
Naiko



Yamo



Mero



Vavi

What are the conditions for constructing the same triangles?

1 Let's think about how to use a compass and a protractor to draw a triangle congruent to triangle ABC.

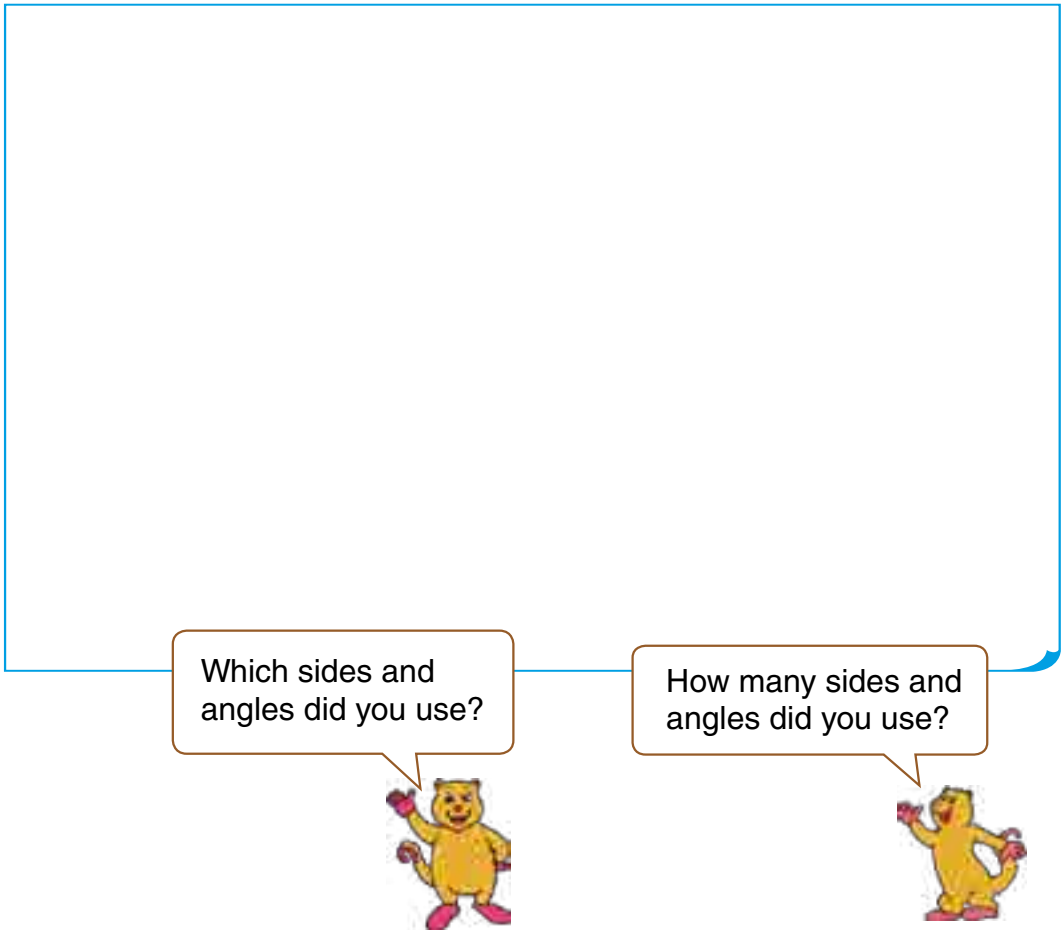
B ——————————— C

I drew the same line as BC.

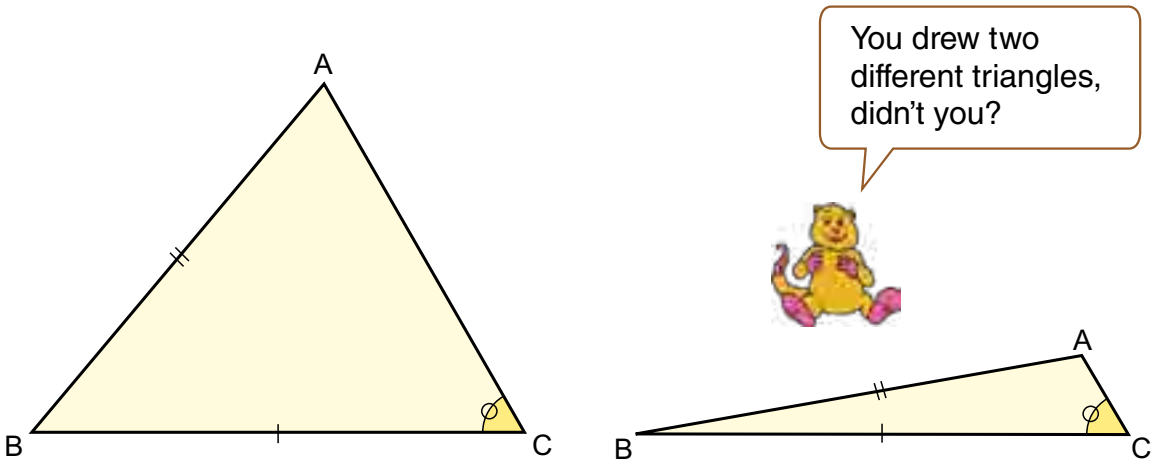
Now we need to determine the position of point A.

Activity

❷ Let's discuss how to locate point A to draw a triangle congruent to triangle ABC.



❸ If you know angle C and the length of sides AB and BC, then you can draw triangle ABC easily.

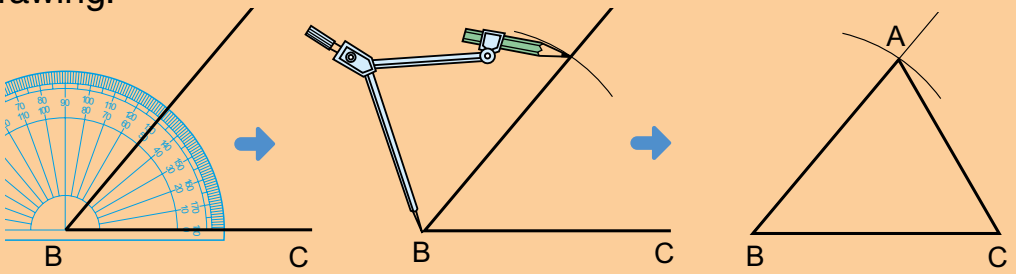


❹ Let's summarise how to draw a congruent triangle.

Let's explain.

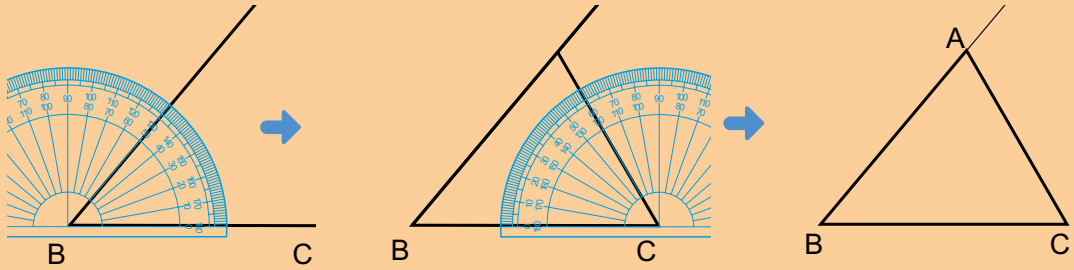
Yamo's Idea

Measure the lengths of two sides and the angle between them for drawing.



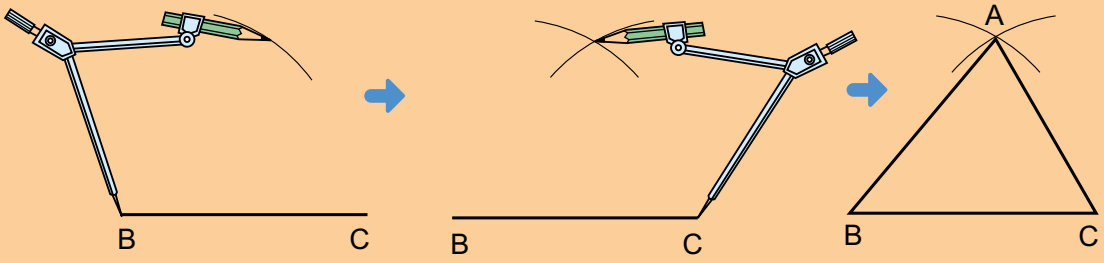
Sare's Idea

Measure two angles and the length between them for drawing.

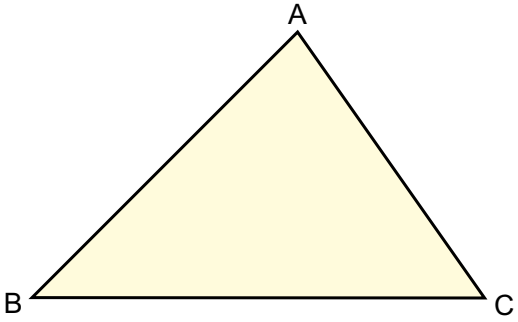


Ambai's Idea

Measure all three sides for drawing.

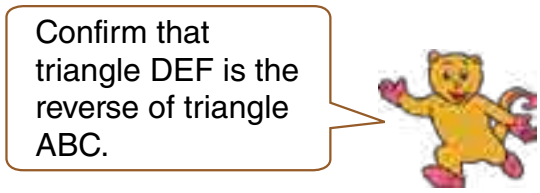


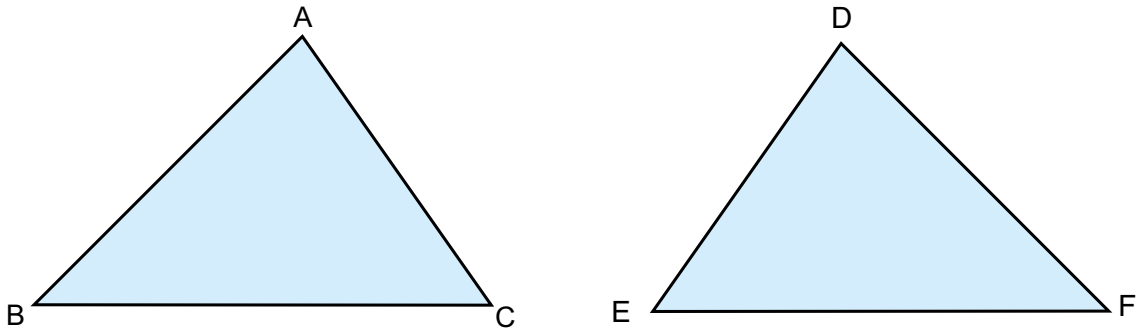
5 Let's draw a triangle congruent to triangle ABC as shown on the right.



Activity

2 Triangle DEF below is the reverse of triangle ABC.





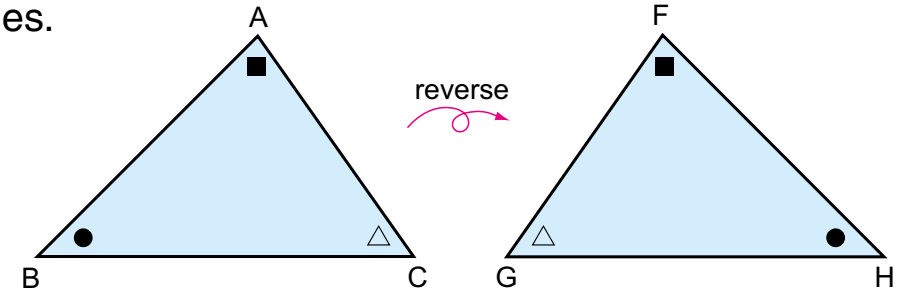
1 Let's confirm whether the two triangles match when they fit by lying on one another.

Two figures are also congruent if they match by reverse.
In congruent figures, the matching points, the matching sides and the matching angles are called; **corresponding vertices, corresponding sides and corresponding angles**, respectively.

2 In the above triangles ABC and DEF, find the corresponding sides and compare the lengths.

3 Find the corresponding angles and compare their sizes.

In congruent figures, the corresponding sides are equal in length and the corresponding angles are also equal in size.
Congruent figure is a figure which is identical in shape, size and angles.



Congruent Triangle

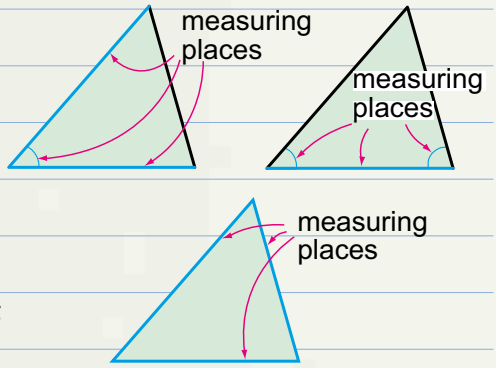
Put the title on top for showing what topic you learned.

Date

Don't forget to write the date.

1 Findings

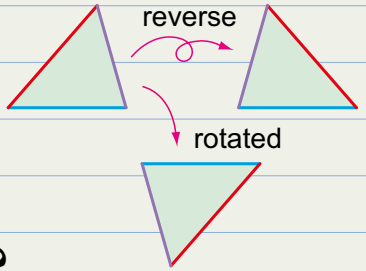
- Two figures are congruent if they fit by lying on top of one another.
- There are three ways for drawing a congruent triangle. The diagrams on the right shows the place for measuring.



- Two triangles are also congruent if they match by flipping over.
- Compass can be used as a tool to copy the same lengths.
- Matching sides and angles are called corresponding sides' and 'corresponding angles', respectively.

2 Interesting points

- The rotated or reversed figure is also congruent.
- There are three conditions for congruence between two triangles. Are there four conditions for quadrilaterals?



- It is interesting that two triangles with all three equal angles are not always congruent.

3 What was difficult

- Finding corresponding sides and angles when the figure is reversed.

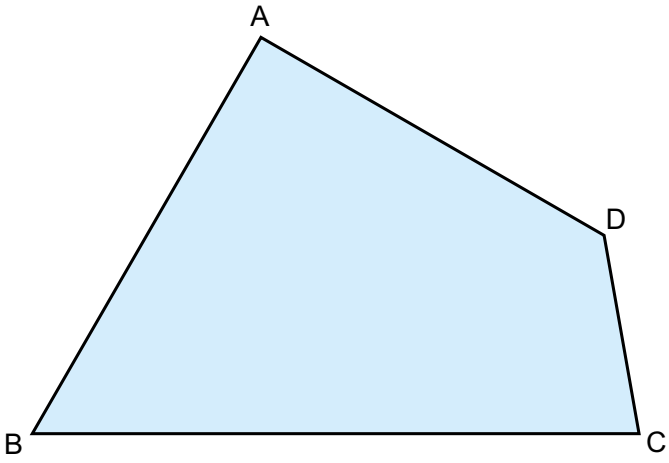
4 Good ideas from Friends

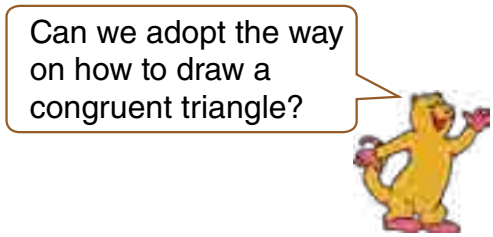
- Ambai's idea for drawing a congruent triangle requires only a compass and does not need to measure angles.

If you recognised good ideas from your friends, write them down.

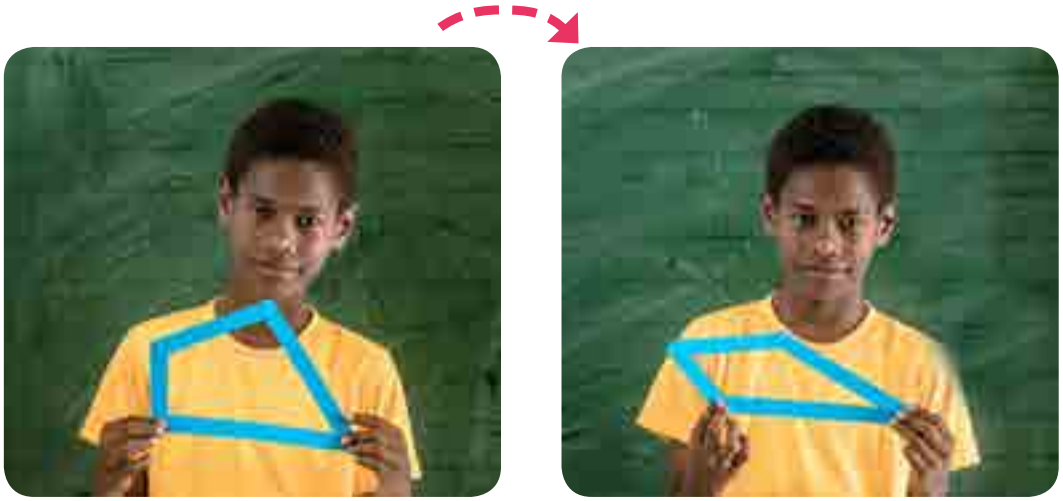
Congruent Quadrilaterals

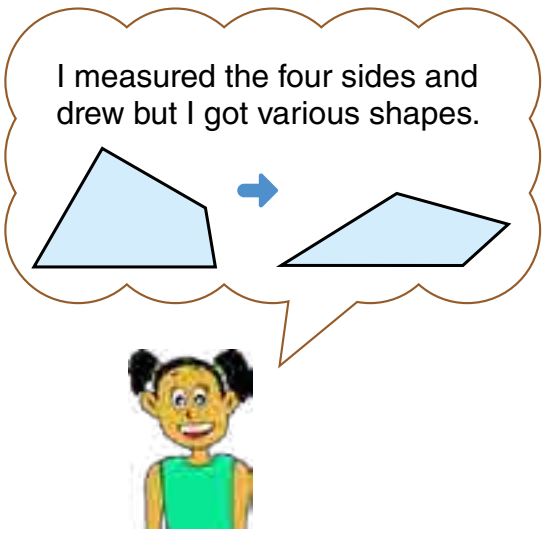
3 Let's think about how to draw a quadrilateral which is congruent to quadrilateral ABCD as shown on the right.

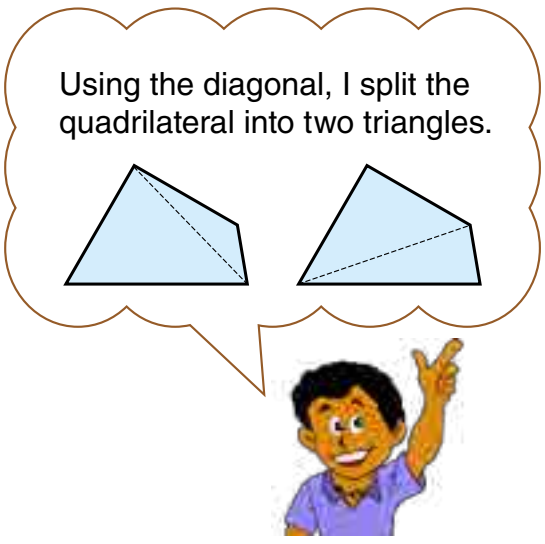




1 If you measure four sides of the quadrilateral for drawing, can you draw a congruent quadrilateral?



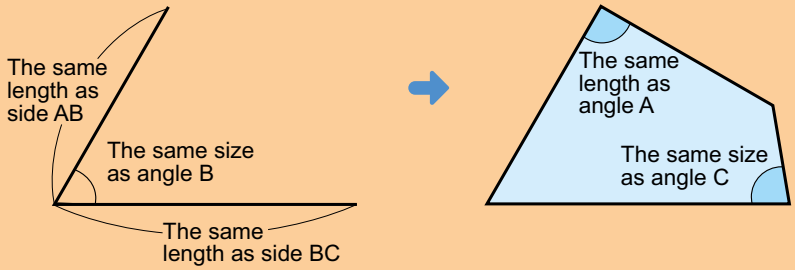




❷ Let's discuss how to draw a congruent quadrilateral with your friends. How can we locate the fourth point?

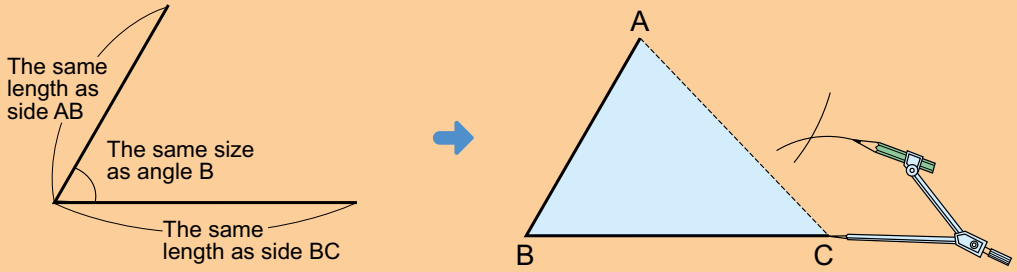
Mero's Idea

Measure angles A and C and determine point D.



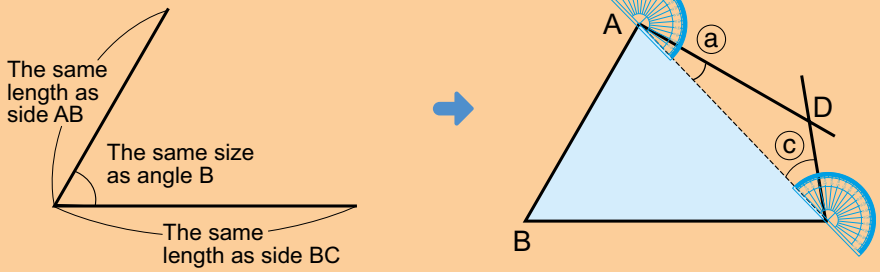
Kekeni's Idea

Use Ambai's idea (page 41) for drawing a congruent triangle to determine point D on quadrilateral. Measure sides AD and CD.



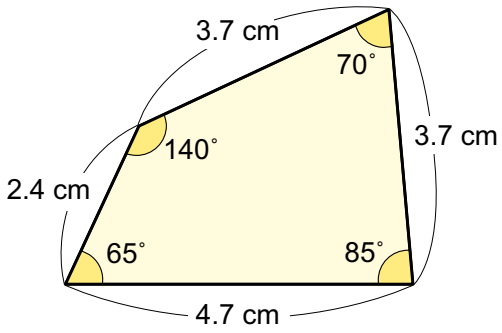
Naiko's Idea

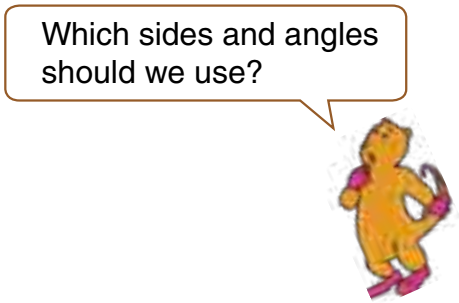
Use Sare's idea (page 41) for drawing a congruent triangle to determine point D on quadrilateral. Measure angles which are subtended by diagonals AC and sides.



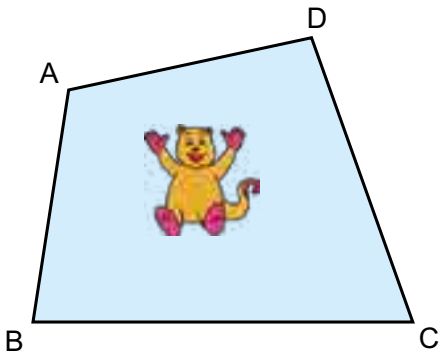
❸ Use the ideas above to draw a congruent quadrilateral for quadrilateral ABCD.

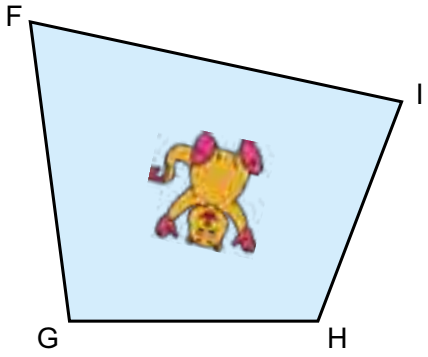
4 Let's draw a congruent quadrilateral to the one shown below.





5 The two quadrilaterals below are congruent.
Describe the corresponding vertices, sides and angles.





❶ The corresponding vertex to A is H.
Write down in your exercise book the other corresponding vertices.

❷ The corresponding side to AB is HI.
Write down in your exercise book the other corresponding sides.

❸ The corresponding angle to A is H.
Write down in your exercise book the other corresponding angles.

EXERCISE

1 Let's draw a congruent triangle with the following conditions.

Pages 39 and 40

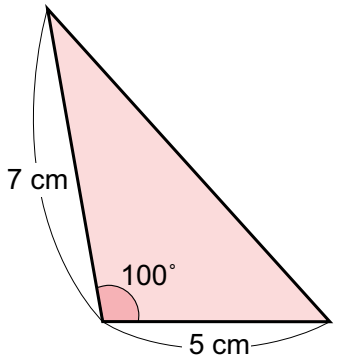
① A triangle with sides 4 cm, 7 cm and 8 cm.

② A triangle with sides 5 cm, 8 cm and an angle of 75° between them.

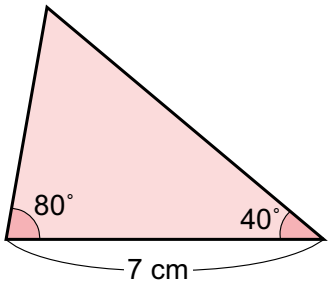
③ A triangle with angles 45°, 60° and a side with 6 cm between them.

④ Triangles ⓐ and ⓑ

ⓐ

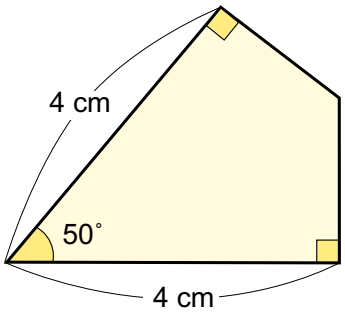


ⓑ



2 Let's draw a congruent quadrilateral to the one on the right.

Pages 44 and 45



Grade 4

Do you remember?

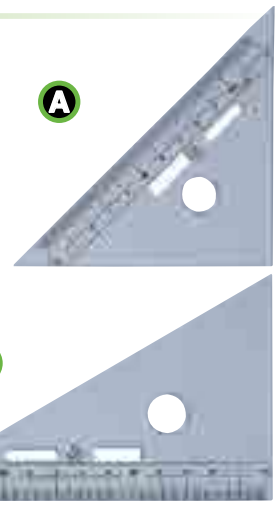
Let's calculate.

① 120 + 60	② 243 + 29	③ 684 + 55
④ 254 + 523	⑤ 675 + 167	⑥ 493 + 728
⑦ 180 − 70	⑧ 383 − 47	⑨ 742 − 68
⑩ 947 − 816	⑪ 657 − 219	⑫ 526 − 338

2 Angles of Triangles and Quadrilaterals

1 Let's explore the sum of two angles excluding the right angle.

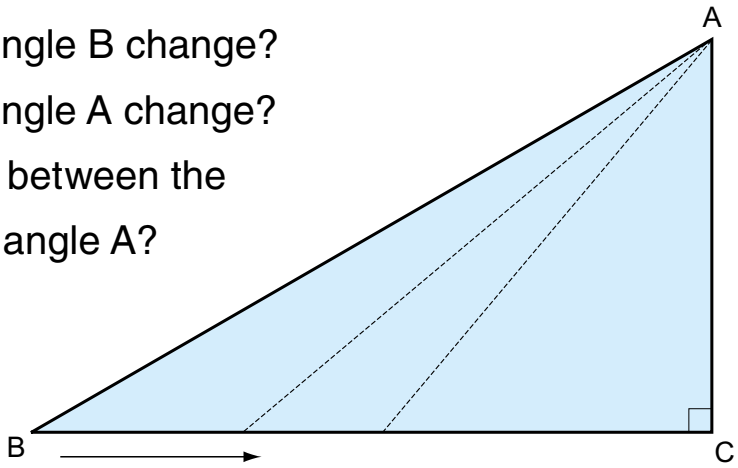
The sum of the two angles are;



A ☐°

B ☐°

In the right triangle below, we are going to move vertex B toward C.



1. How does the value of angle B change?
2. How does the value of angle A change?
3. Is there any relationship between the changes in angle B and angle A?

4. Look at the change in the sum of angle A and angle B.

Angle A (degrees)	60	50				
Angle B (degrees)						
Sum (degrees)						

From the above table, what did you find about the sum of the three angles in a right triangle?

Let's explore the sum of three angles in a triangle.

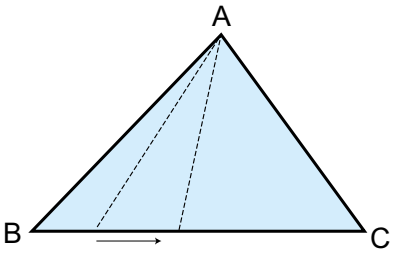
Angles of Triangles

A straight angle is 180°, isn't it?

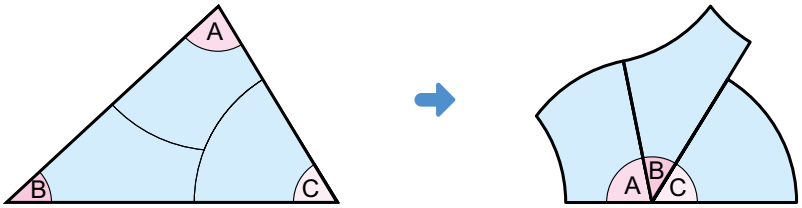
2 Look at the sum of the 3 angles of a triangle in various ways.

① Draw a triangle and measure the angles with a protractor.

The sum of the 3 angles is ☐°.

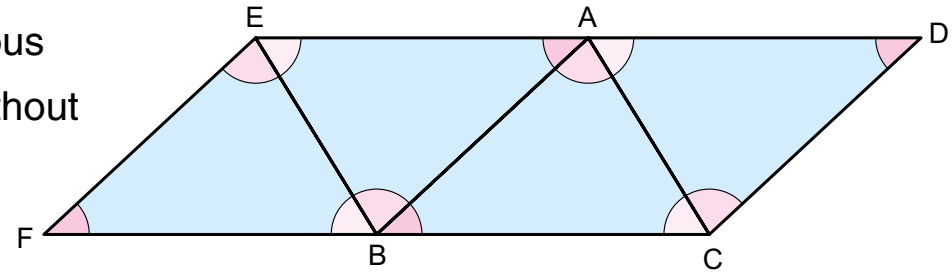


② Cut out the 3 angles and place them together as shown below.



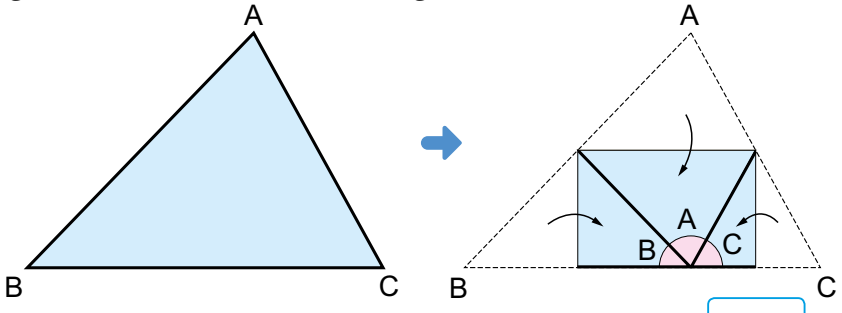
Since the 3 angles together make a straight line, the sum of these angles is ☐°.

③ Put together triangles with the same shape and size to make a continuous pattern without any gaps.



Since 3 angles at points A and B make a straight line, their sums are ☐°.

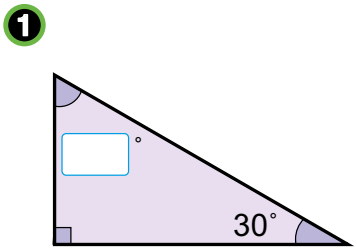
④ Fold a triangle to connect the 3 angles.



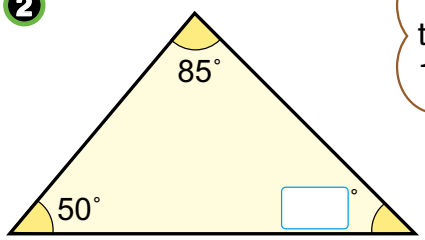
Since the 3 angles make a straight line, the sum is ☐°.

In any triangles, the sum of the three angles is 180°.

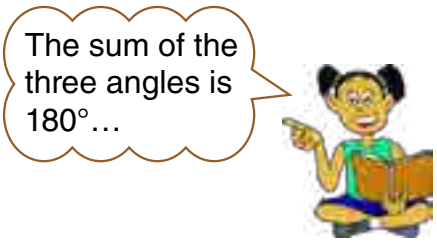
3 Let's calculate and fill in the ☐ with appropriate numbers.

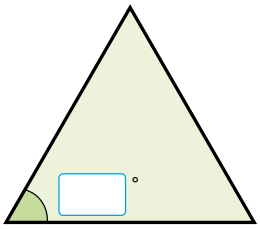


1 Right-angle triangle

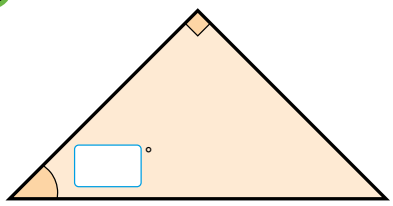


2 Isosceles triangle

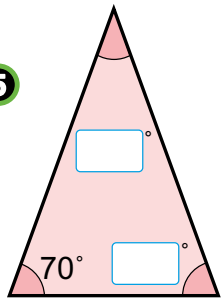




3 Equilateral triangle



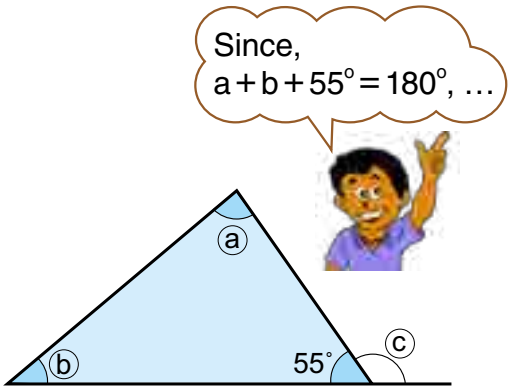
4 Isosceles triangle



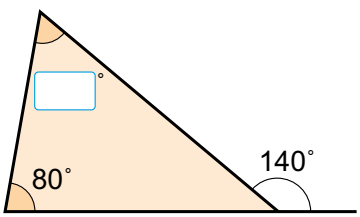
5 Isosceles triangle

4 Look at the triangle below.

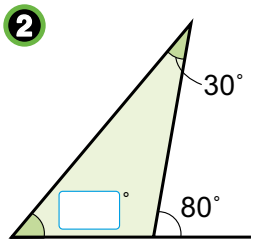
1 Find the sum of angles ⓐ and ⓑ.
2 What is angle ⓒ?
3 What can you conclude about the relationship among angles ⓐ, ⓑ and ⓒ?



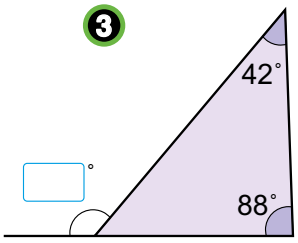
5 Let's calculate and fill in the ☐ with appropriate numbers.



1



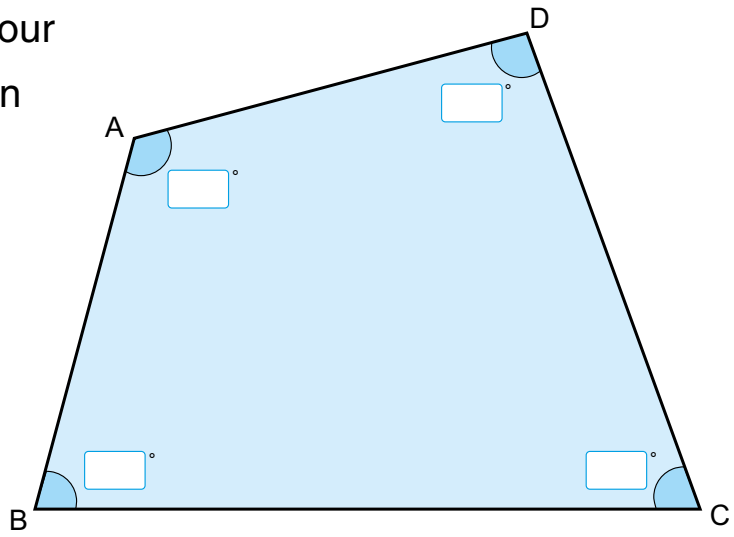
2



3

Angles of Quadrilaterals

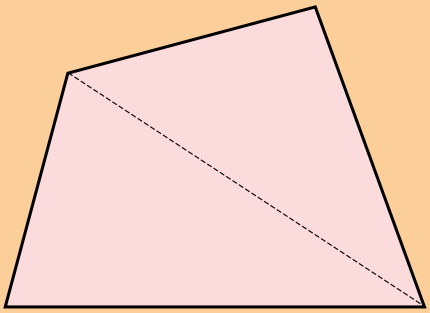
6 Let's explore the sum of four angles in a quadrilateral in various ways.



❶ Measure the four angles with a protractor.

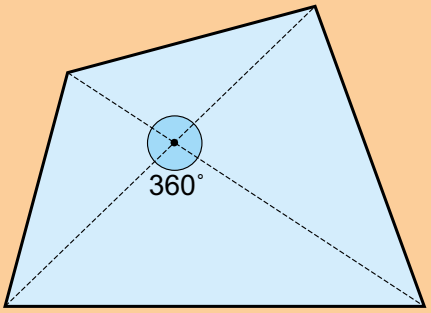
❷ Let's calculate through dividing the quadrilateral by diagonals.

Vavi's Idea



Divide by a diagonal. There are two triangles inscribed. Therefore,
□° × 2 = □°.

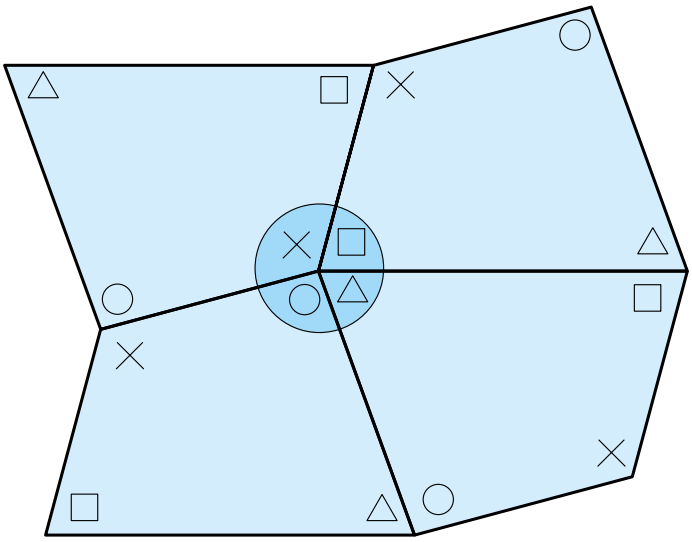
Mero's Idea



Divide a quadrilateral into four by diagonals.
There are four triangles inscribed, □° × 4 = □°
subtract the extra □°, so □°.

❸ Let's think about and discuss other ways of finding the sum of angles in a quadrilateral.

4 Let's explore the sum of quadrilaterals through tessellation.



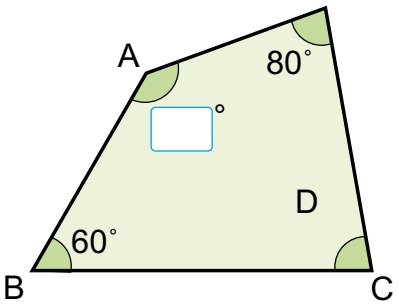
5 Share your findings with your friends.

What have you learned?

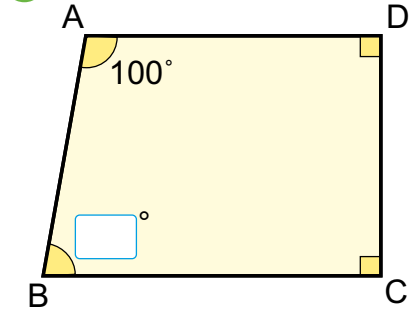
In any quadrilateral, the sum of 4 angles is 360°.

7 Let's fill in the ☐ by calculations.

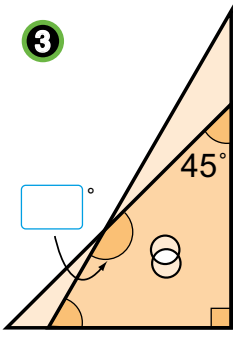
1



2

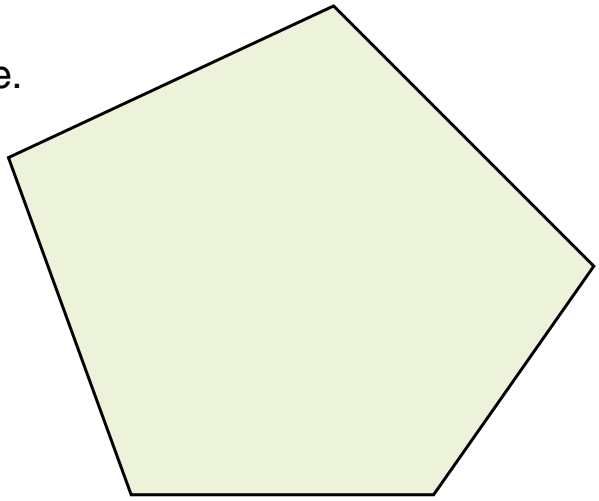


3



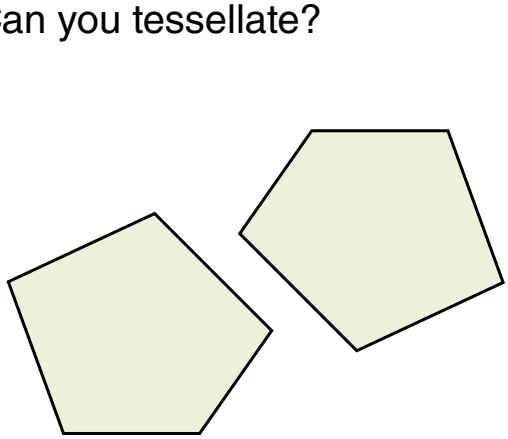
Angles of Polygons

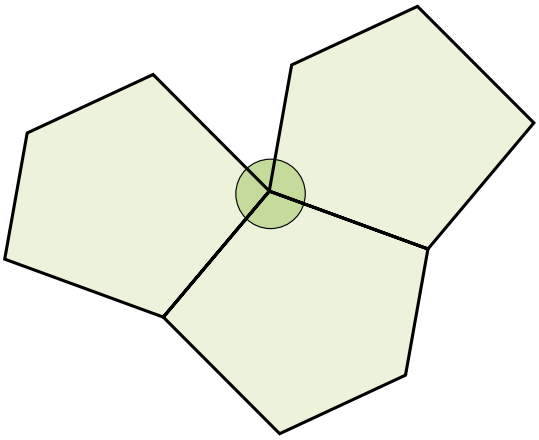
A pentagon is a five sided figure.



8 Let's explore how to find the sum of 5 angles in a pentagon.

1 Can you tessellate?

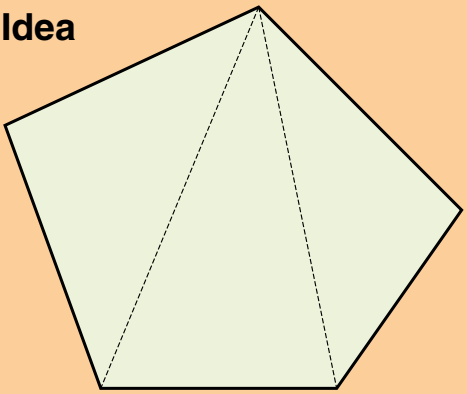


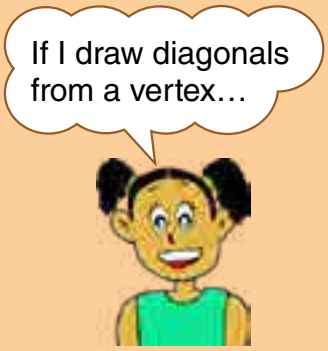


For tessellation of figures, the sum of angles which meet at one vertex is 360°. In the case of a pentagon, it cannot be tessellated.

2 Let's divide a pentagon into triangles.

Yamo's Idea

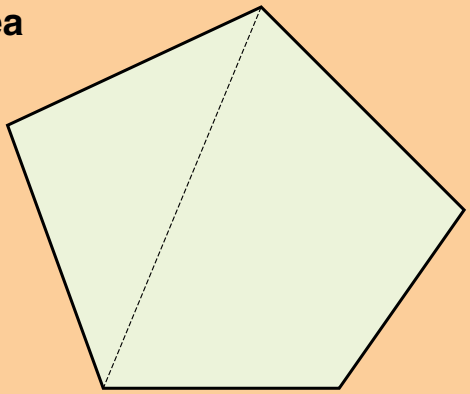




Draw diagonals and divide it into ☐ triangles.

Therefore, 180° × ☐ = ☐ °.

Mero's Idea



Divide a pentagon into a triangle and a quadrilateral.

Therefore, 180° + ☐ ° = ☐ °.

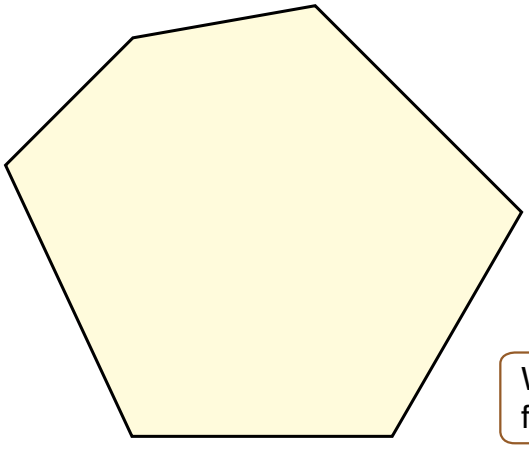
Activity

3 Let's think about other ways of finding the sum of angles and discuss.

In any pentagon, the sum of 5 angles is 540°.

9 A hexagon is a six sided figure.

Let's explore how to find the sum of 6 angles in a hexagon.

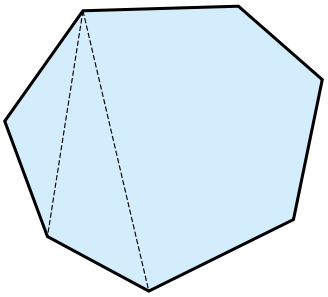


In any hexagon, the sum of 6 angles is ☐ °.

A shape which is enclosed by straight lines, such as a triangle, quadrilateral, pentagon, hexagon, etc., is called a polygon.
In a **polygon**, each straight line that connects any two vertices other than adjacent sides is called a **diagonal**.

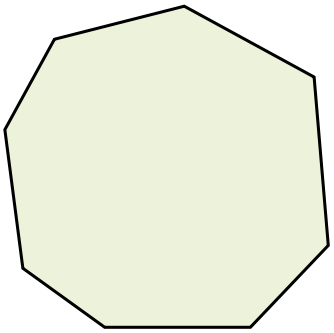
10 Summarise the relationships for the sum of angles in polygons by filling in the table below.

	Triangle	Quadrilateral	Pentagon	Hexagon	Heptagon	Octagon	Nonagon
The number of triangles made by the diagonals from one vertex in a polygon		2	3	4			
The sum of angles	180°	360°	540°	720°			



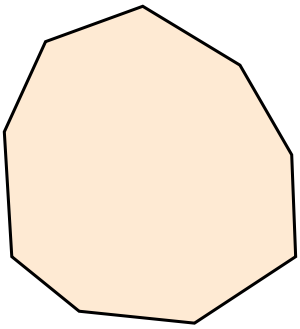
Heptagon

180° × ☐ = ☐ °



Octagon

180° × ☐ = ☐ °

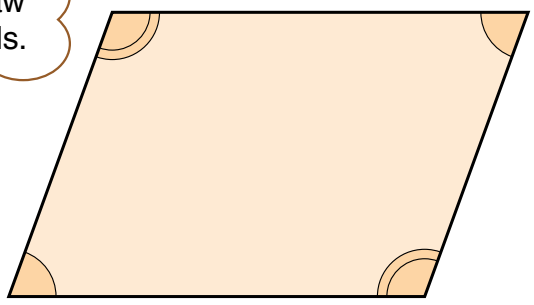


Nonagon

180° × ☐ = ☐ °

The Opposite Angles of a Parallelogram

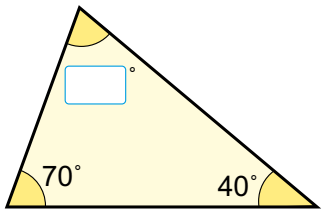
11 Let's use what you have learned to explain that the opposite angles of a parallelogram are equal.

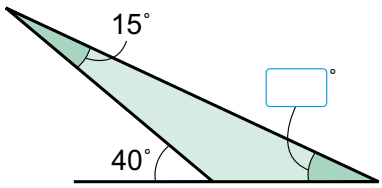


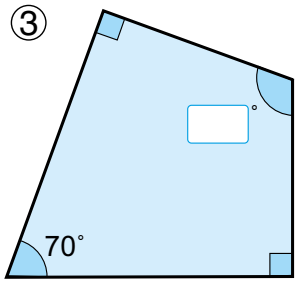
EXERCISE

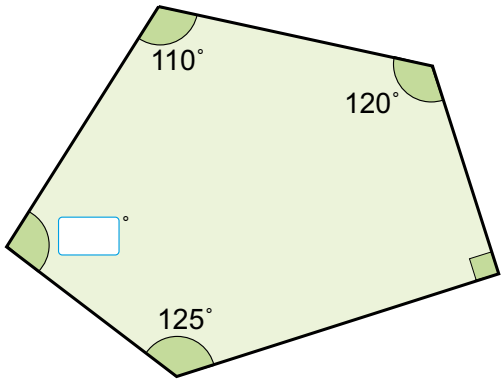
1 Let's calculate and fill in the □ with numbers.

Pages 49 to 54

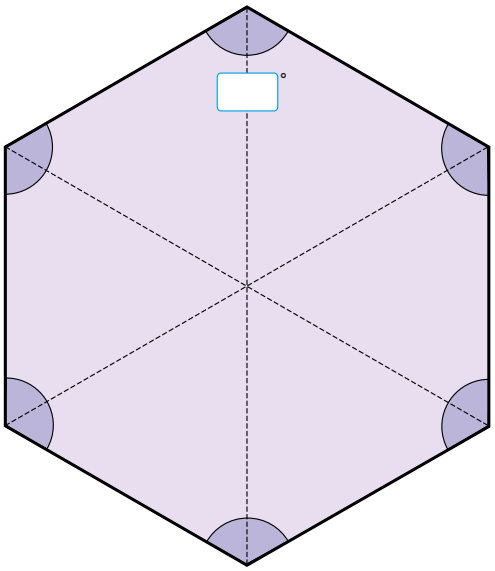
① 

② 

③ 

④ 

⑤ A hexagon is developed by 6 equilateral triangles.



Let's calculate.

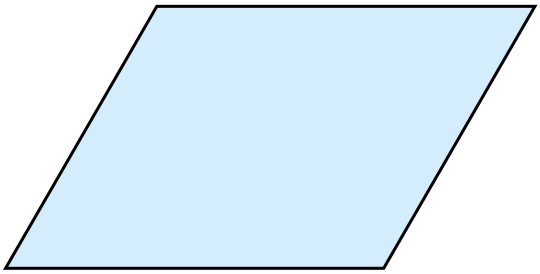
Grade 4
Do you remember?

① 24 ÷ 2	② 69 ÷ 3	③ 96 ÷ 4
④ 44 ÷ 11	⑤ 72 ÷ 12	⑥ 92 ÷ 23
⑦ 168 ÷ 3	⑧ 675 ÷ 9	⑨ 464 ÷ 8
⑩ 288 ÷ 48	⑪ 333 ÷ 37	⑫ 969 ÷ 17

PROBLEMS

1 Let's draw a congruent quadrilateral to the one below.

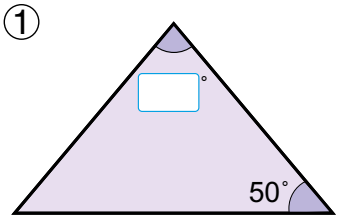
● Constructing a congruent quadrilateral.



2 Let's fill in the ☐ with numbers.

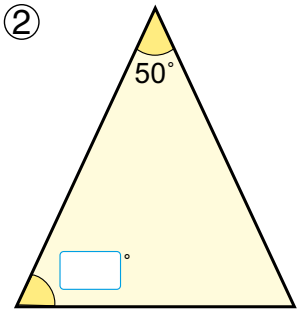
● Using the sum of angles in a polygon.

①



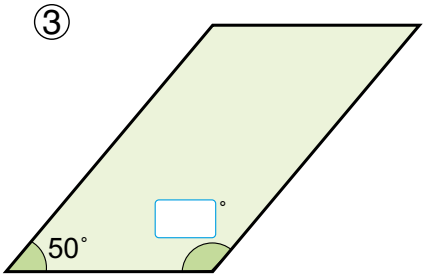
Isosceles triangle

②



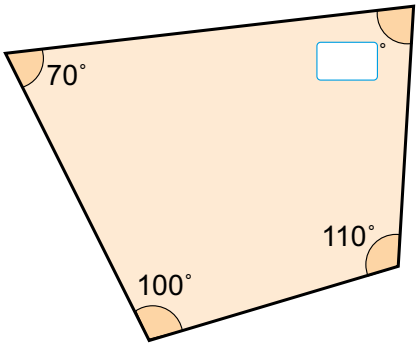
Isosceles triangle

③

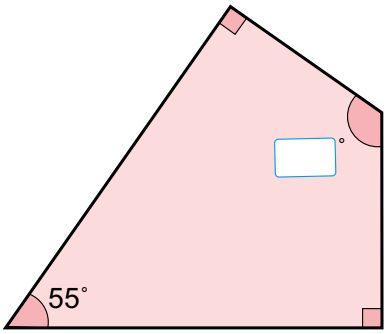


Parallelogram

④



⑤

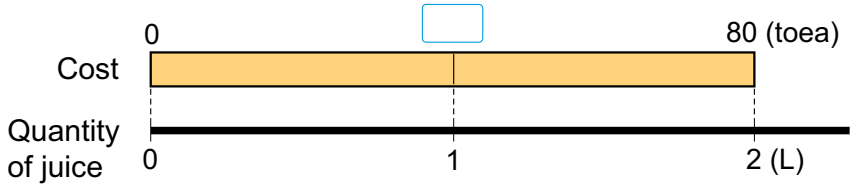


5 Division of Decimal Numbers

1 Operation of Whole Numbers ÷ Decimal Numbers

1 Jane and Betu went to the supermarket to buy juice.

1 How much is the cost of 1 L in the 2 L container?



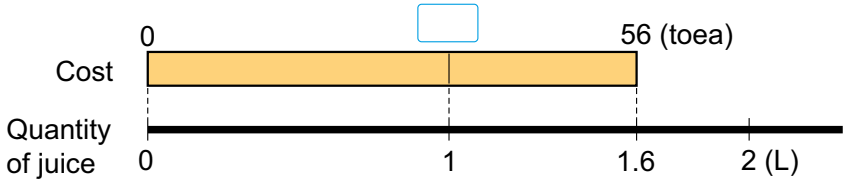
Ⓐ Write a mathematical expression.

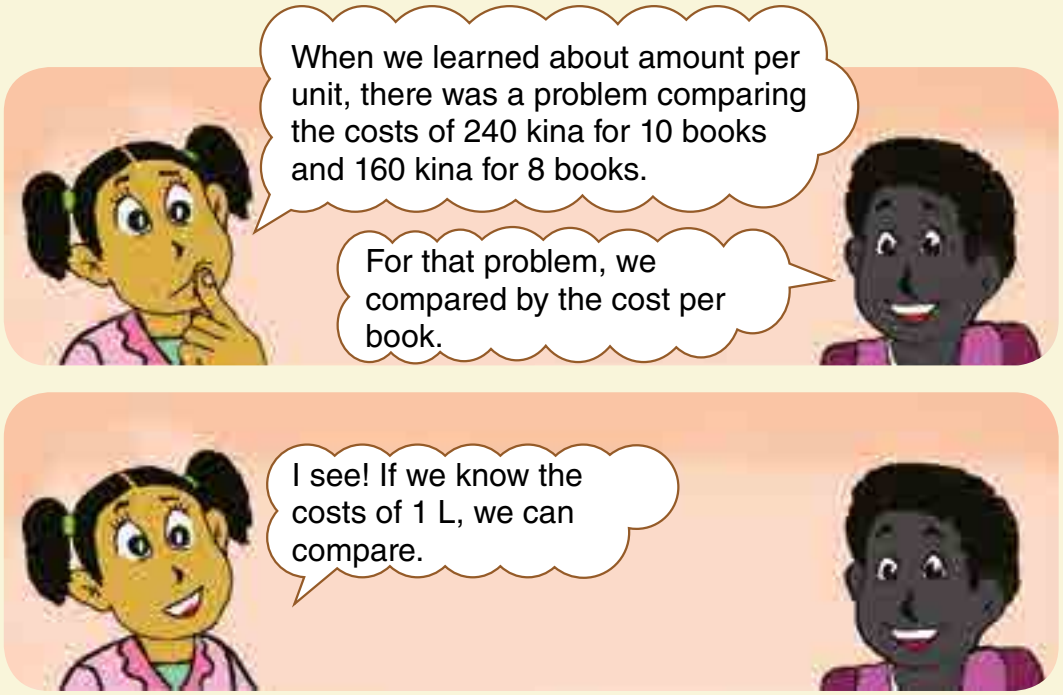
Cost (Kina)	?	80
Quantity of juice (L)	1	2

÷ □ (Cost) ÷2 (Quantity of juice)

Ⓑ Let's calculate the mathematical expression in Ⓐ

2 How much is the cost of 1 L for the 1.6 L container?





Ⓐ Write a mathematical expression.

Cost (toea)	?	56
Quantity of juice (L)	1	1.6

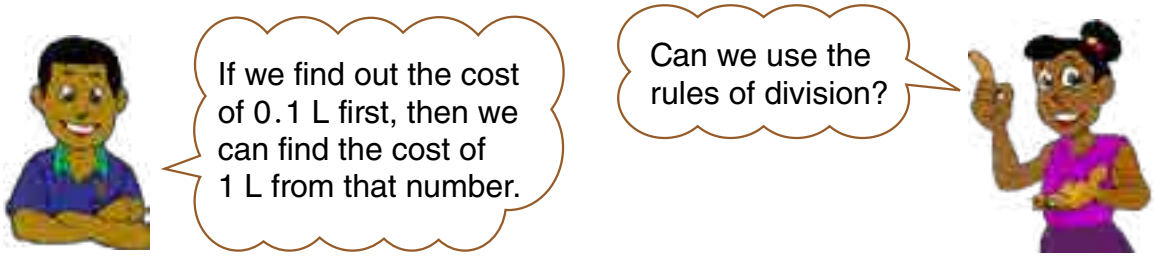
÷ □

÷1.6

Ⓑ Approximately how much would the cost be?

As shown with the quantity of juice, when the divisor is a decimal number instead of a whole number, the expression is the same as for division of whole numbers and means to calculate the quantity per unit.

Ⓒ Let's think about how to calculate 56 ÷ 1.6

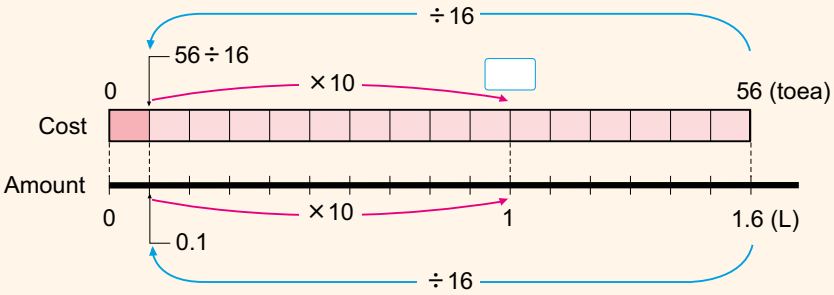


Activity

Ⓓ Let's explain the ideas below.

Mero's Idea

Cost of 1.6 L is 56 toea.
1.6 L is 16 sets of 0.1 L so,
Cost of 0.1 L is 56 ÷ 16 = 3.5 (toea)
10 times of 0.1 L is the cost of 1 L, so
Cost of 1 L is 3.5 × ☐ = ☐ (toea)



Kekeni's Idea

If I buy juice 10 times of 1.6 L, the price will also become 10 times more. However, the cost per 1 L is the same.

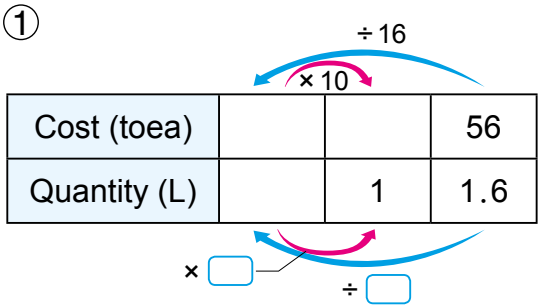
Cost of 1 L when I buy 1.6 L of juice　56 ÷ 1.6 = ☐ (toea)

×10 ↓　↓ ×10

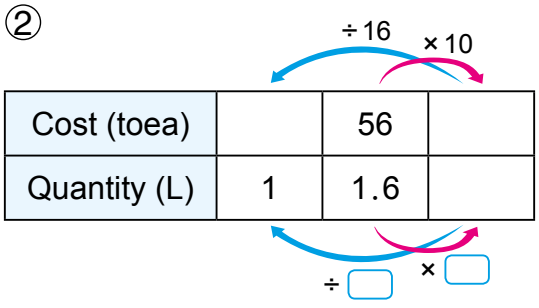
Cost of 1 L when I buy 16 L of juice　560 ÷ 16 = 35 (toea)

Ⓔ Which idea corresponds to each of the two tables shown below?
Discuss what the two ideas have in common.

①



②



= ☐ × ☐

Ⓕ Let's explain how to divide 320 ÷ 1.6 in vertical form.

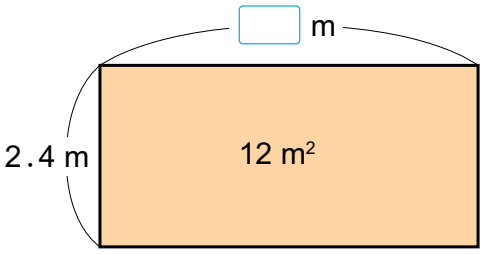
$$1.6\overline{)320}$$

× 10 ↓ ↓ × 10

$$16\overline{)3200}$$

In division, the answer does not change if the dividend and divisor are multiplied by the same number.
When we divide a number by a decimal number, we can calculate by changing the dividend and divisor into whole numbers by using the rule of division.

2 A rectangular flowerbed has a width of 2.4 m and an area of 12 m². How long is the length in metres?



1 Let's write a mathematical expression.

2 Let's think about how to calculate.

3 Let's think about how to divide in vertical form.

2	.	4	1	2
× 10			× 10	

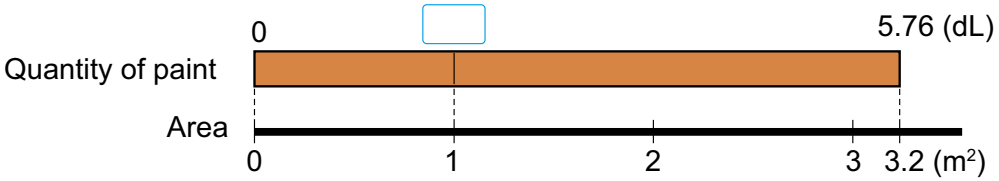
Exercise

Let's divide in vertical form.

① 9 ÷ 1.8　② 91 ÷ 2.6　③ 6 ÷ 4.8

2 Operation of Decimal Numbers ÷ Decimal Numbers

1 We used 5.76 dL of paint to paint a 3.2 m² wall.
How many decilitre (dL) of paint will we use to paint a 1 m² wall?



1 Let's write a mathematical expression.

Quantity of paint (dL)	?	5.76
Area (m²)	1	3.2

÷ ☐ (above ?)
÷3.2 (below 1)

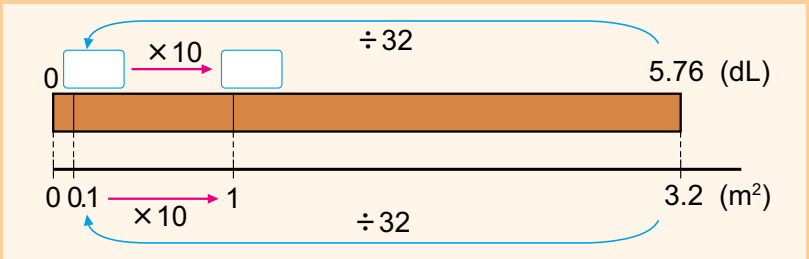
2 Approximately how many dL will we use?

3 Let's think about how to calculate.

How can we change it to division of whole numbers?

Naiko's Idea

Paint needed for 0.1 m² is 5.76 ÷ 32 = 0.18 (dL).
Paint needed for 1 m² will be 10 times of that, so 0.18 × 10 = ☐ (dL).



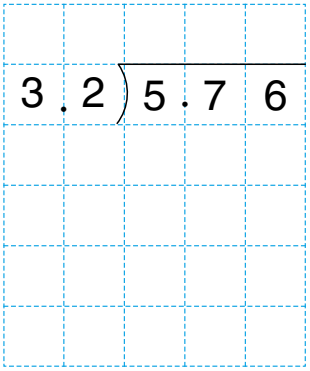
Yamo's Idea

I will apply the rules of division to change the divisor into a whole number.

5.76 ÷ 3.2 = ☐
×10 ↓ ×10 ↓
57.6 ÷ 32 = ☐

Activity

4 Let's think about how to divide in vertical form.



How to Divide Decimal Numbers in Vertical Form

① Multiply the divisor by 10, 100 or more to make it a whole number and move the decimal point to the right accordingly.

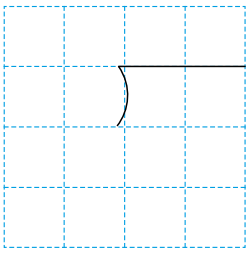
② Multiply the dividend by the same amount as the divisor and move the decimal point to the right accordingly.

③ The decimal point of the answer comes at the same place as where the decimal point of the dividend has been moved to.

④ Then, calculate as if this is the division of whole numbers.

```
      1.8
3.2)5.7.6
    3 2
    2 5 6
    2 5 6
        0
```

2 There is a rectangular flowerbed that has an area of 8.4 m² and the length of 2.8 m. How many metres is the width?



1 Let's write a mathematical expression.

2 Let's calculate ① in vertical form and find the answer.

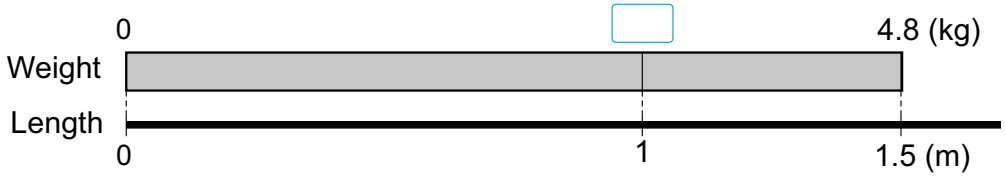
Exercise

Let's divide in vertical form.

① 9.52÷3.4　② 9.88÷2.6　③ 7.05÷1.5

④ 8.5÷1.7　⑤ 7.6÷1.9　⑥ 9.2÷2.3

3 A metal bar is 1.5 m and weighs 4.8 kg.
How many kilograms (kg) will 1 m of this bar weigh?



1 Let's write a mathematical expression.

Weight (kg)	?	4.8
Length (m)	1	1.5

÷1.5 ÷1.5

2 Let's think about how to calculate.

Ⓐ By what number should we multiply the divisor and the dividend?

Ⓑ Think of 48 as 48.0 to continue with the division.

```
    3.□
1.5)4.8.0
    4 5
    ---
    3 0
```

4 Let's think about how to divide 3.23÷3.8 in vertical form.

Why is there no quotient in the ones place?

```
     0.8 5
   ------
3.8)3.2.3
    3 0 4
    -----
      1 9 0
      1 9 0
      -----
          0
```

Exercise

1 Let's divide in vertical form.

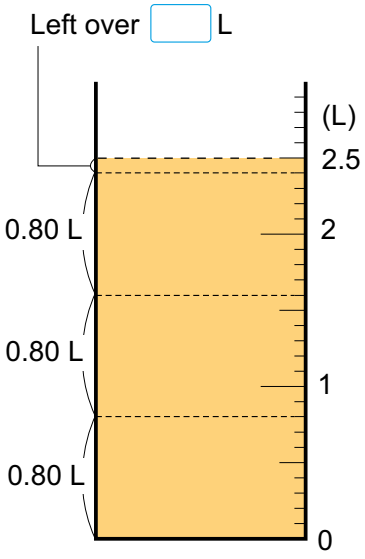
① 36.9÷1.8 ② 3.06÷4.5 ③ 0.49÷3.5

2 There is a rectangular flowerbed that has an area of 36.1 m^2.
How many m is the width if the length is 3.8 m?

3 Division Problems

Division with Remainders

1 I had 2.5 L of juice and poured 0.8 L into each bottle.
How many bottles of 0.8 L of juice do I have now? How many Litres (L) of juice is left over?

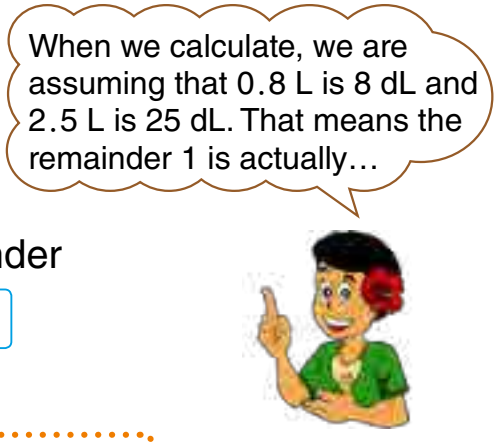


1. Let's write a mathematical expression.

2. The calculation is shown on the right.
If the left over is 1 L in this case, what will happen?
Write down what you think.

3. Where should we put the decimal point of the remainder?

$$0.8\overline{)2.5}\quad 3.\ \ 24\ \ 1$$



Dividend = Divisor × Quotient + Remainder

2.5 = 0.8 × 3 + ☐

In division of decimal numbers, the decimal point of the remainder comes at the same place as the original decimal point of the dividend.

$$0.8\overline{)2.5}\quad 3.\ \ 24\ \ 0.1$$

Exercise

A 8 kg of rice is divided into bags of 1.5 kg.
How many bags of 1.5 kg rice will be filled and how many kg of rice will be left over?

2 I weighed a 2.4 m long metal bar and it weighed 2.84 kg. How many kg does 1 m of this bar weigh?

1 Let's write an expression.

2 The calculation carried out is shown on the right.
What will be the answer?

3 Round the quotient to the thousandths place and give the answer to the nearest hundredth.

```
      1.1 8 3
2.4 ) 2.8.4
      2 4
      4 4
      2 4
      2 0 0
      1 9 2
          8 0
          7 2
            8
```

When a remainder is not divisible by the divisor or when the numbers become too long, the quotient is rounded.

Exercise

1 For answering the quotient at the nearest hundredths place, round the quotient to the thousandths place.

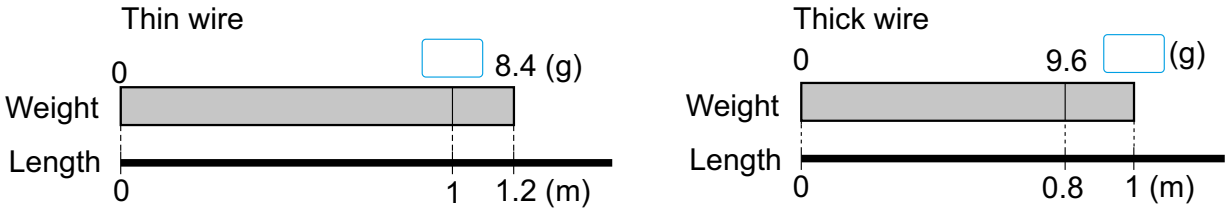
① 2.8÷1.7　② 5÷2.1　③ 9.4÷3

④ 61.5÷8.7　⑤ 0.58÷2.3　⑥ 19.2÷0.49

2 A 0.3 m wire weighs 1.6 g. Approximately, how many g does 1 m of this wire weighs? For answering the quotient at the nearest tenths place, round the quotient to the hundredths place.

Dividing by Decimal Numbers Smaller than 1

3 There is a thin wire that is 1.2 m long which weighs 8.4 g and a thick wire that is 0.8 m long and weighs 9.6 g.
Let's find the weight of 1 m for each wire.



1. How many g does 1 m of the thin wire weigh? Write an expression and calculate it. ☐
2. How many g does 1 m of the thick wire weigh? Write an expression and calculate it. ☐
3. Let's compare the quotients and dividends of each of them.
4. Let's calculate 9.6 ÷ ☐ by putting numbers into the ☐ apart from 0.8 Let's talk about what you noticed.

9.6 ÷ 1 = ☐	9.6 ÷ 0.6 = ☐	9.6 ÷ 0.2 = ☐
9.6 ÷ 0.9 = ☐	9.6 ÷ 0.5 = ☐	9.6 ÷ 0.1 = ☐
9.6 ÷ 0.8 = 12	9.6 ÷ 0.4 = ☐	
9.6 ÷ 0.7 = ☐	9.6 ÷ 0.3 = ☐	

When a number is divided by a number smaller than 1, the quotient becomes larger than the dividend.

Exercise

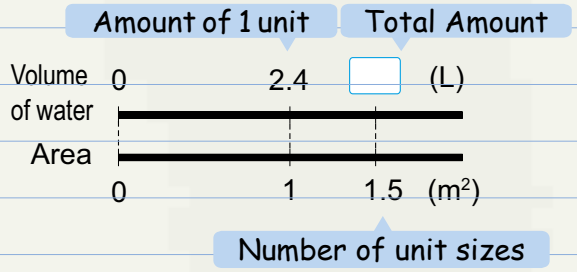
Let's divide in vertical form.

① 4.9 ÷ 0.7	② 3.2 ÷ 0.4	③ 1.5 ÷ 0.3
④ 0.9 ÷ 0.6	⑤ 0.4 ÷ 0.5	⑥ 0.2 ÷ 0.8

4 What Kind of Calculation Would It Be? Draw Diagrams to Help You Think

1 Minie watered a 1 m² flowerbed with 2.4 L of water.
How many L of water will she use to water a 1.5 m² flowerbed?

Estimation : Water needed for 1.5 m^2 will probably be more than the water for 1 m^2.



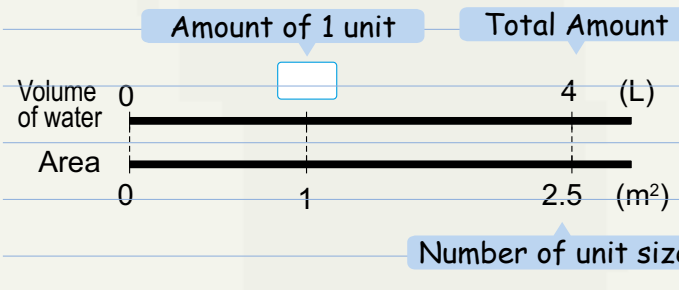
Volume of water (L)	2.4	?
Area (m²)	1	1.5

×□ ×1.5

Expression : 2.4 □ 1.5 = □ Answer □ L

2 Jack used 4 L of water to water 2.5 m².
How many L will he use to water 1 m²?

Approach : We want to know the amount of 1 unit size, so we use division.



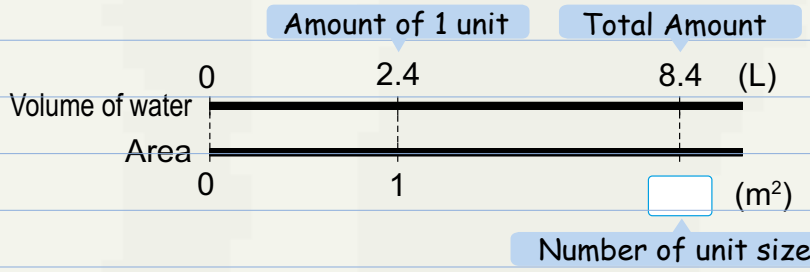
Volume of water (L)	?	4
Area (m²)	1	2.5

÷□ ÷2.5

Expression : □ ÷ □ = □ Answer □ L

3 Lyn used 2.4 L of water to water 1 m^2 flowerbed.
How many m^2 can she water with 8.4 L?

Approach : Use the amount of 1 unit size to calculate the number of unit sizes.



Volume of water (L)	2.4	8.4
Area (m^2)	1	?

÷ 2.4 ÷ ☐

Expression : ☐ Answer ☐ m^2

4 Ben wrote the following questions.

There is a solar panel that weighs 2.5 kg for 1 m^2.

The weight of 3.8 m^2 of this panel is ☐ kg.

Let's fill in the ☐ with an appropriate number.

1. Fill in the ☐.
2. Let's make a multiplication problem by changing the numbers and words.
3. Let's make a division problem by changing the numbers and words.

EXERCISE

1 Let's divide in vertical form.

Pages 58 to 69

① 12÷1.5　② 36÷1.8　③ 40÷1.6

④ 7.2÷2.4　⑤ 9.8÷1.4　⑥ 8.1÷2.7

⑦ 7.2÷0.9　⑧ 8.4÷0.6　⑨ 0.3÷0.8

⑩ 9.1÷3.5　⑪ 5.4÷1.2　⑫ 2.2÷5.5

⑬ 0.87÷0.6　⑭ 14.8÷1.6　⑮ 0.12÷0.48

2 Let's find the quotient within whole numbers and give also the remainders.

Pages 65 and 66

① 9.8÷0.6　② 6.23÷0.23　③ 9.72÷1.6

3 I poured 3.4 L of juice into cups of 0.8 L each. How many cups of 0.8 L juice will I have and how many L of juice will be left over?

Pages 58, 59 and 65

4 For answering the quotient to the nearest hundredths place, round the quotient to the thousandths place.

Page 66

① 0.84÷1.8　② 5.18÷2.4　③ 8.07÷0.96

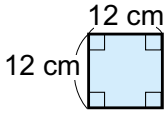
5 There is a wire 0.7 m long that weights 5.8 g.
About how many g will 1 m of this wire weigh?
To answer the quotient at the nearest tenths place, round the quotient to the hundredths place.

Page 67

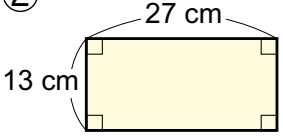
Grade 4
Do you remember?

Let's find the area of the following figures.

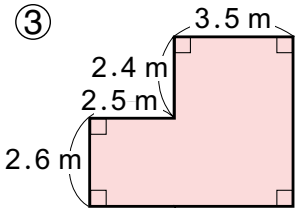
①



②



③



PROBLEMS

1 Let's divide in vertical form.

● Dividing decimal numbers by decimal numbers.

① $39.1 \div 1.7$　② $6.5 \div 2.6$　③ $29.4 \div 0.3$

④ $4.23 \div 1.8$　⑤ $0.99 \div 1.2$　⑥ $0.15 \div 0.08$

2 There is a rectangular flowerbed that is 17.1 m^2 and the length is 3.8 m.

What is the width in metres?

● Calculating the length of sides from the area.

3 We distributed 3 L of milk into 0.18 L per cup.

How many cups can we fill? How many litres of milk will be left over?

● Calculating the decimal number with remainder.

4 4.5 L of paint weighed 3.6 kg.

What are the meanings of the following expressions?

● Considering relationship between the dividend and the divisor.

① $4.5 \div 3.6$　② $3.6 \div 4.5$

5 Which is greater?

Let's fill in the ☐ with inequality signs.

● Understanding the relationship between the divisor and the quotient.

① $125 \div 0.8$ ☐ 125　② $125 \div 1.2$ ☐ 125

6 Let's explain how to calculate $6.21 \div 2.3$

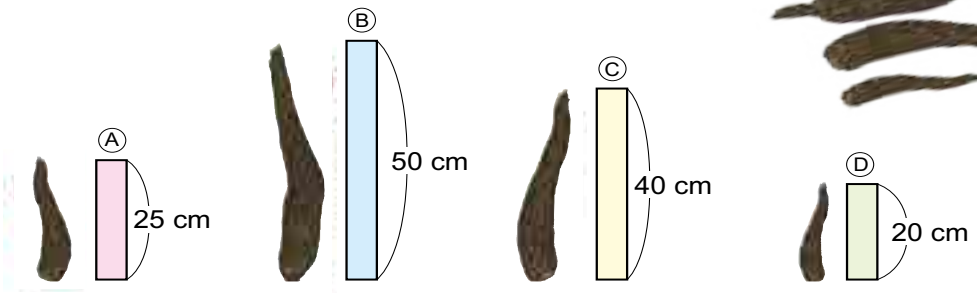
Why did you calculate like that?

Let's write the reasons which you used.

● Using calculation rules to explain.

Comparing Lengths

1 There are 4 different sizes of Cassava.



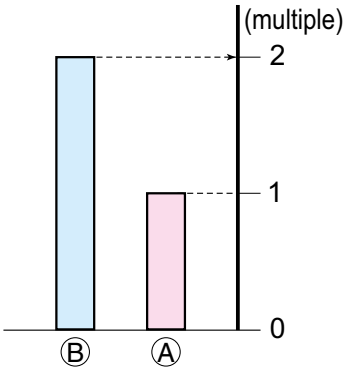
1 By how many times is the length of Ⓐ compared to Ⓑ?

50 ÷ 25 = ☐

Length of Ⓑ / Length of Ⓐ / Multiple

	Ⓐ	Ⓑ
cm	25	50
Multiples	1	?

(÷25, ÷25)



2 By how many times is the length of Ⓐ compared to Ⓒ ?

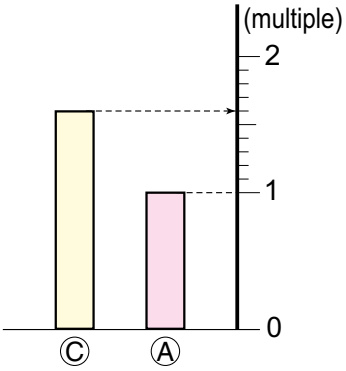
When Ⓒ is measured with Ⓐ there is a remainder.

Thus, we need to express the answer as decimal number by dividing the length between 1 and 2 into 10 equal parts.

☐ ÷ ☐ = ☐

	Ⓐ	Ⓒ
cm	25	40
Multiples	1	?

(÷25, ÷25)



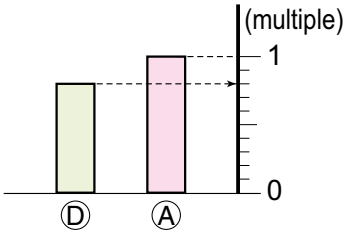
3 By how many times is the length Ⓐ to Ⓓ?

Since Ⓓ is shorter than Ⓐ, this multiple will be a number that is shorter than 1.

☐ ÷ ☐ = ☐

	Ⓐ	Ⓓ
cm	25	20
Multiples	1	?

(÷25, ÷25)



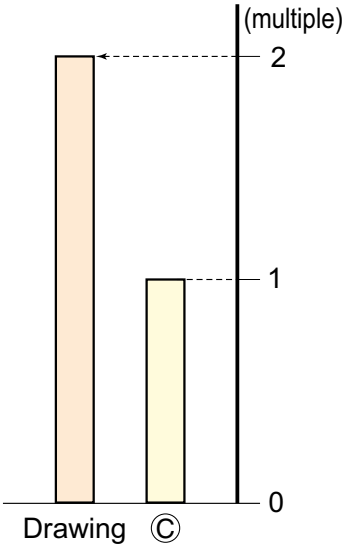
2 We are going to draw pictures of cassava based on cassava ©.

1 If we draw a cassava twice the height of ©, what will be the length of the new cassava?

40 × 2 = □

Length of © | Multiple | Length of drawing

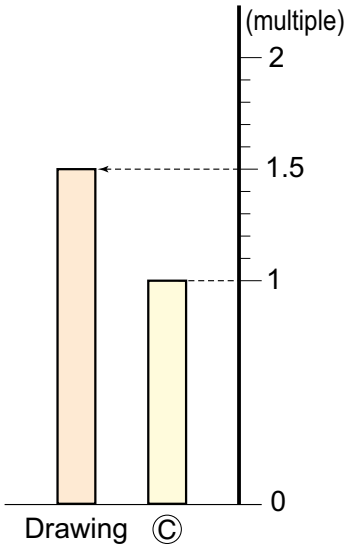
		× □
cm	40	?
Multiples	1	2
		×2



2 To make the drawing of the cassava 1.5 times the length of ©, how many cm should it be? The length of 1.5 times is when the length between 1 and 2 is divided into 10 equal parts.

□ × □ = □

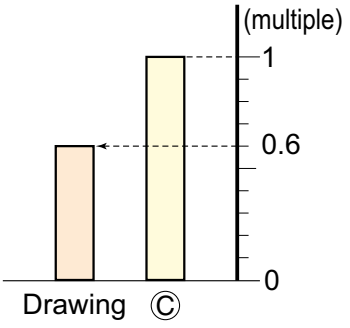
		× □
cm	40	?
Multiples	1	1.5
		×1.5



3 To make the drawing of the cassava 0.6 times the length of ©, how many cm should it be? The length multiplied by 0.6 will become smaller than when it is multiplied by 1, so it will be smaller than the original length.

□ × □ = □

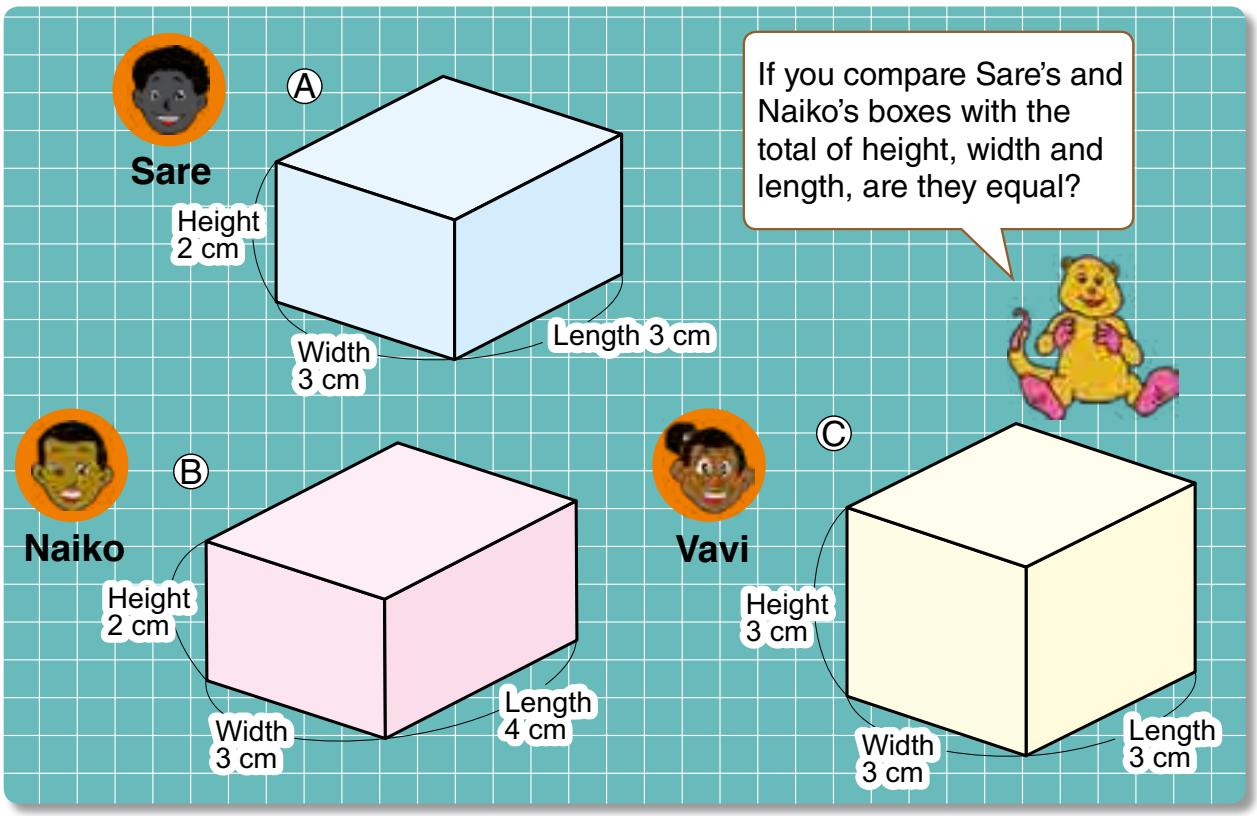
		× □
cm	40	?
Multiples	1	0.6
		×0.6



6 Volume

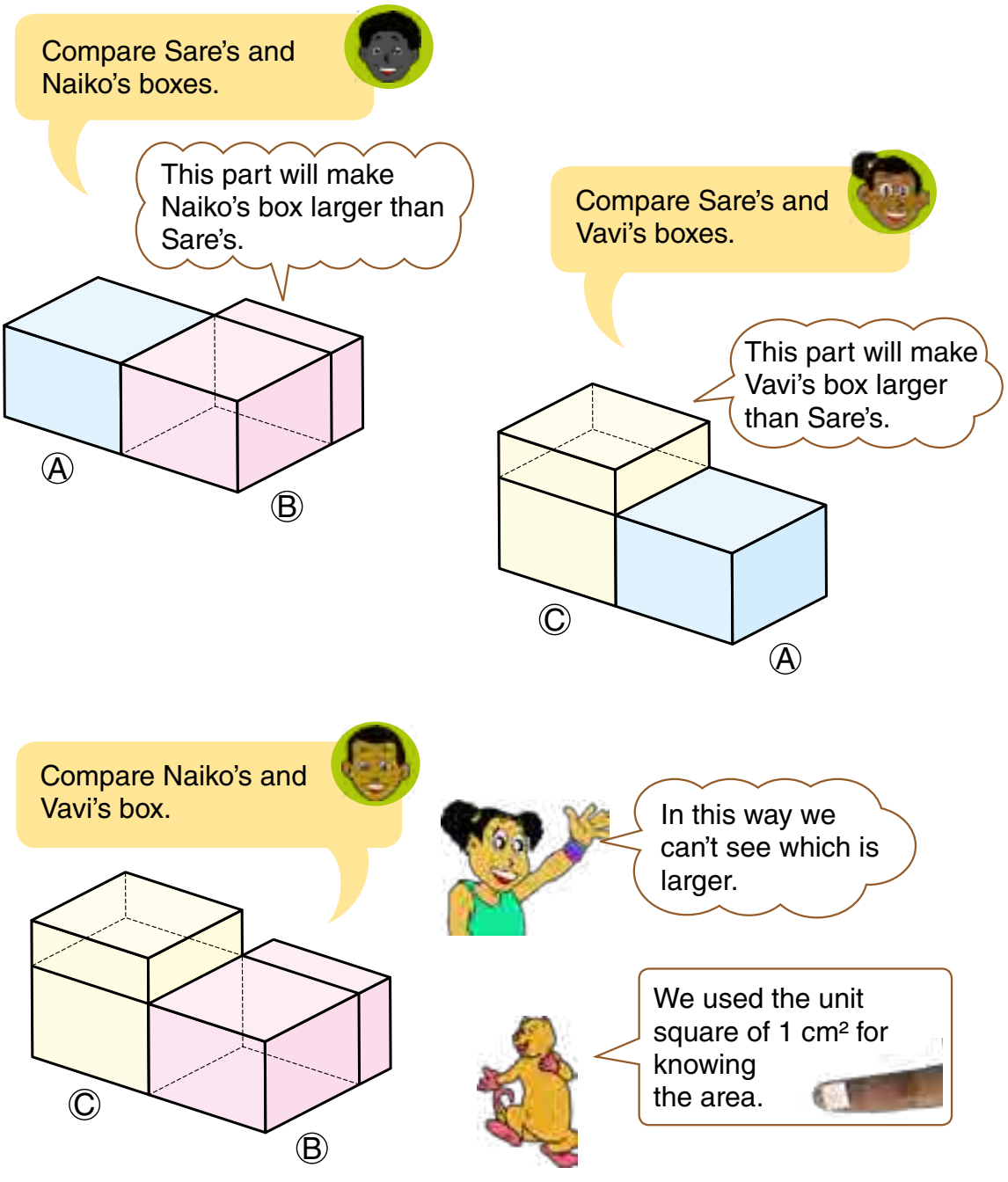
Let's draw the development of a rectangular prism and a cube on a squared paper below. How can you make the largest box?

Whose box is the largest amongst the three?



1 Volume

1 Let's compare the sizes of the boxes which the three children prepared.

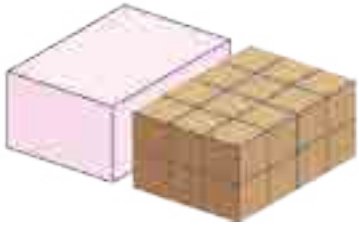


1 Let's think about how to compare the sizes of the boxes.

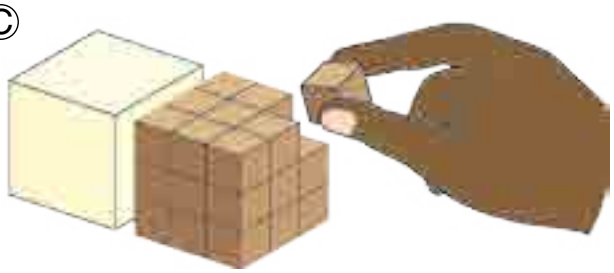
Let's explore how we can represent the sizes of rectangular prisms and cubes.

2 We made the same solids by using 1 cm cubic blocks.
Let's compare the number of cubes needed to make Naiko and Vavi's boxes.

Ⓑ



Ⓒ



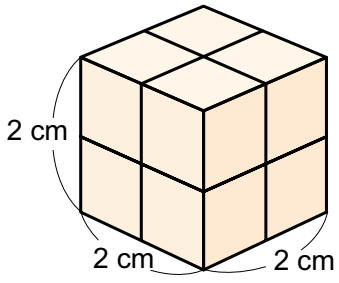
Ⓑ needs ☐ boxes.

Ⓒ needs ☐ boxes.

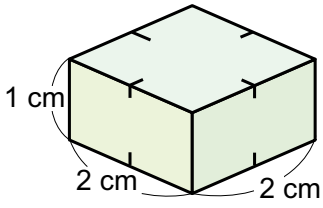
☐ needs ☐ more boxes.

2 How many 1 cm cubes are needed for the following rectangular prism and cube?

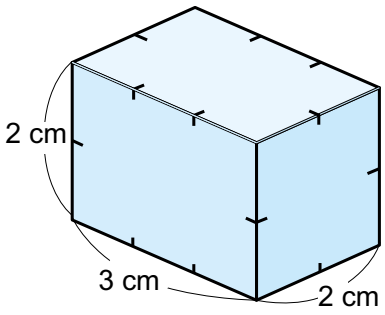
1



2



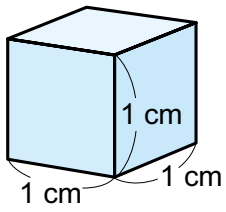
3



The size of a solid represented by a number of units is called **volume**.

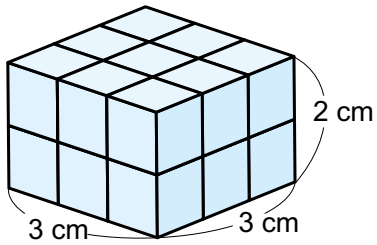
1 cm cube is used as a unit for volume. We represent volume by counting the number of cube units.

The volume of a cube with 1 cm sides is called **1 cubic centimetre** and is written as 1 cm^3.
Cubic centimetre (cm^3) is a unit of volume.

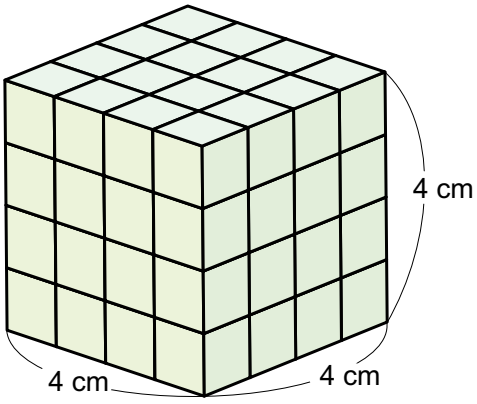


3 Let's find the volume of the following rectangular prism and the cube.

1



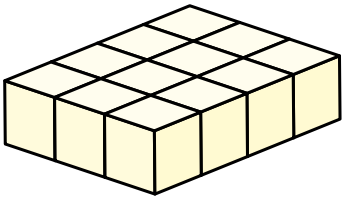
2



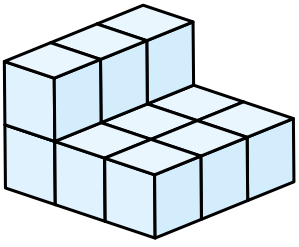
Same Volume

Use 12 cubes of 1 cm^3 and make different shapes.

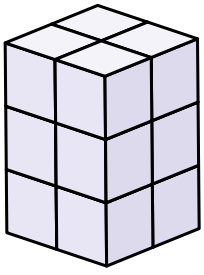
Ⓐ



Ⓑ

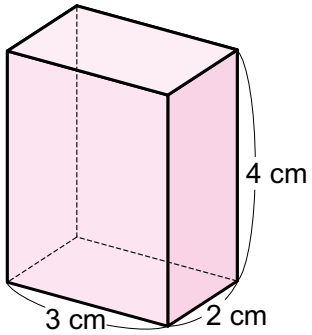


Ⓒ



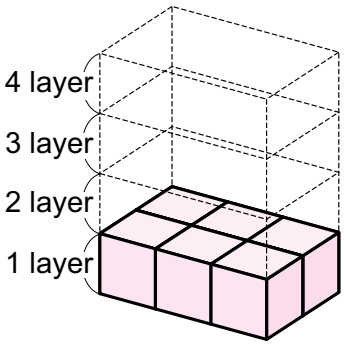
2 Formula for Volumes

1 Let's think about how to find the volume of the rectangular prism on the right.



① How many 1 cm³ cubes are on the bottom layer?

② How many layers are there?



③ How many 1 cm³ cubes are there and what is its volume?

$3 \times 2 \times 4 = \square$

Number of length | Number of width | Number of height | Total number

What do we need to know in order to calculate volume?

The number of cubes used in length is equal to length, the number of cubes used in width is equal to width and the number of cubes used in height is equal to height respectively.

$3 \times 2 \times 4 = \square$ (cm³)

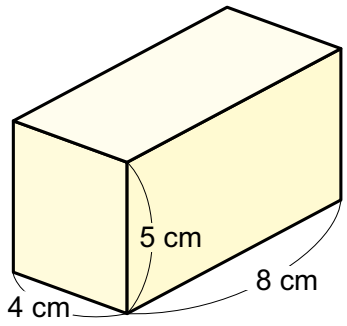
Length | Width | Height | Volume

The volume of a rectangular prism is expressed in the following formula using length, width and height.

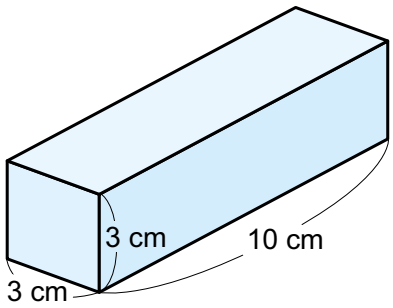
Volume of rectangular prism = length × width × height

2 Let's find the volume of the following prisms below.

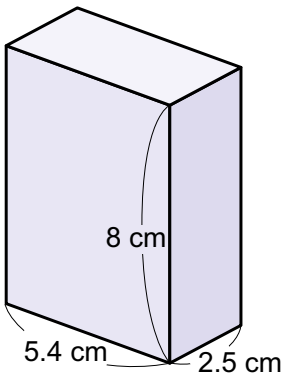
1



2



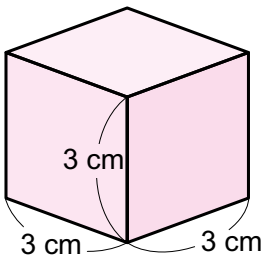
3



3 Let's find the volume of this cube.

1 How many 1 cm³ cubes are there in this cube?

2 What is the volume?

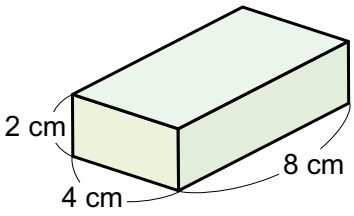


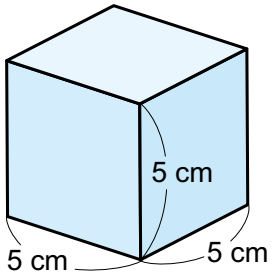
Since the size of length, width and height of cube are equal, its formula is the following:

Volume of cube = side × side × side

Exercise

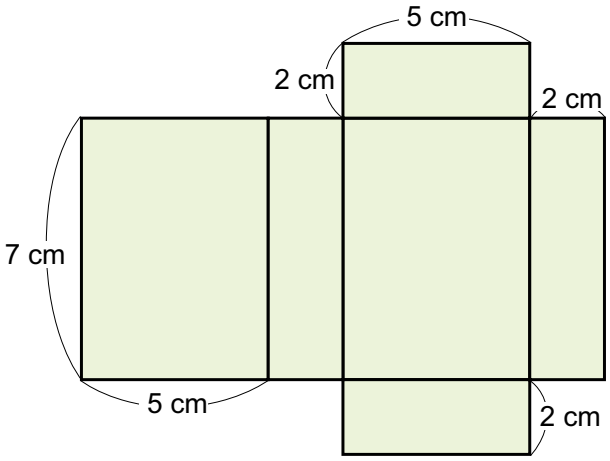
1 Let's find the volumes of the rectangular prism and the cube below.





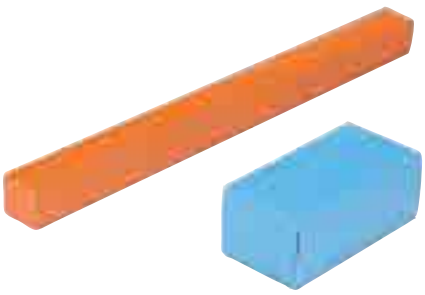
2 Let's find the volumes of rectangular prisms and cubes from your surroundings.

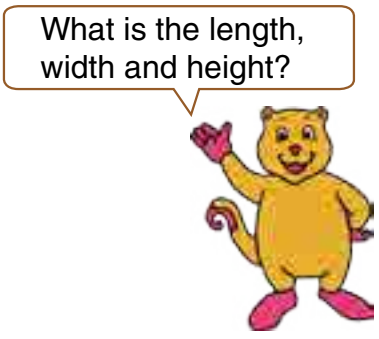
4 Fold the development below and find the volume.



Let's Make a Box of 200 cm^3

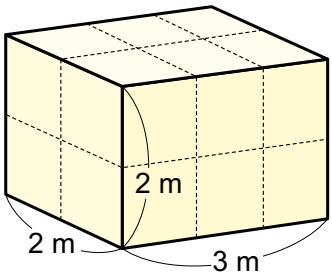
Make several boxes which have a volume of 200 cm^3.





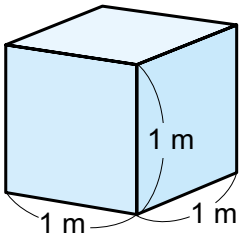
3 Large Volumes

1 Let's think about how to express the volume of a large rectangular prism such as this one.



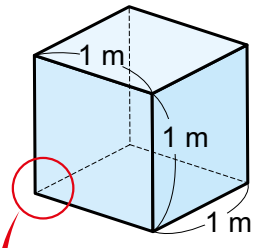
1. How many 1 m cubes are in this prism?

The volume of a cube with 1 m sides is called **1 cubic metre** and expressed as 1 m^3.

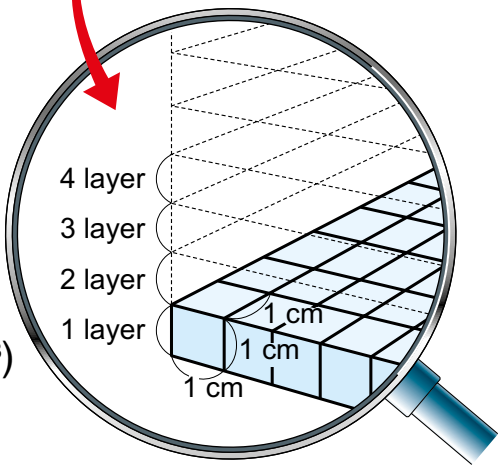


2. What is the volume of the prism in 1 m^3?

2 Let's find how many cm^3 equals to m^3.



1. How many 1 cm^3 cubes will line up for the width and the length of 1 m^2 base?
2. How many layers of 1 cm^3 are there?
3. What is the total of 1 cm^3 cubes and the volume in cubic centimetre?



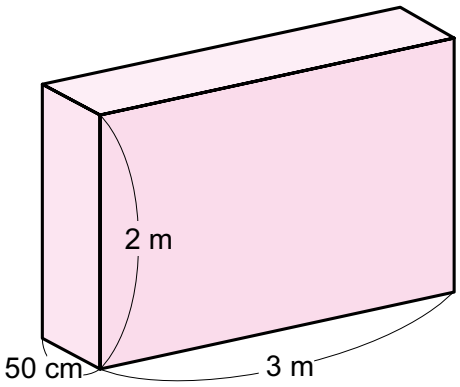
100 × 100 × 100 = ☐ (cm^3)

Length Width Height Volume

1 m^3 = 1 000 000 cm^3

1 m is equal to how many cm?

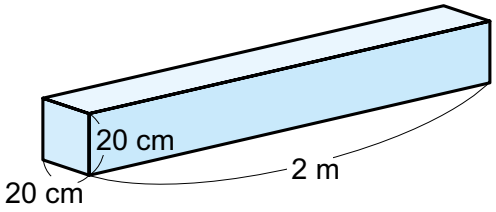
3 Let's find the volume of the rectangular prism on the right.



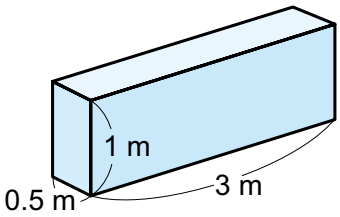
1. Think about how to calculate.
2. What is its volume in m^3 and in cm^3 ?

Exercise

1 What is the volume of this rectangular prism?

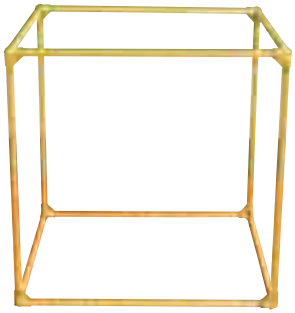


2 Find the volume of this rectangular prism both in m^3 and cm^3.

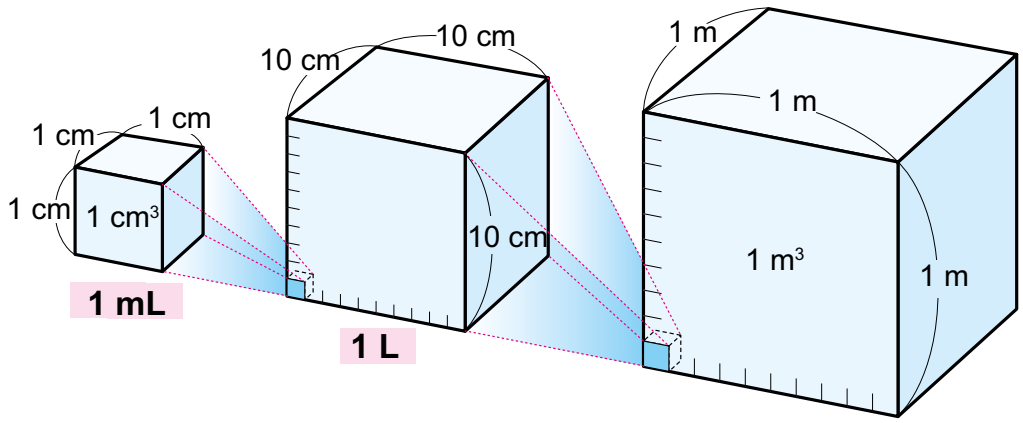


The Volume of 1 m^3 Cube

How many people can get inside this 1 m^3 cube?



4 Let's check the relationship between the amount of water and the volume.



1 1 L equals 1000 mL.
How many cm³ is 1 L?

1 mL = ☐ cm³

2 Find the volume in cm³ of the water which would fill a 1 L container.

1 L = ☐ cm³

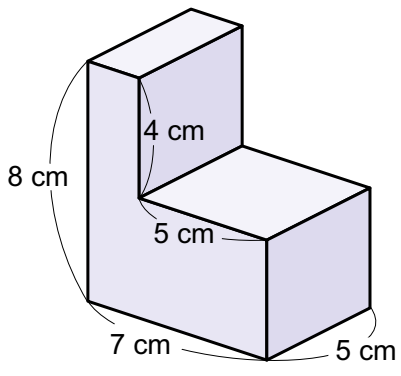
3 How many L of water will fill a 1 m³ tank?

1 m³ = ☐ cm³
= ☐ L

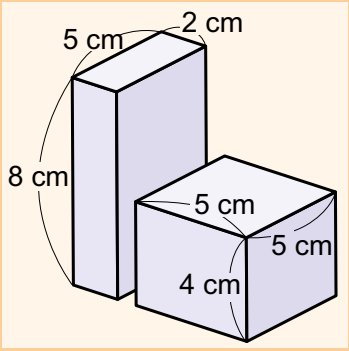
The units for the amount of water are expressed by L, dL and mL.

1000 L = 1 m³ 1 dL = 100 cm³ 1 mL = 1 cm³

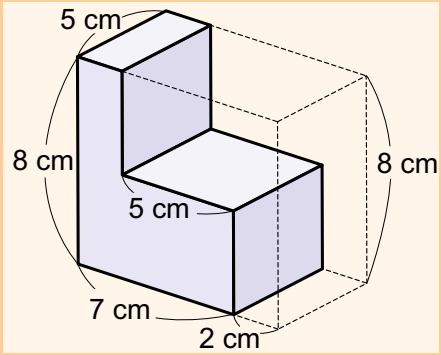
5 Let's think about how to find the volume of the solid on the right.



Gawi's Idea



Ambai's Idea



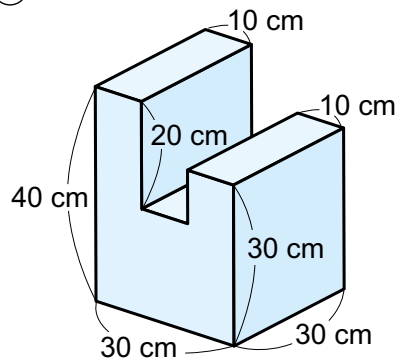
Activity

1. Write down expressions and answers by using their ideas.
2. Discuss with your friends about other ideas.

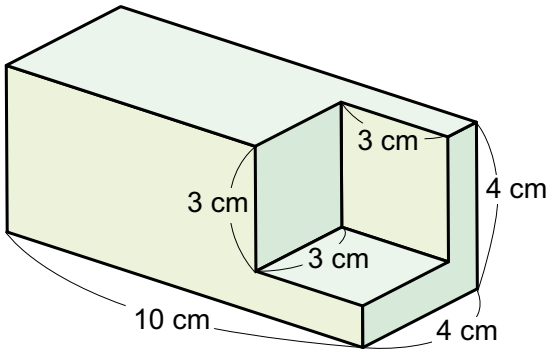
Exercise

Let's find the volume of these solids below.

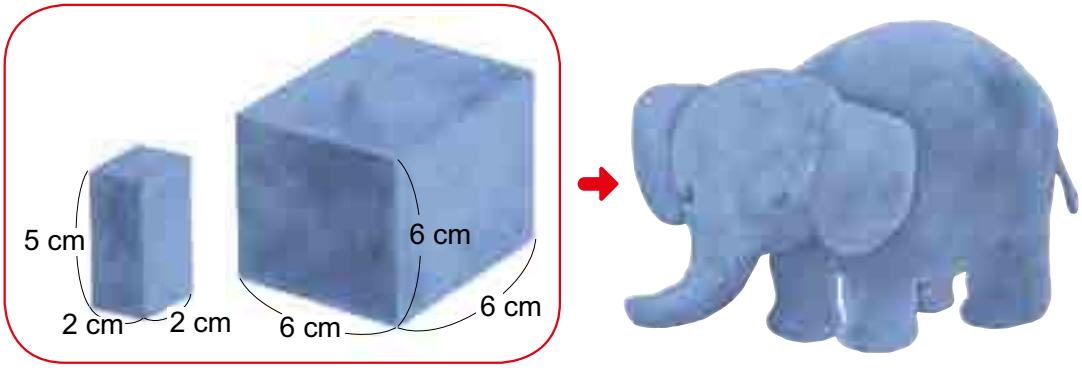
①



②



6 We made an elephant by using a cubic and rectangular prism clay below. Find the volume of the elephant.



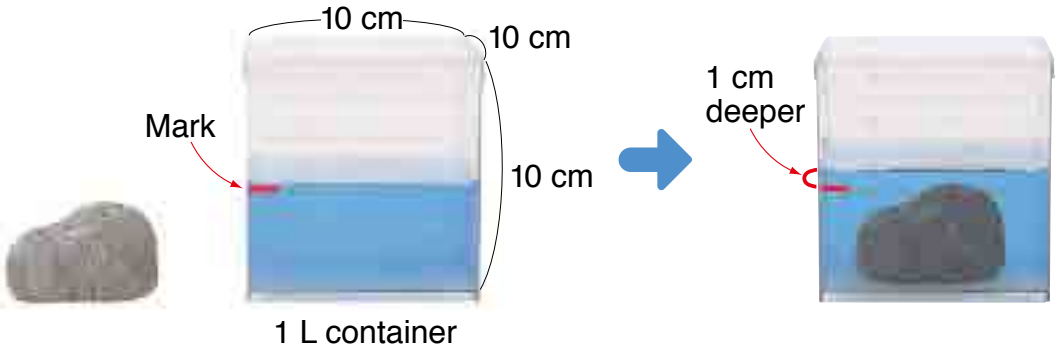
Volumes of Various Shapes

Physical objects have volumes. How can we find the volumes of other objects that are not cubes or rectangular prisms?

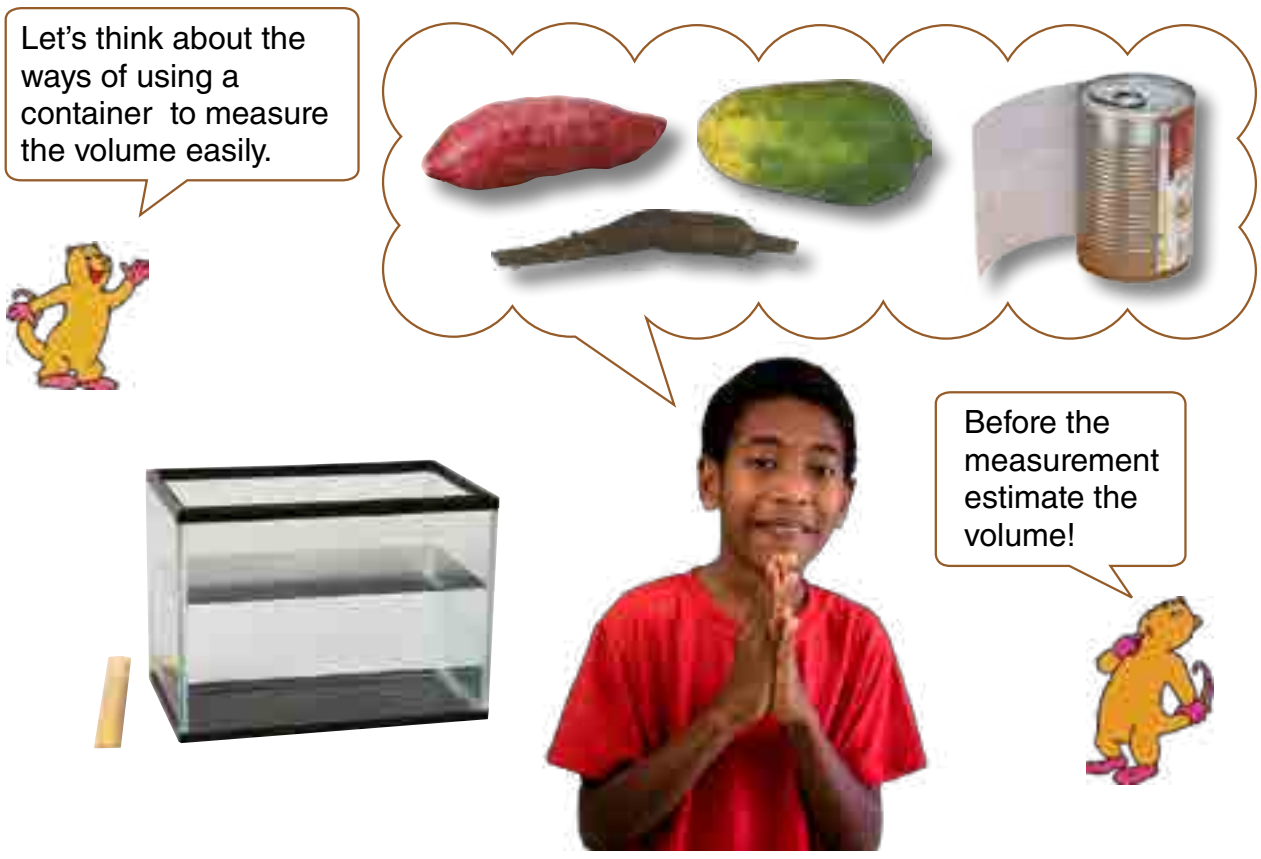
For example, an uneven shape such as a rock can be calculated by putting it in the water.

7 When you sink an object in the water, the level of water will be increase by the volume of the object.

Let's find the volume of the rock below.



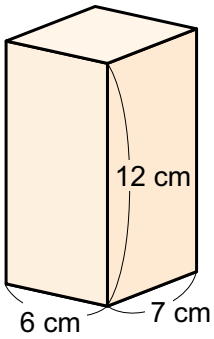
8 Let's measure the volume of various objects.

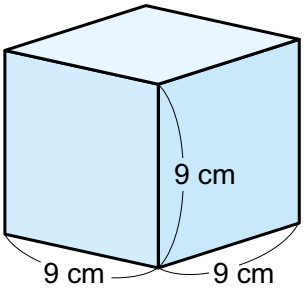


EXERCISE

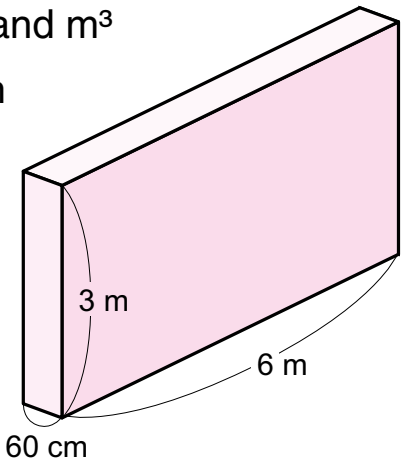
1 Let's find the volume of the rectangular prism and the cube below.

Pages 72, 78 and 79

① 

② 

2 What is the volume in cm^3 and m^3 for the rectangular prism on the right?

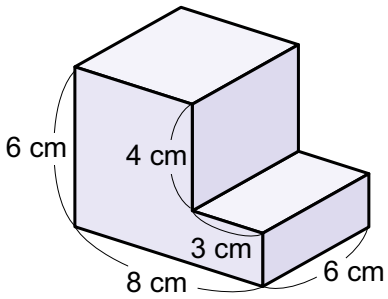


Pages 81 and 82

3 What is the volume of 400 L water in cm^3 and m^3?

Page 83

4 Let's find the volume of the object on the right.



Pages 84 and 85

Grade 5

Do you remember?

Let's calculate.

① 30×1.2 ② 5.4×1.2 ③ 2.13×5.4 ④ 0.12×0.5

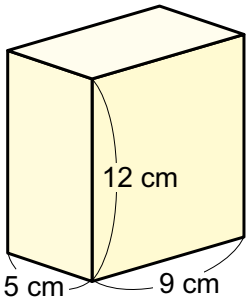
⑤ $9 \div 1.5$ ⑥ $4.5 \div 2.5$ ⑦ $6.12 \div 7.2$ ⑧ $1.61 \div 0.7$

PROBLEMS

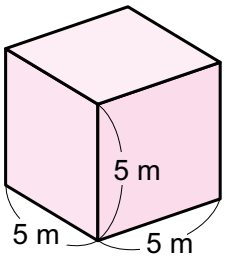
1 Let's find the volume of the following rectangular prism and cube.

● Using the formula.

①



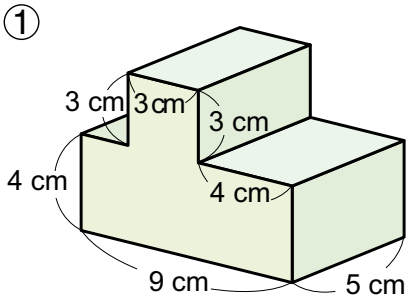
②



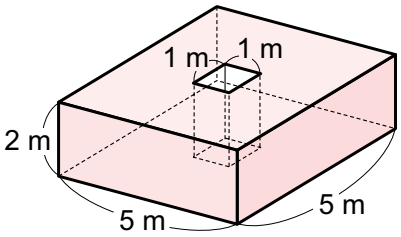
2 Let's find the volumes below.

● Considering the ways.

①

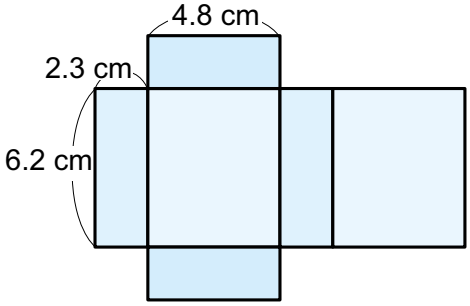


②



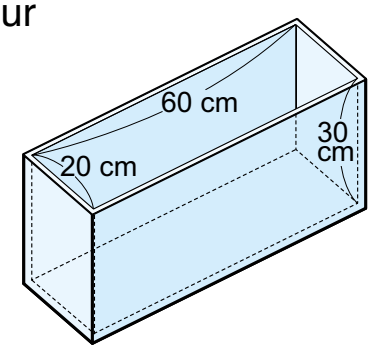
3 Let's find the volume of a prism which could be made by the development on the right.

● Calculating the volume from its development.



4 Let's fill the rectangular prism tank below with water. How many times do you need to pour water with a 10 L bucket?

● Representing the volume of water by various units.



7 Multiples and Divisors

Let's think about number groups.
First, decide the "clap number".

Make a circle and say the number in the order from one. When the count numbers is 3, each person claps, every 3rd person claps by saying the "clap number".

Activity

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Let's enjoy "Clap Number" game

1 Multiples and Common Multiples

Multiples

1 When the "clap number" is 3, let's consider which numbers will be clapped.

1. Write numbers in the table on the right and put colours on the number which will be clapped.
2. Put colours on the numbers line below, too.
   Let's discuss what the groups of coloured numbers are.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22								

31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

Activity

Multiples of 3 are whole numbers multiplied by 3 like
3×1, 3×2, 3×3, … .
$3\times0=0$, but 0 is not a multiple of 3.

2 Clap by multiples of 2.

Let's find the relationship of the numbers clapped.

Circle the clapped numbers on the number line below.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48

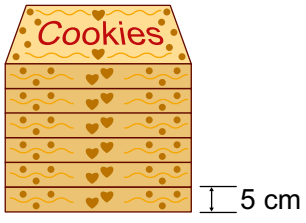
49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64

Exercise

1 Stack the boxes of cookies with a height of 5 cm.

① What is the total height of 6 boxes?

② Which multiple gives the total height?

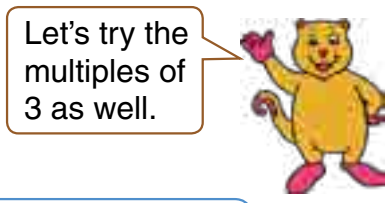


2 Let's write the first 5 numbers of the following multiples.

① Multiples of 8 ② Multiples of 9

How Multiples Make Patterns in Numbers

Circle the multiples of 2 in the table below.
How do the multiples of 2 line up?
Let's check the multiples of other numbers.



Multiples of 2

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Multiples of 3

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Multiples of □

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Multiples of □

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Common Multiples

3 Let's play "clap number game" by raising hands at the multiples of 2 and clapping at the multiples of 3.

For 6, raise hands and clap at the same time, right?

Are there any other numbers which students raise hands and clap at the same time like 6?

Multiples of 2 | **Multiples of 3** | **Multiples of both 2 and 3**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	…

1 Let's find numbers that are multiples of both 2 and 3.

A number that is a multiple of both 2 and 3 is called a **common multiple** of 2 and 3. The smallest of all common multiples is called the **least common multiple**.

2 What is the number of the least common multiple of 2 and 3?

4 Let's think about how to get the common multiples of 3 and 4. Four friends found different ways to determine the common multiples as follows. Let's read their ideas and describe each method in sentences. Explain the ideas to your friends.

Mero's note

multiples of 3 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36...

multiples of 4 4, 8, 12, 16, 20, 24, 28, 32, 36, 40 ...

I find the common numbers from the multiples of 3 and 4.

Yamo's note

Think about multiples of 3...
then, circle the multiples of 4.

3, 6, 9, 12, 15
× × × ○ ×

18, 21, 24, 27 ...
× × ○ ×

Sare's note

Write the multiples of 4
then, circle the multiples of 3.

4, 8, 12, 16, 20,
× × ○ × ×

24, 28, 32, 36 ...
× × ○ ×

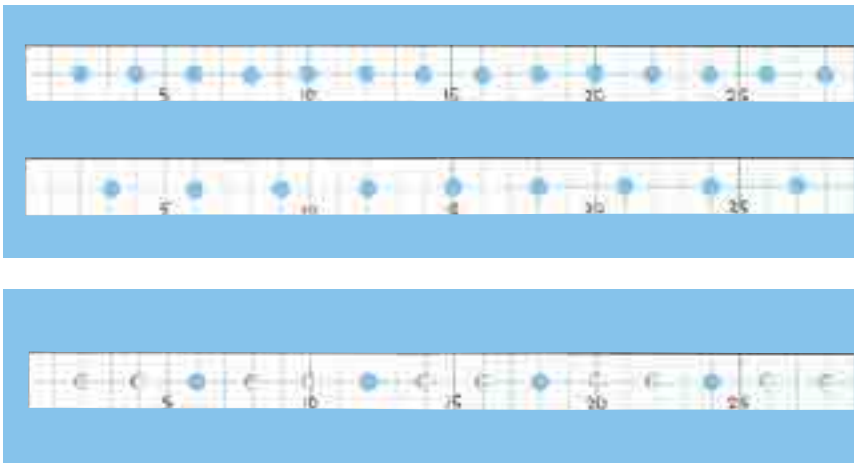
Vavi's note

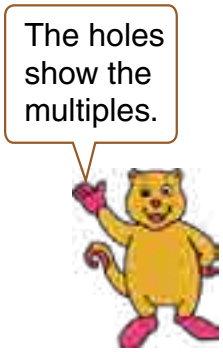
3, 6, 9, 12
4, 8, 12

12 × 2 = 24, 12 × 3 = 36

Making Tapes of Multiples

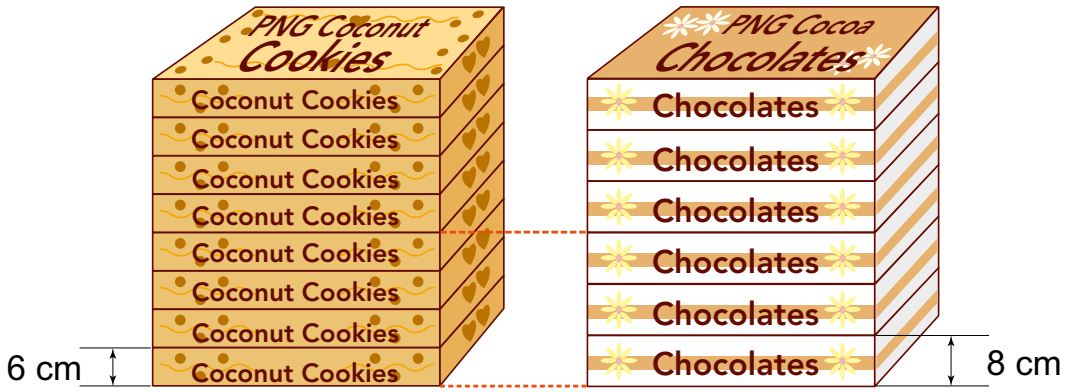
Place the tape of multiples of 2 on top of the tape of multiples of 3. The common multiples of 2 and 3 are where the holes on both tapes overlap.





The least common multiple of 3 and 4 is 12. All common multiples of 3 and 4 are multiples of 12.

5 Stacked are boxes of cookies with a height of 6 cm each and chocolate boxes with a height of 8 cm each.



1. The total height of the boxes of cookies are multiples of which number?
2. The total height of the chocolate boxes are multiples of which number?
3. What will be the least height that the cookie boxes and chocolate boxes be equal? How many boxes are in each stack?
4. Write the first 3 numbers where the height of both stacks are equal.

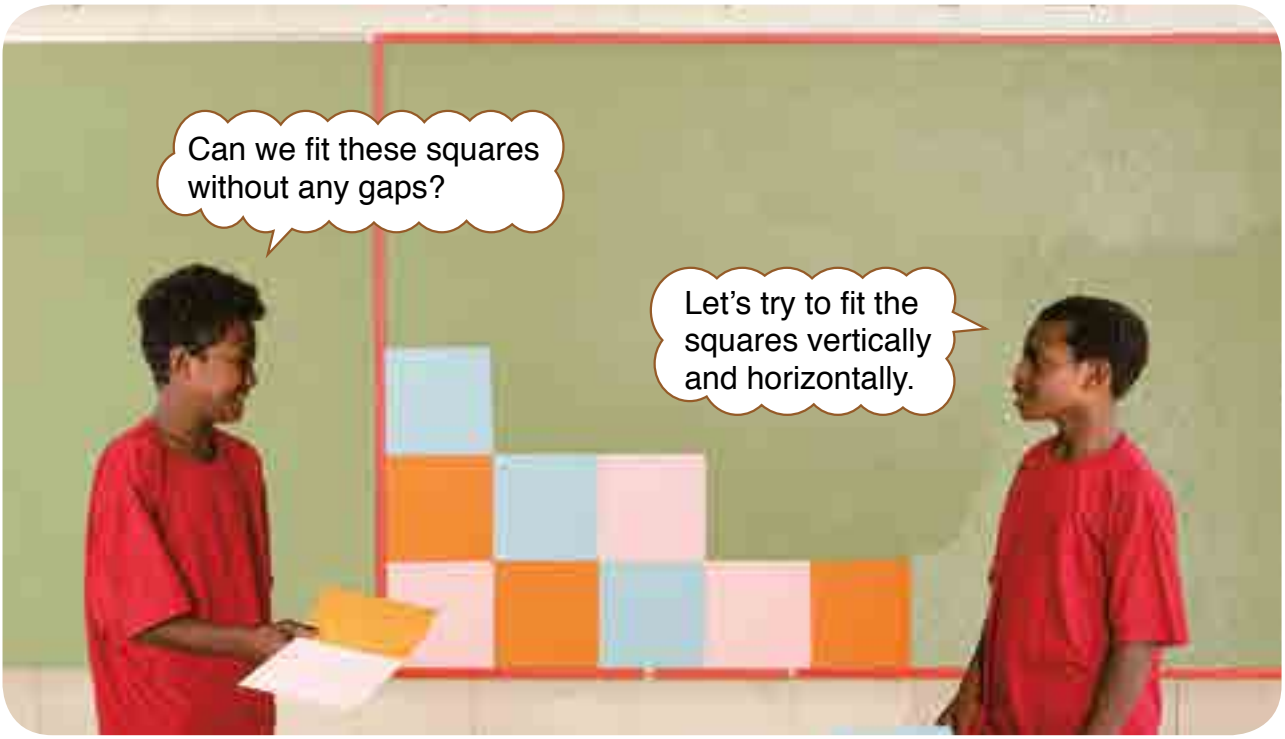
Exercise

1 Write the first 4 common multiples for each of the following groups of numbers. Find the least common multiples.

① (5, 2) ② (3, 9) ③ (4, 6)

2 Stack boxes with heights of 6 cm and 9 cm. What is the smallest number where the total heights of the two stacks are equal?

2 Divisors and Common Divisors

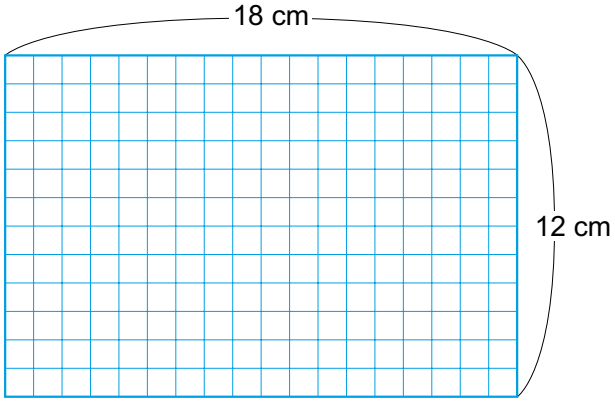


We want to put squares in this frame so there are no gaps.

Let's find out which squares can fit in the frame without any gaps.

Divisor

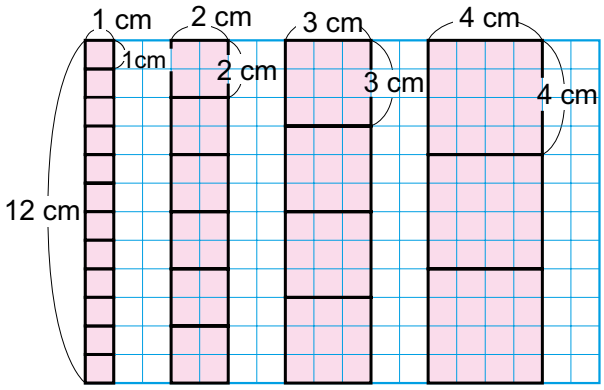
1 Place squares of the same size in a 12 cm × 18 cm rectangle.
How long is each side of the square?



Think of the length of the sides of the squares when the squares are lined up vertically without any gaps.

(1) How many cm is each side of the squares when they are lined up vertically over a 12 cm length without any gaps?

The lengths of the sides of the squares when lined up vertically over a 12 cm length without any gaps are 1 cm, 2 cm, 3 cm, 4 cm, 6 cm and 12 cm.

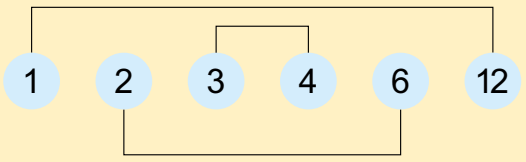


2 Divide 12 by 1, 2, 3, 4, 6 and 12 one by one to confirm that there are no gaps. Are they divisible by 12?

The whole numbers by which 12 can be divided with no remainder are called **divisors** of 12.

1, 2, 3, 4, 6, 12 .....Divisors of 12

3 What can you find when divisors of 12 are grouped as shown below?



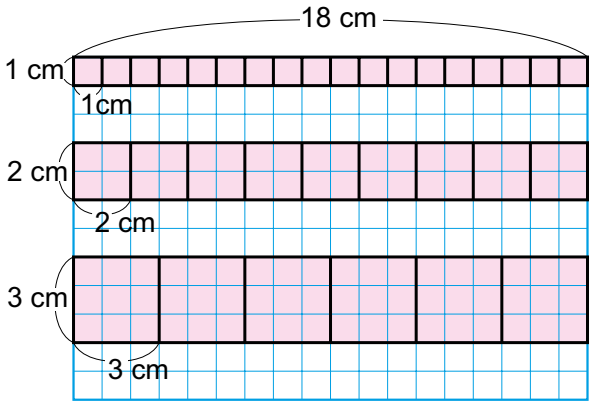
$1 \times 12 = 12$
$2 \times 6 = 12$
$3 \times 4 = 12$

Any number is divisible by 1 and itself.

Think about the length of the sides of the squares when the squares are lined up horizontally without any gaps.

4 How many cm is each side of the squares when they are lined up horizontally over a 18 cm length without any gaps?

The lengths of the sides of the squares when lined up horizontally over a 18 cm length without any gaps are 1 cm, 2 cm, 3 cm, 6 cm, 9 cm and 18 cm.



18 cm is included because we think only horizontally.

1, 2, 3, 6, 9, 18 .....Divisors of 18

Common Divisors

5 How many cm can the sides of the squares be, when lined up vertically and horizontally without any gaps?

Height..... 1 2 3 4 6 12 (cm)

Width..... 1 2 3 6 9 18 (cm)

We get squares when the width and height are equal.

The numbers that are divisors of both 12 and 18 are called **common divisors** of 12 and 18. The largest of all common divisors is called **greatest common divisor**.

6 The common divisors of 12 and 18 are 1, 2, 3 and 6.
What is the greatest common divisor of 12 and 18?

Exercise

1 Find all the divisors of 6, 8 and 36 respectively.

2 Write all the common divisors of 8 and 36.

2 Let's think about how to find the common divisors of 18 and 24.
Two friends calculated common divisors in different ways in their exercise books but did not complete.
Complete their ideas by considering their thinking.

Divisors of 18, ①, ②, ③, ⑥, 9, 18
Divisors of 24, ①, ②, ③, 4, ⑥, 8, 12, 24

Divisors of 18 1, 2, 3, 6, 9, 18
24÷1=24, 24÷2=12, 24÷3=8, 24÷6=4,
24÷9=2 r 6, 24÷18=1 r 6

3 Let's find all the common divisors and then find the greatest common divisors.

❶ (8, 16) ❷ (15, 20) ❸ (12, 42) ❹ (13, 9)

There are some pairs of numbers like ❹, that have only 1 as a common divisor.

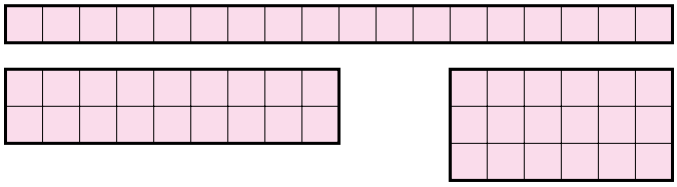
Exercise

1 We want to divide 8 pencils and 12 exercise books equally amongst the students.
What should be the appropriate number of students for distribution?

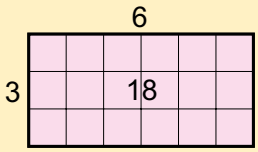
The Relationship between Multiples and Divisors

4 Let's think about the divisors of 18.

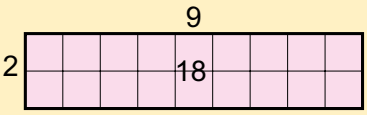
1 Find the divisors of 18 by arranging 18 square cards to make rectangles.



2 Is 18 a multiple of the divisors you found in **1**?



- 3 and 6 are divisors of 18.
- 18 is a multiple of 3 and 6.



- 2 and ☐ are divisors of 18.
- 18 is a multiple of ☐ and 9.

Prime Numbers

Some numbers like 2, 3, 5 and 7 are divisible only by 1 and itself.
Find such numbers amongst the following numbers.
Divide by 2, 3, 4… in order to find them.

2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21
22	23	24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39	40	41

A number that can be divided only by one and itself is called a **prime number**. One is not a prime number.

Using Prime Numbers

5 Let's represent whole numbers by a product form of prime number.

1. Express 6 by a product form of a prime number.
2. Express 30 by a product form of a prime number.

$$30 = 5 \times 6$$
$$= 5 \times 3 \times 2$$

Let's find divisors of 6.

3. Determine divisors of 30 by using the expression in 2.

2, 3 and 5 are easily found as divisors.

Divisor of 30 is the product of the combination of prime numbers.

6 Let's determine the greatest common divisor of 24 and 36 by using a prime number.

$24 = 4 \times 6$
$= 2 \times 2 \times 2 \times 3$

$36 = 6 \times 6$
$= 2 \times 3 \times 2 \times 3$
$= 2 \times 2 \times 3 \times 3$

When the multiples representations of prime numbers products are compared, it is common to, $2 \times 2 \times 3 = 12$.
Then, the greatest common divisor is 12.

$24 = 2 \times 2 \times 2 \times 3$
$36 = 2 \times 2 \times 3 \times 3$

7 Let's discuss how to determine the least common multiple of 24 and 36 by using a prime number.

Using multiple representation of prime number products, let's find the numbers that should be multiplied to get the same products?

$24 \times \square = 2 \times 2 \times 2 \times 3 \times \square$
$36 \times \square = 2 \times 2 \times 3 \times 3 \times \square$

Sieve of Eratosthenes

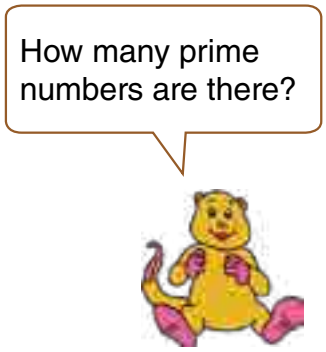
Determine a prime number that is less than 100 by the next procedure.

① Erase 1.
② Leave 2 and erase multiple of 2.
③ Leave 3 and erase multiple of 3.

Leave the first numbers and erase its multiples.
Using this method, a prime number like 2, 3, 5, 7, 11, etc, are left.

Using this method, find a prime number until 100.

~~1~~	(2)	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



Sieve of Eratosthenes is a method that was discovered by a mathematician named Eratosthenes in ancient Greece.
He was born in BC (Before Christ) 276 and died BC 194.

3 Even Numbers and Odd Numbers

1 Divide numbers from 0 to 20 into 2 groups by writing them alternately in the two rows below. Start with 0 in the upper row and then 1 in lower row, upper row, lower row, ...sequentially.

0,

1,

1. Divide the numbers in each row by 2.
2. What did you notice when dividing numbers in each row?

2 Arrange the whole numbers into 2 groups as shown below.

Ⓐ 0, 18, 36…
176, 212…

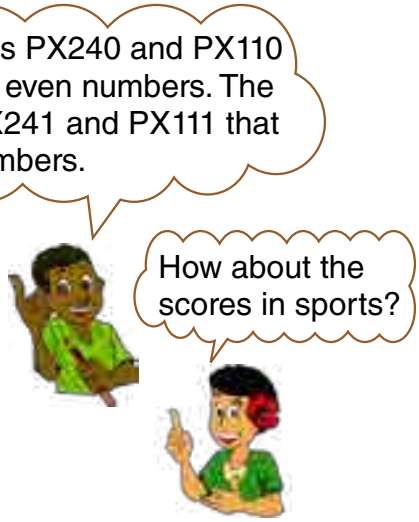
Ⓑ 1, 19, 37…
177, 213 …

3. In which group does 23 belong? How about 98?
4. What rule did you apply when dividing?

For the whole numbers, the numbers that can be divided by 2 without remainder are called **even numbers** and numbers that can be divided by 2 and leaves a remainder 1 are called **odd numbers**.

3 Identify some situations where we can use even and odd numbers?

Flight No	Time	Departure	Arrival	Time
PX240	08:40	POM	HKN	09:45
PX241	10:15	HKN	POM	11:20
PX110	12:05	POM	MAG	13:05
PX111	13:35	MAG	POM	14:35
PX186	15:20	POM	HGU	16:20
PX187	16:50	HGU	POM	17:50
PX113	07:00	MAG	POM	08:00
PX120	09:00	POM	WWK	10:20
PX121	10:50	WWK	POM	12:10
PX184	12:55	POM	HGU	13:55
PX185	14:25	HGU	POM	15:25
PX102	09:25	POM	LAE	10:10
PX103	10:40	LAE	POM	11:25
PX204	12:10	POM	RAB	13:35
PX207	14:05	RAB	POM	15:25
PX106	16:10	POM	LAE	16:55
PX107	17:25	LAE	POM	18:10



EXERCISE

1 Let's think about numbers up to 50.

Pages 88 and 98

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50

① Make a list of the multiples of 3.

② Make a list of the multiples of 7.

③ Make a list of the common multiples of 3 and 7.

④ Make a list of the divisors of 28.

⑤ Make a list of the divisors of 32.

⑥ Make a list of the common divisors of 28 and 32.

2 Let's write the first 3 common multiples of the following pairs of numbers. Then, find the least common multiples.

Pages 92 to 94

① (3, 6) ② (8, 10) ③ (3, 5)

3 Let's find all the common divisors of the following pairs of numbers. Then, find the greatest common divisors.

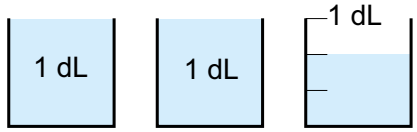
Pages 95 to 98

① (6, 12) ② (18, 20) ③ (32, 42)

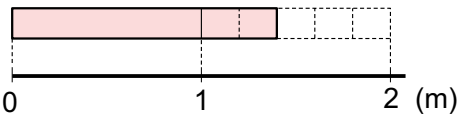
Grade 4

Do you remember?

Express the next volume and length by a mixed fraction and an improper fraction.

① 

□ □/□ dL □/□ dL

② 

□ □/□ m □/□ m

PROBLEMS

1 Let's write 3 multiples of the following numbers from the smallest to largest. Find all the divisors for them.

● Finding multiples and divisors.

① 16 ② 13 ③ 24

2 Let's write 3 common multiples of the following pairs of numbers from the smallest to the largest. Find the least common multiple for them.

● Finding common multiples and least common multiples.

① (3, 7) ② (12, 18) ③ (10, 20)

3 Let's write all the common divisors of the following pairs of numbers.
Find the highest common divisor for them.

● Finding common divisors and the greatest common divisors.

① (9, 15) ② (4, 11) ③ (12, 24)

4 PMV bus A departs every 12 minutes and bus B departs every 8 minutes at 4 mile bus stop. Bus A and B both departed at 9 am. What is the next time that bus A and B will depart at the same time?

● Solving problems by using common multiples or common divisors.

5 Start with a sheet of graph paper that is 30 cm wide and 12 cm long. Cut out squares of the same size so that no paper is left over. How many cm is each side of the biggest square? How many of these squares can be cut out?

● Solving problems by using common multiples or common divisors.

6 Let's find the prime number that is bigger than 50 and closest to 50.

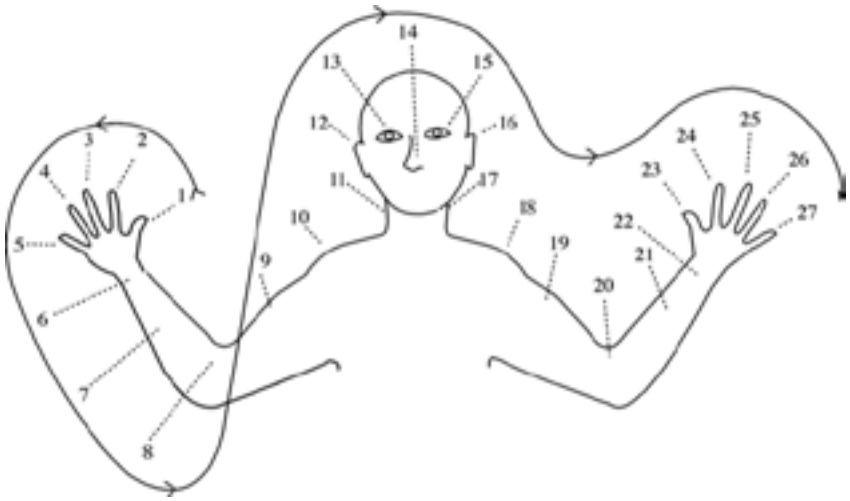
● Understanding some numbers can be divided by only 1 and itself.

Mathematics Practices in Papua New Guinea

Topic 2: Traditional Body Counting System Used in Okasapmin

Papua New Guinea is home to an extraordinary number of languages and cultural groups. Traditionally, these communities have used diverse and fascinating ways to count and communicate about number. Prof. Geoffery Saxe researched the counting system in Oksapmin, Sandaun province. Let's find out the counting system of the Oksapmin people.

Many groups count by pointing to positions on the body and the Oksapmin people are a good example. As shown in the figure, a person begins on the thumb on one side of the body and counts around the upper body to the little finger on the opposite hand while naming corresponding body parts. To count beyond 27, Oksapmin people continue around the body back up the wrist of the second hand.

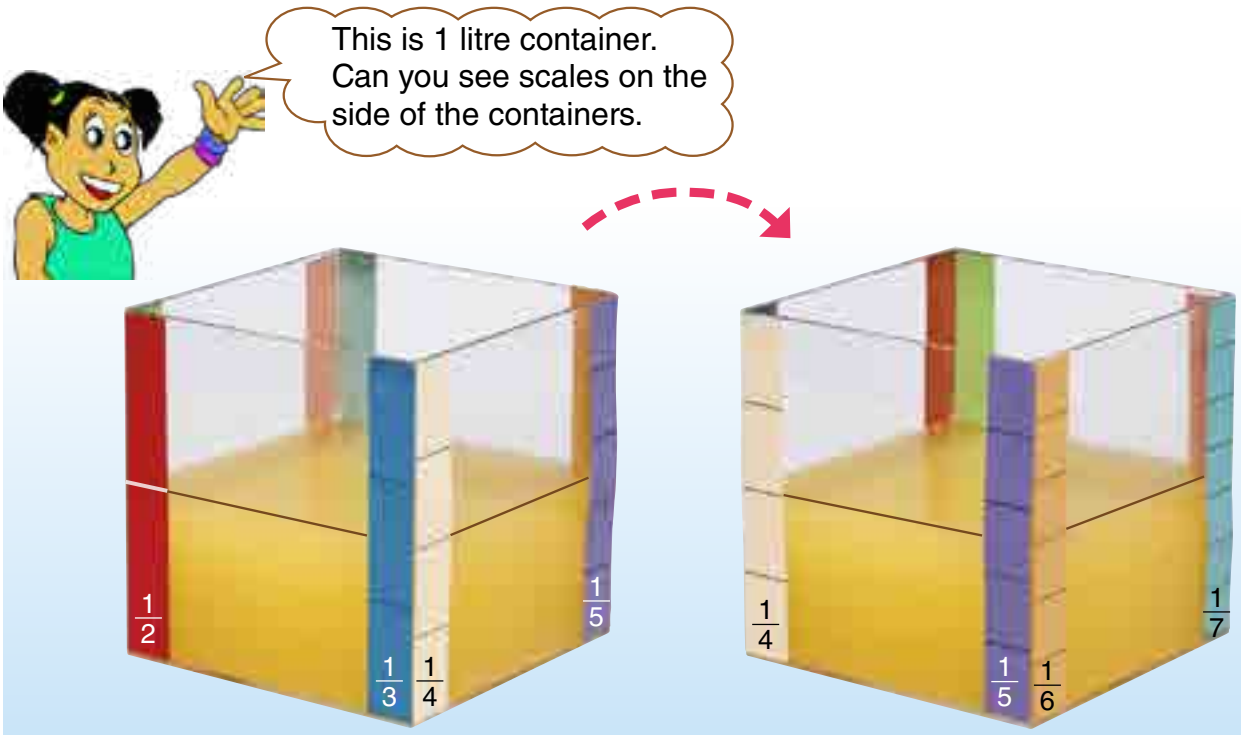


In traditional life, Oksapmin people used their counting system in several ways. For example, they counted important objects; they indicated order, like points of arrival on a path; they tallied contributions in a bride price exchange. You might be surprised to learn that Oksapmin people did not use their body part counting system to solve arithmetic problems in their traditional activities. However, with the introduction of Australian currency (shillings and pounds) in the 1960's and in the shift to Papua New Guinea currency (Kina and toea) with independence from Australia in 1975, Oksapmin people developed new ways of using their body system to calculate money when buying and selling goods.

Source: Professor Geoffery Saxe Ph.D., , University of California, Berkeley, 2013.

8 Fractions

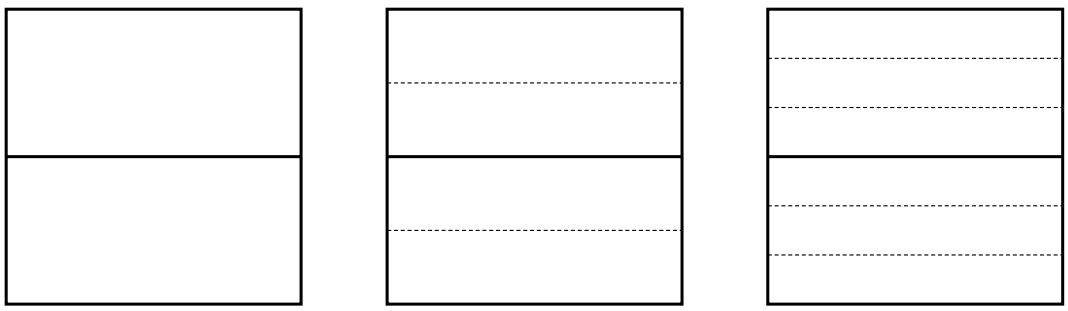
Let's pour some orange juice in a fraction measuring container.



There is $\frac{1}{2}$ L of juice in the fraction measuring container.

If you draw dividing lines as shown below, how will the quantity be represented?

Let's use fractions to represent the quantity of juice.

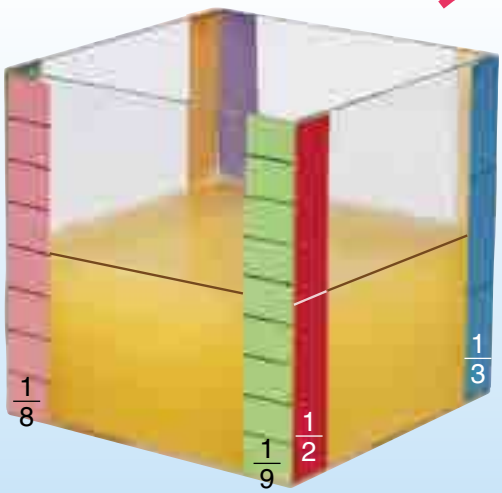


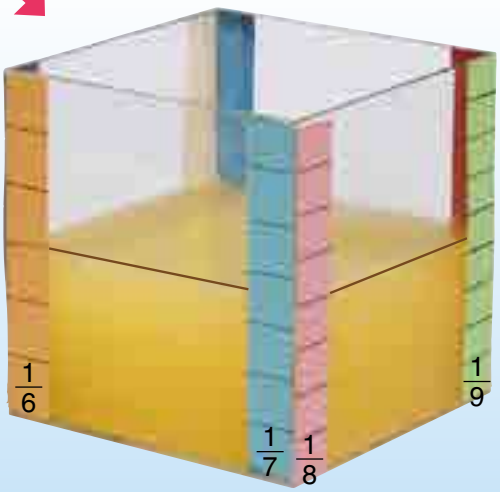
$\frac{\square}{\square}$ L $\frac{\square}{\square}$ L $\frac{\square}{\square}$ L

I can use $\frac{1}{2}$ litre to see the red measurement.

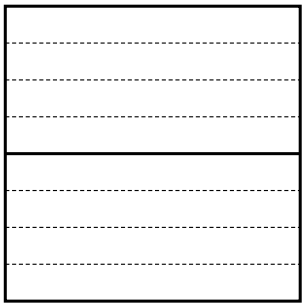
$\frac{1}{2}$

I can see $\frac{1}{2}$ litre represented.

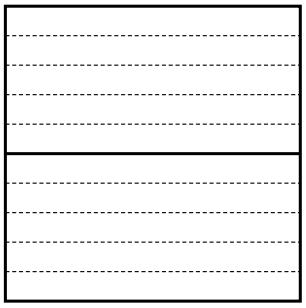




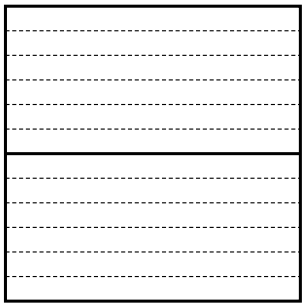
You can represent the same amount of juice in many different ways in fraction.



$\frac{\square}{\square}$ L



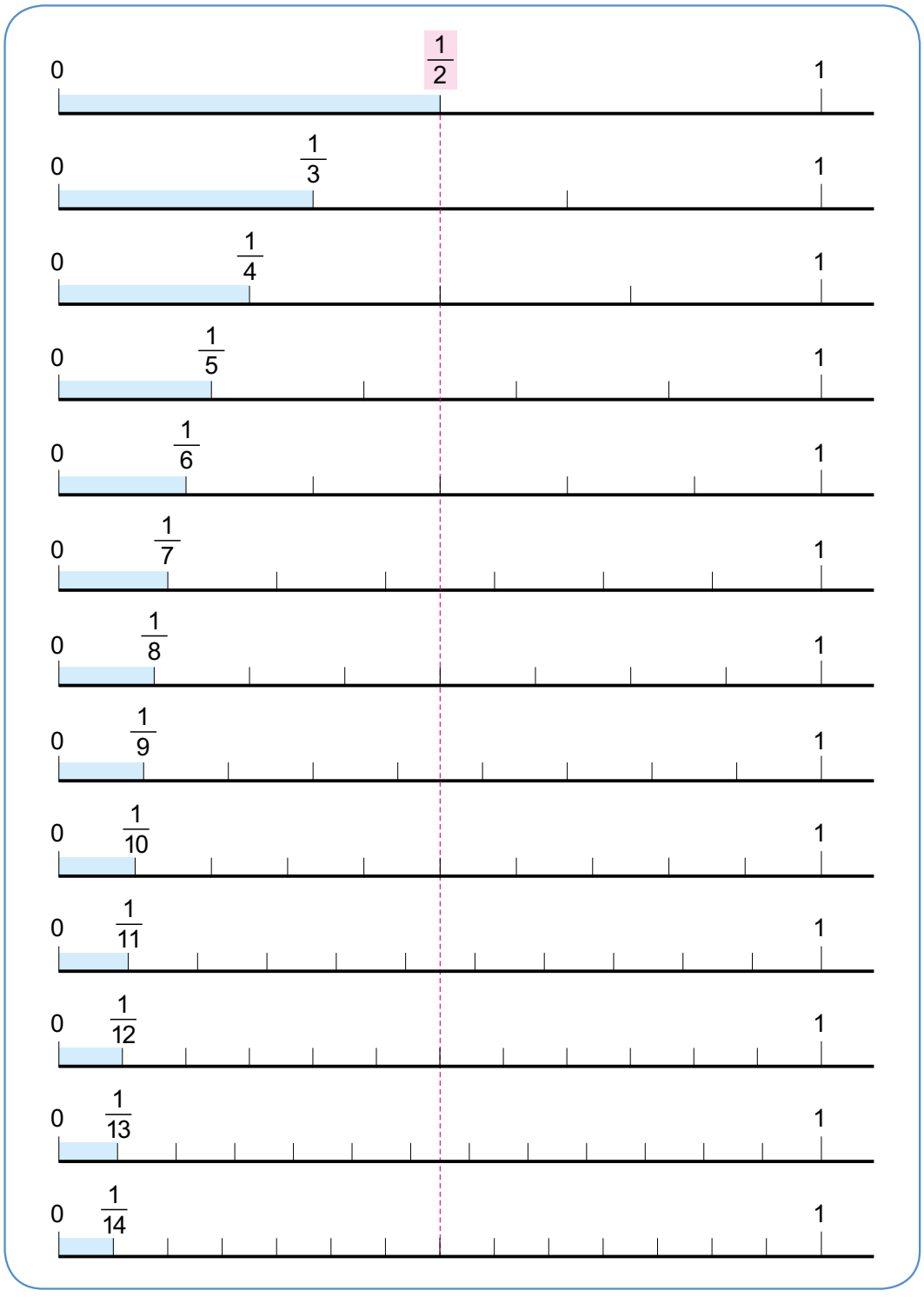
$\frac{\square}{\square}$ L



$\frac{\square}{\square}$ L

1 Equivalent Fractions

1 Let's explore the equivalence of fractions by using the number line.



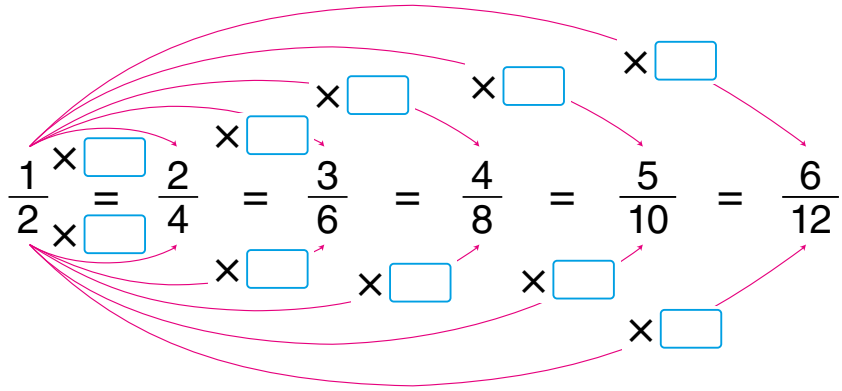
1 Let's find fractions, which are equivalent to $\frac{1}{2}$.

$$\frac{1}{2} = \frac{\square}{4} = \frac{\square}{6} = \frac{\square}{8} = \frac{5}{\square} = \frac{6}{\square} = \frac{\square}{14}$$

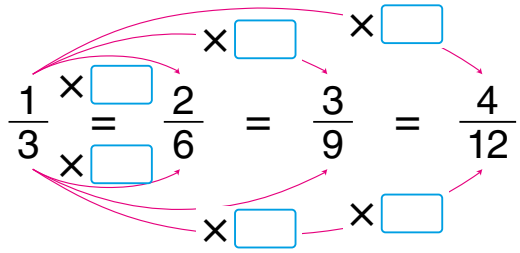
2 Let's find fractions, which are equivalent to $\frac{1}{3}$.

$$\frac{1}{3} = \frac{\square}{6} = \frac{3}{\square} = \frac{\square}{12}$$

3 What numbers are multiplied to each denominator and numerator of the fraction $\frac{1}{2}$ in problem 1?



4 What numbers are multiplied to each denominator and numerator of the fraction $\frac{1}{3}$ in problem 2?



Exercise

Let's develop 4 fractions which are equivalent to $\frac{1}{4}$.

2 Comparision of Fractions

Let's compare the sizes of $\frac{2}{4}$, $\frac{2}{3}$ and $\frac{3}{4}$.

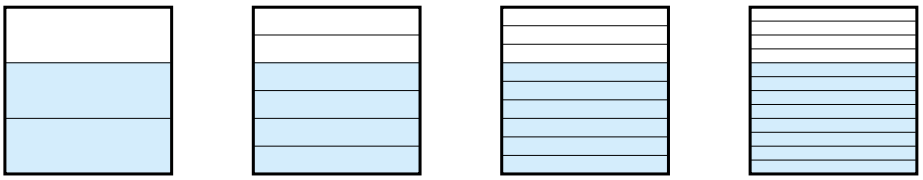
$\frac{2}{4}$ and $\frac{3}{4}$ have same denominator so we can compare them.

How can we compare the sizes of $\frac{2}{3}$ and $\frac{3}{4}$.

Let's think about how to compare the size of fractions with different denominators.

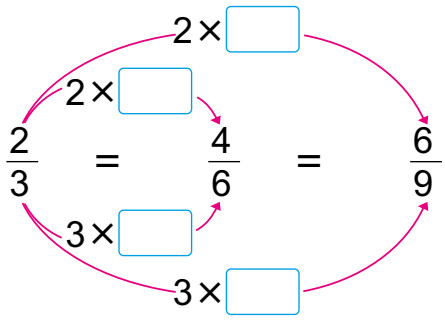
1 Let's think about how to compare $\frac{2}{3}$ and $\frac{3}{4}$.

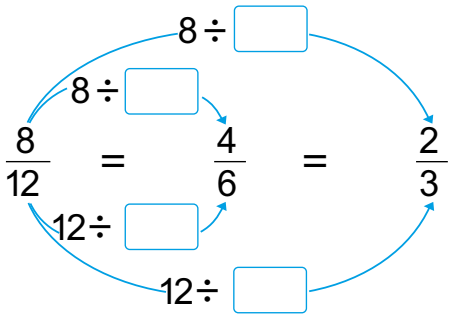
1 Let's represent $\frac{2}{3}$ using various fractions.



Ⓐ Let's represent $\frac{2}{3}$ by $\frac{1}{6}$, $\frac{1}{9}$ and $\frac{1}{12}$ as the units.

Ⓑ What is the relationship between denominators and numerators of equivalent fractions?





The size of fractions does not change even if the numerator and denominator are multiplied or divided by the same number.

$$\frac{\blacktriangle}{\bullet} = \frac{\blacktriangle \times \blacksquare}{\bullet \times \blacksquare} = \frac{\blacktriangle \div \blacksquare}{\bullet \div \blacksquare}$$

② Let's represent $\frac{3}{4}$ by $\frac{1}{8}$, $\frac{1}{12}$ and $\frac{1}{16}$ as the units.

$$\frac{3}{4}=\frac{3\times\square}{4\times\square}=\frac{\square}{12}$$

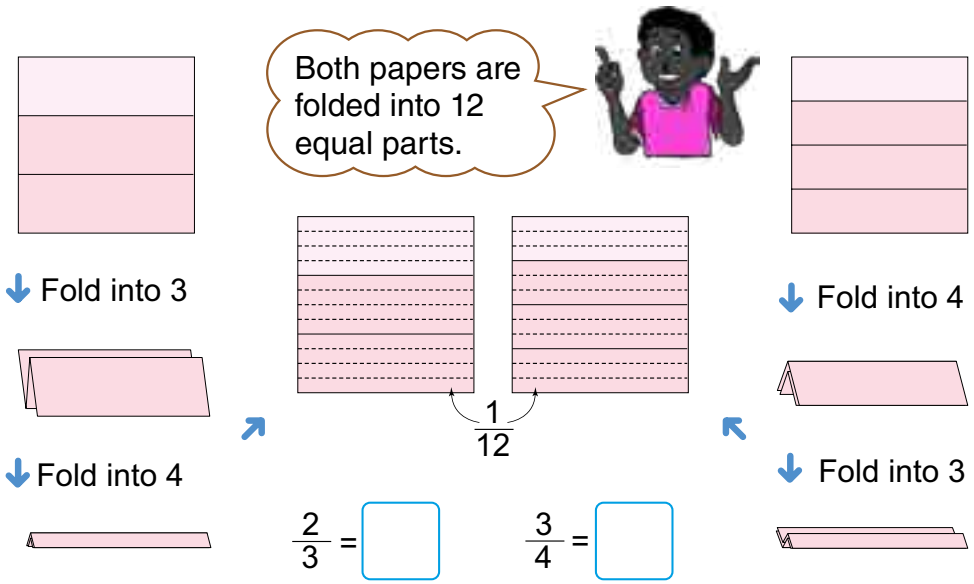
The same fraction can be represented in many ways by changing the units.

③ Let's compare $\frac{2}{3}$ and $\frac{3}{4}$ by changing their representation using the same denominator.

$\frac{2}{3}=\square$, $\frac{3}{4}=\square$ therefore, $\frac{2}{3}\ \square\ \frac{3}{4}$

Let's Fold a Paper to Compare the Size of Fractions

Let's fold square papers to represent $\frac{2}{3}$ and $\frac{3}{4}$ as fractions with the same denominator.



Common Denominators

2 Compare $\frac{3}{4}$ and $\frac{4}{5}$ by changing them to equivalent fractions with a common denominator. Which denominators can the two fractions below be compared with? Circle them.

$\frac{3}{4}$ $\frac{6}{8}$ $\frac{9}{12}$ $\frac{12}{16}$ $\frac{15}{20}$ $\frac{18}{24}$ $\frac{21}{28}$ $\frac{24}{32}$ $\frac{27}{36}$ $\frac{30}{40}$ ....

$\frac{4}{5}$ $\frac{8}{10}$ $\frac{12}{15}$ $\frac{16}{20}$ $\frac{20}{25}$ $\frac{24}{30}$ $\frac{28}{35}$ $\frac{32}{40}$ $\frac{36}{45}$ $\frac{40}{50}$ ....

Fractions with different denominators can be compared by changing them to fractions with the same denominator.

Finding a common denominator means changing fractions with different denominators into equivalent fractions with the same denominator.

3 Compare $\frac{2}{3}$ and $\frac{4}{7}$ by changing them into fractions with common denominators.

$\frac{2}{3} = \frac{\square}{21}$, $\frac{4}{7} = \frac{\square}{21}$, then $\frac{2}{3} \square \frac{4}{7}$

We can find the common denominator if we multiply denominators of fractions which we would like to compare with.

Finding Common Denominators

4 Let's find the common denominator for $\frac{5}{6}$ and $\frac{7}{8}$.

Mero's Idea

Multiply the two denominators to get the common denominator.

$$\frac{5}{6} = \frac{5 \times \square}{6 \times \square} = \frac{40}{48}$$

$$\frac{7}{8} = \frac{7 \times \square}{8 \times \square} = \frac{42}{48}$$

Yamo's Idea

Choose 24, the least common multiple of 6 and 8, as the common denominator.

$$\frac{5}{6} = \frac{5 \times \square}{6 \times \square} = \frac{20}{24}$$

$$\frac{7}{8} = \frac{7 \times \square}{8 \times \square} = \frac{21}{24}$$

5 Usually, you should choose the least common multiple as the common denominator to use as the smallest common denominator.

Let's compare the following fractions using common denominators.

1. $\frac{1}{4}$ and $\frac{2}{7}$ The least common multiple of 4 and 7 is $\square$.

$$\frac{1}{4} = \frac{1 \times \square}{4 \times \square} = \frac{\square}{\square}, \quad \frac{2}{7} = \frac{2 \times \square}{7 \times \square} = \frac{\square}{\square}, \text{ therefore } \frac{1}{4} \square \frac{2}{7}$$

2. $\frac{1}{3}$ and $\frac{2}{9}$ The least common multiple of 3 and 9 is $\square$.

$$\frac{1}{3} = \frac{1 \times \square}{3 \times \square} = \frac{\square}{\square}, \text{ therefore } \frac{1}{3} \square \frac{2}{9}$$

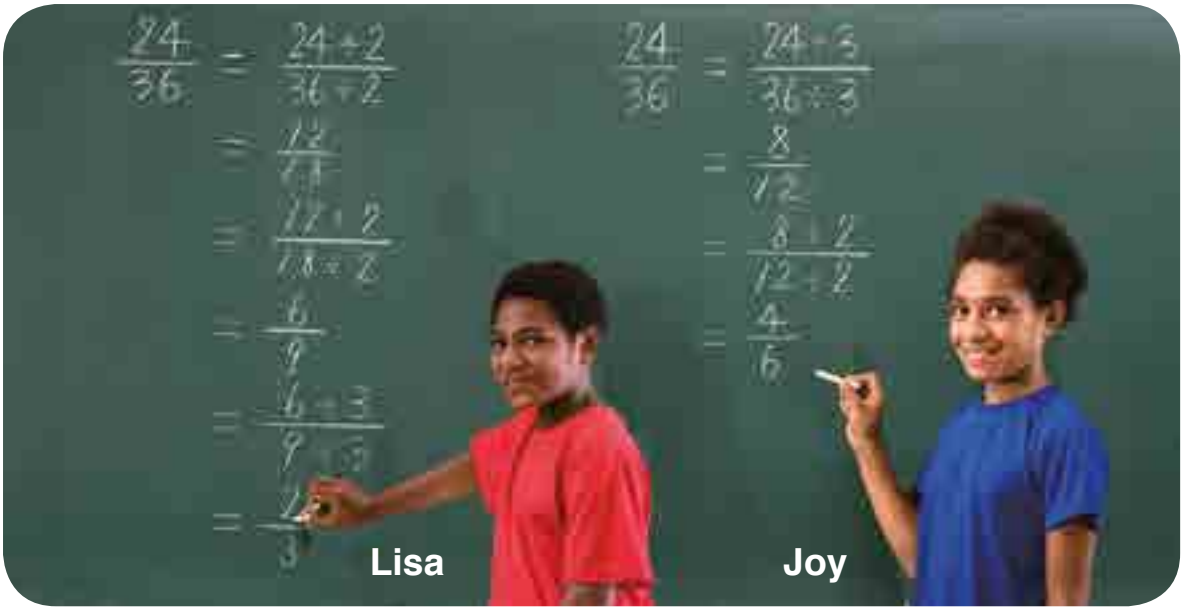
6 Let's compare $1\frac{3}{4}$ and $\frac{11}{6}$ using a common denominator.

I changed mixed fraction to improper fraction.

I changed improper fraction to mixed fraction.

Reducing Fractions

7 Lisa and Joy are looking for fractions that are equivalent to $\frac{24}{36}$ and with denominators and numerators smaller than 36 and 24.



1. What rule of fraction are they using?
2. Lisa and Joy got different fractions. Explain their reasons.

Phrase

Because

It is a word used to explain, by stating the conclusion first and then explaining why by showing a reason.

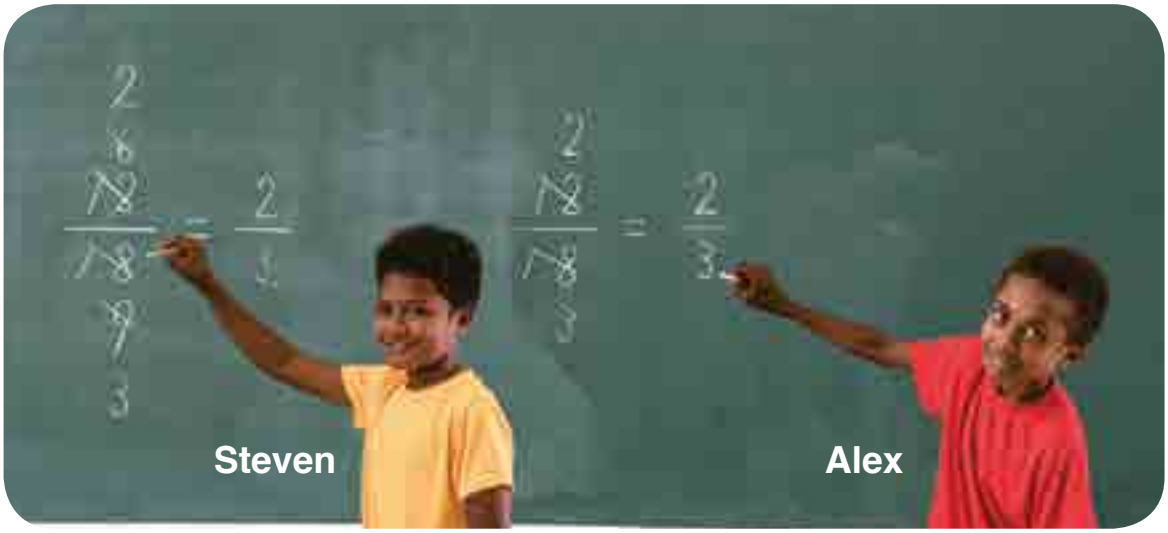
" ○○○ is because △△△ ".

For example: We reduce fractions **because** it makes calculation easier.

Reducing a fraction means dividing the numerator and denominator by a common divisor to make a simpler fraction.

When we reduce a fraction, we usually divide until we get the smallest numerator and denominator.

8 Steven and Alex reduced $\frac{12}{18}$. Let's explain their ideas.



1. What are the similarities in their ideas?
2. What are the differences between their ideas?

When you reduce a fraction, use the greatest common divisor to reduce the denominator and numerator, just like Alex did in 8.

Exercise

1 Let's reduce these fractions to a common denominator and fill in the ☐ with inequality signs.

① $\frac{2}{3}$ ☐ $\frac{4}{5}$ ② $\frac{1}{2}$ ☐ $\frac{3}{8}$ ③ $\frac{5}{6}$ ☐ $\frac{8}{9}$ ④ $\frac{7}{12}$ ☐ $\frac{5}{8}$

2 Let's reduce these fractions.

① $\frac{8}{10}$ ② $\frac{3}{21}$ ③ $\frac{16}{20}$ ④ $\frac{18}{24}$

1 Fractions, Decimals and Whole Numbers

Quotients and Fractions

1 When we divide 2 L milk amongst ☐ students equally, how many litres of milk will each student receive?

$2 \div$ ☐

1 Enter the numbers from 1 to 5 in the ☐ and calculate the answers.

$2 \div$ ☐, $2 \div$ ☐, $2 \div$ ☐, $2 \div$ ☐, $2 \div$ ☐

2 Divide the above expressions into 3 groups based on the answers.

Ⓐ Answers that are whole numbers.

( )

Ⓑ Answers that are expressed exactly as decimal numbers.

( )

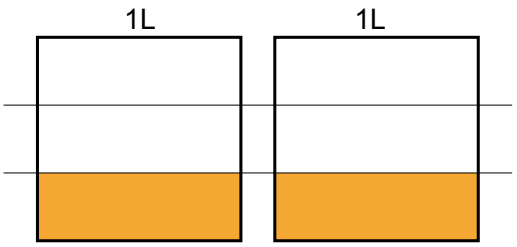
Ⓒ Answers that are not expressed exactly as decimal numbers.

( )

$2 \div 3$ is 0.666..., so this cannot be expressed exactly as a decimal number because there is no end.

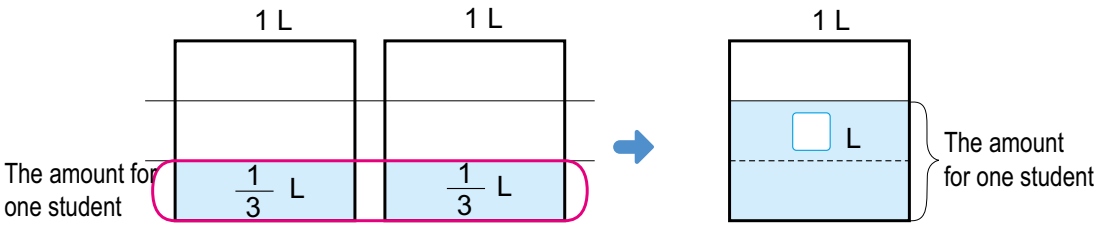
3 When 2 L is divided equally amongst 3 students.

Ⓐ Colour the part for one student in the diagram.



Ⓑ How many L will each student receive?

Let's see how to express the quotient of a division problem when it cannot be expressed exactly as a decimal number.



The amount for one student when 1 L is divided into 3 equal parts… □ L.

The amount for one student when 2 L is divided into 3 equal parts… □ L.

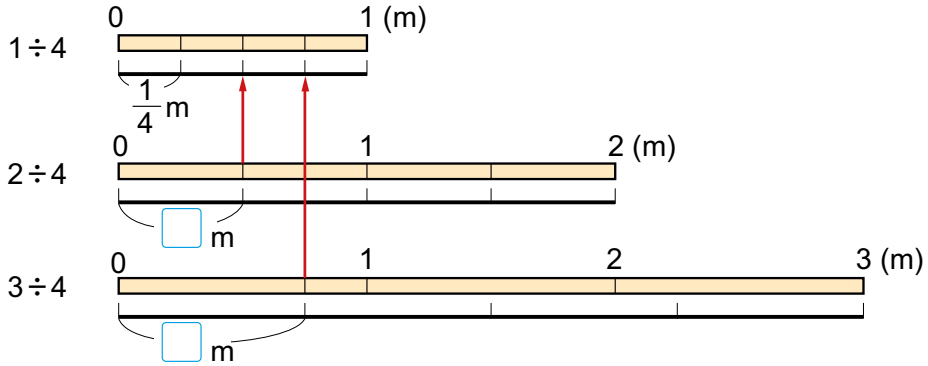
$2 \div 3 = \frac{\square}{\square}$

I used $\frac{1}{3}$ L from the first 1 L container and $\frac{1}{3}$ L from the second 1 L container to fill up the empty container.

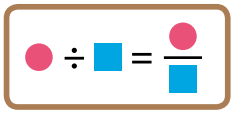
2 Let's find the length of one section when 1 m, 2 m and 3 m string is divided into 4 equal parts?

1 Let's write mathematical expressions for 1 m, 2 m and 3 m strings.

2 Let's find the answers based on a 1 m string?



The quotient of a division problem in which a whole number is divided by another whole number can be expressed as a fraction.



The quotient can be expressed precisely as a fraction.

Exercise

Let's represent the quotient using a fraction.

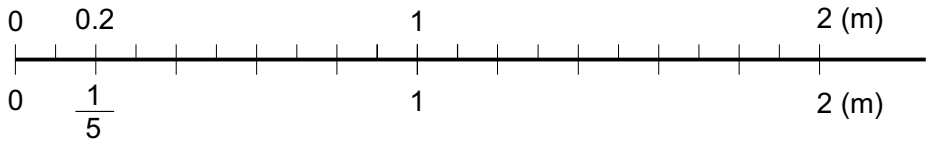
① 1 ÷ 6　② 5 ÷ 8　③ 4 ÷ 3　④ 9 ÷ 7

3 If we divide a 2 m tape into 5 equal sections, how many metres long will be each section?

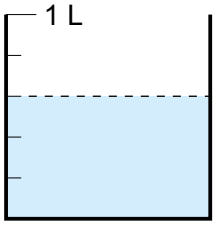
1 Let's express the answer as a fraction and as a decimal number.

$2 \div 5 = \frac{\square}{\square}$ $\quad$ $2 \div 5 = \square$

2 Let's write this fraction and decimal number on the number line.

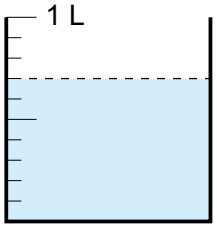


4 Which is larger $\frac{3}{5}$ L or 0.7 L?



$\frac{3}{5} = 3 \div 5 = \square$ therefore,

$\frac{3}{5} \square 0.7$



To represent a fraction as a decimal number or whole number, we divide the numerator by the denominator.

5 Let's express these fractions as decimal numbers or whole numbers.

1 $\frac{3}{10} = \square$ $\quad$ 2 $\frac{29}{100} = \square$

3 $\frac{12}{4} = 12 \div 4 = \square$ $\quad$ 4 $1\frac{3}{5} = \frac{8}{5} = 8 \div 5 = \square$

6 Let's express 2 and 5 as fractions.

$2 = 2 \div 1 = \frac{2}{1}$ $\quad 5 = 5 \div 1 = \square$

$2 = 4 \div 2 = \frac{4}{2}$ $\quad 5 = 10 \div 2 = \square$

$2 = 8 \div \square = \square$ $\quad 5 = 30 \div \square = \square$

Whole numbers can be expressed as fractions no matter what number you choose for the denominator.

7 Let's express the decimal numbers 0.19 and 1.7 as fractions.

1 Since 0.19 is 19 sets of 0.01,

↓

we can think of this as 19 sets of $\frac{1}{100}$ and get $\square$.

2 Since 1.7 is $\square$ sets of 0.1,

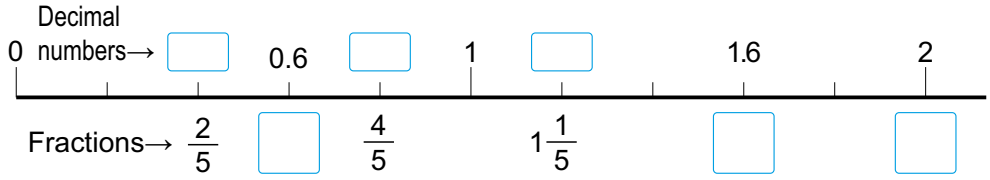
↓

we can think of this as 17 sets of $\square$ and get $\square$.

Decimal numbers can be expressed as fractions if we choose $\frac{1}{10}$ and $\frac{1}{100}$ as the units.

Exercise

Fill in the $\square$ with decimals and fractions.



8 Let's divide the following fractions into 3 groups.

$\frac{8}{10}$ $1\frac{1}{2}$ $\frac{4}{11}$ $\frac{3}{5}$ $\frac{3}{1}$ $2\frac{1}{3}$ $\frac{6}{3}$

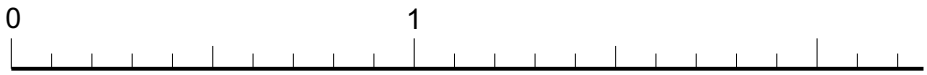
Ⓐ Whole numbers.

Ⓑ Accurate decimal numbers.

Ⓒ Other decimal numbers.

9 Let's place these numbers on the number line below.

$\frac{4}{11}$ $\frac{4}{5}$ 0.6 $1\frac{7}{20}$ 2 1.25 $\frac{1}{4}$ $\frac{2}{3}$



Whole numbers, decimal numbers and fractions can all be expressed on one number line.
That makes it easy to compare numbers.

Changing fractions to decimal numbers makes them easier to compare.

$\frac{2}{3}=2\div3=0.666\ldots$about 0.67

Exercise

1 Let's line up these numbers starting from the smallest.

1.3 0.75 $\frac{4}{2}$ $1\frac{1}{2}$ $\frac{7}{10}$ $\frac{5}{7}$

2 Let's change decimals to fractions and fractions to decimals or whole numbers.

① 0.9 ② 1.25 ③ $\frac{3}{4}$ ④ $\frac{24}{6}$ ⑤ $1\frac{2}{5}$

EXERCISE

1 Let's change fractions using common denominators by filling in the ☐ with inequality signs.

Pages 110 to 111, 115

① $\frac{2}{3} \square \frac{1}{2}$ ② $\frac{3}{4} \square \frac{5}{7}$ ③ $\frac{1}{6} \square \frac{5}{18}$ ④ $\frac{6}{3} \square \frac{5}{12}$

2 Let's reduce these fractions.

Pages 114 to 115

① $\frac{4}{8}$ ② $\frac{6}{9}$ ③ $\frac{21}{28}$ ④ $\frac{16}{24}$ ⑤ $\frac{75}{100}$

3 Let's represent their quotients by fractions.

Pages 116 to 117

① $1 \div 7$ ② $5 \div 9$ ③ $11 \div 3$

4 Let's represent these fractions by decimals or whole numbers.

Pages 118 to 120

① $\frac{5}{10}$ ② $\frac{31}{100}$ ③ $\frac{18}{6}$ ④ $1\frac{1}{4}$

5 Let's represent these decimals with fractions.

Pages 119 to 120

① 0.3 ② 1.9 ③ 0.61 ④ 1.11

6 Let's write ↓ for numbers on the number line.

Pages 118 to 120

1 $\frac{2}{5}$ 0.7 $1\frac{5}{20}$ 1.8 $\frac{7}{5}$

Grade 4

Do you remember?

Let's calculate.

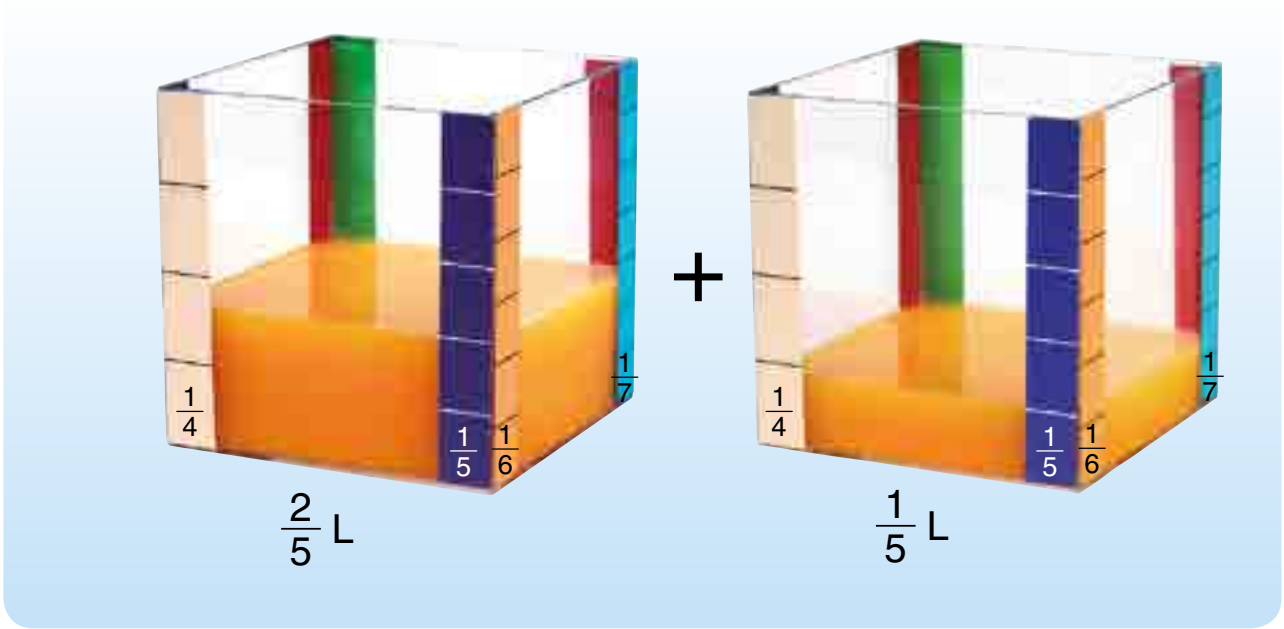
① $\frac{1}{5} + \frac{1}{5}$ ② $\frac{2}{7} + \frac{5}{7}$ ③ $1\frac{2}{4} + \frac{3}{4}$

④ $1\frac{5}{7} - \frac{6}{7}$ ⑤ $2\frac{3}{5} - 1\frac{4}{5}$ ⑥ $2 - \frac{5}{8}$

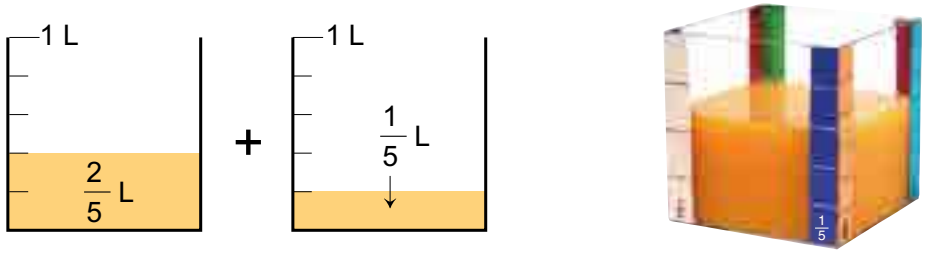
9 Addition and Subtraction of Fractions

1 Addition of Fractions

1 There are $\frac{2}{5}$ L and $\frac{1}{5}$ L of orange juice in the containers.
How many litres are there altogether?



1 Let's write a mathematical expression.

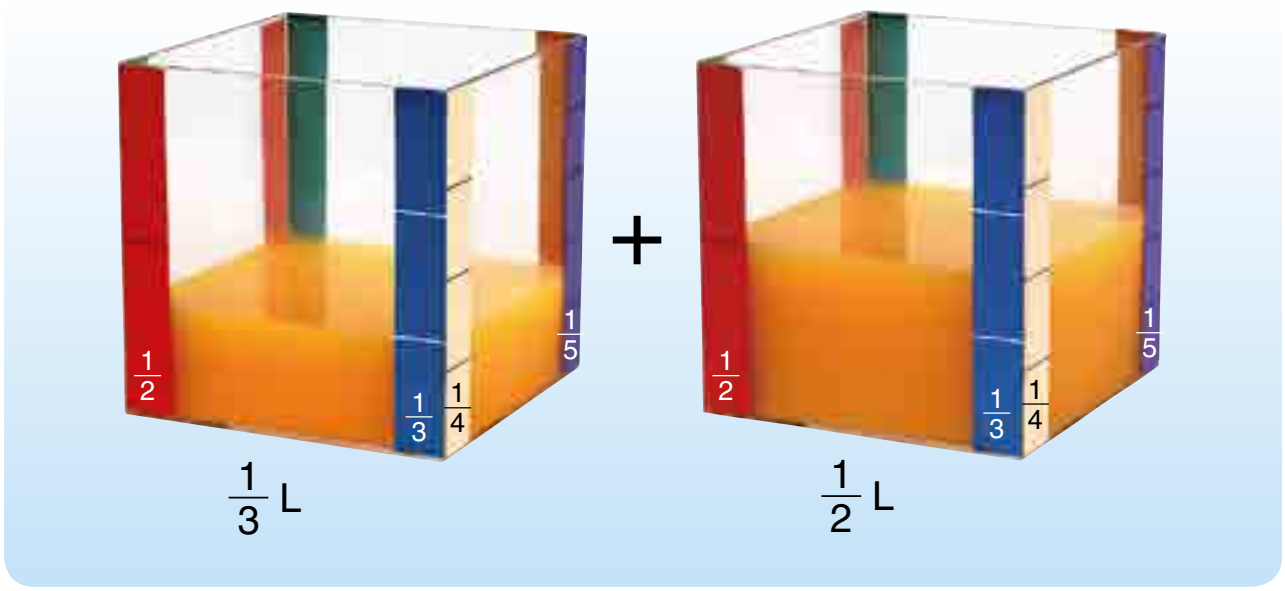


Expression:

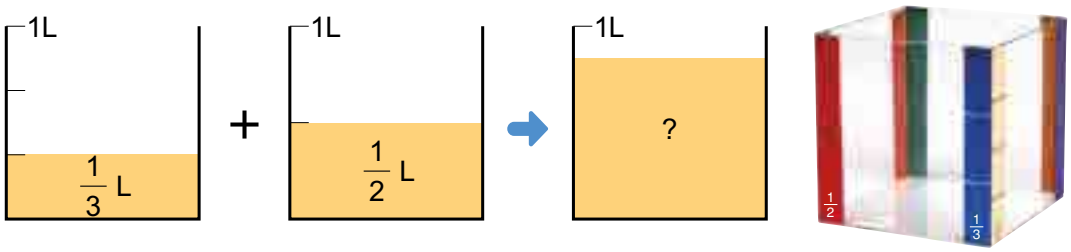
We have learned the addition of fractions with the same denominator in grade 4.

2 Let's calculate.

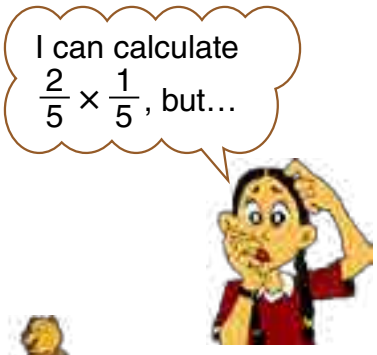
2 There are $\frac{1}{3}$ L and $\frac{1}{2}$ L of orange juice in the containers. How many litres are there altogether?



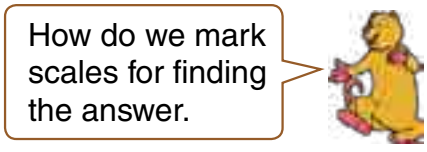
1 Write the mathematical expression.



Expression: ＿＿＿＿＿＿



2 Let's think about how to calculate.



Let's think about how to add and subtract fractions with different denominators.

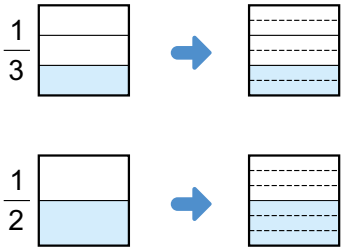
3 Let's explain how to calculate $\frac{1}{3}+\frac{1}{2}$ by using the following figure below.

Since denominators are different, how can I calculate to find the sum?

We can represent the fractions to have the same denominators, and calculate.

$\frac{1}{3}+\frac{1}{2}=\frac{\square}{\square}+\frac{\square}{6}$

$=\square$



For adding fractions with different denominators, we can calculate the answer by changing the representation of fractions to have the same denominator.

If the denominators are changed to the same number, we can know the number of times to increase each numerator.

3 Let's think about how to calculate $\frac{1}{10}+\frac{1}{6}$.

$\frac{3}{10}+\frac{1}{6}=\frac{\square}{\square}+\frac{\square}{\square}$

$=\frac{\square}{\square}$

$=\square$

If the answer can be simplified, you should simplify it to its simplest fraction.

Exercise

① $\frac{2}{3}+\frac{1}{4}$ ② $\frac{1}{2}+\frac{1}{5}$ ③ $\frac{2}{5}+\frac{1}{6}$

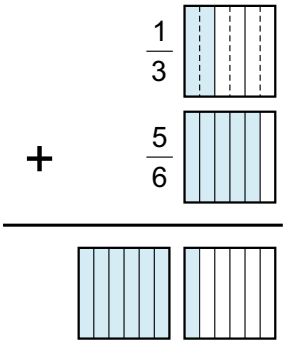
④ $\frac{1}{2}+\frac{1}{10}$ ⑤ $\frac{5}{12}+\frac{1}{3}$ ⑥ $\frac{1}{4}+\frac{3}{20}$

4 Let's think about how to calculate.

$\frac{1}{3} + \frac{5}{6} = \frac{\square}{\square} + \frac{\square}{6}$

$= \frac{\square}{\square}$

$= \square$



When the answer is an improper fraction, we should change it into a mixed fraction. Then, it is easier to compare with others.

5 Put $1\frac{1}{3}$ g of goods into a $1\frac{2}{3}$ g box.
How many kilograms are there altogether?

1 Vavi thinks about how to calculate as follows.
Let's explain how she calculate.

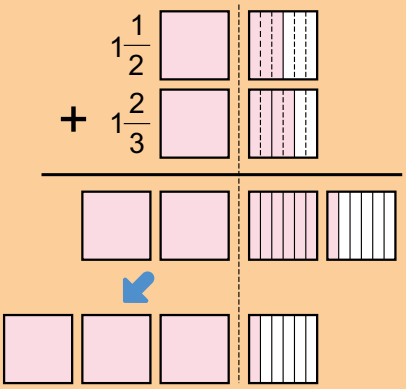
Vavi's Idea

Add the parts of whole numbers and parts of proper fractions, respectively.

$1\frac{1}{2} + 1\frac{2}{3} = 1\frac{\square}{6} + 1\frac{\square}{6}$

$= \square\frac{\square}{6}$

$= \square\frac{\square}{6}$



2 Kekeni first changed the mixed fractions into improper fractions, and then added them.
Let's calculate the fractions by using Kekeni's idea.

Exercise

① $\frac{3}{8} + \frac{7}{10}$　② $\frac{4}{5} + \frac{13}{15}$　③ $\frac{11}{12} + \frac{1}{4}$

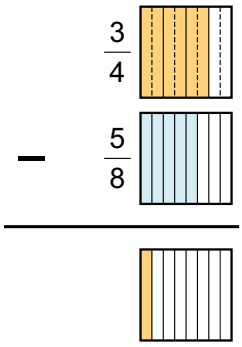
④ $1\frac{5}{6} + 1\frac{1}{2}$　⑤ $2\frac{1}{6} + 1\frac{1}{2}$　⑥ $1\frac{2}{3} + 2\frac{3}{4}$

1 Subtraction of Fractions

1 There are $\frac{3}{4}$ L of juice and $\frac{5}{8}$ L of milk.
What is the difference in Litres between the juice and milk.

1 Find equivalent fractions and compare the volumes and then write an expression.

$\frac{3}{4} = \frac{\square}{\square}$ and then, $\frac{3}{4} \square \frac{5}{8}$



2 Let's think about how to calculate.

$\frac{3}{4} - \frac{5}{8} = \frac{\square}{\square} - \frac{\square}{\square}$

$= \square$

We should change them to fractions with the same denominators.

To subtract fractions with different denominators, we can calculate by changing the representation of fractions to have the same denominator.

2 Let's think about how to calculate $\frac{5}{6} - \frac{3}{10}$.

$\frac{5}{6} - \frac{3}{10} = \frac{\square}{\square} - \frac{\square}{\square}$

$= \frac{\square}{\square}$

$= \square$

How is it different from **1**?

Exercise

① $\frac{6}{7} - \frac{3}{4}$　② $\frac{5}{8} - \frac{1}{4}$　③ $\frac{2}{3} - \frac{1}{6}$

④ $\frac{3}{4} - \frac{7}{10}$　⑤ $\frac{2}{5} - \frac{1}{15}$　⑥ $\frac{7}{15} - \frac{3}{10}$

3 Let's think about how to calculate $\frac{7}{5} - \frac{5}{6}$.

$$\frac{7}{5} - \frac{5}{6} = \frac{\square}{\square} - \frac{\square}{\square}$$

$$= \square$$

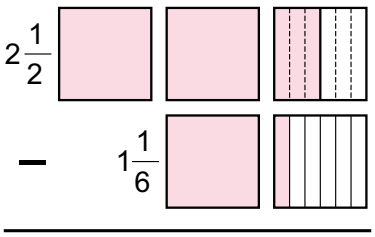
We can calculate "improper fractions minus proper fractions" in the same way.

4 Let's think about how to calculate $2\frac{1}{2} - 1\frac{1}{6}$.

$$2\frac{1}{2} - 1\frac{1}{6} = 2\frac{\square}{\square} - 1\frac{1}{6}$$

$$= \square\frac{\square}{\square}$$

$$= \square$$



5 Yamo has $2\frac{1}{2}$ L of juice. In a week she drank $1\frac{5}{6}$ L.
How much juice is left?

1. Write an expression.
2. Let's calculate.

I should change to improper fractions. What do you think?

Even if you reduced to mixed fractions, you cannot subtract $\frac{5}{6}$ from $\frac{3}{6}$.

Activity

Mero's Idea

Change mixed fractions into improper fractions.

$2\frac{1}{2} = \frac{\square}{2}$, $1\frac{5}{6} = \frac{\square}{6}$

Then, $2\frac{1}{2} - 1\frac{5}{6} = \frac{\square}{2} - \frac{\square}{6} = \frac{\square}{6} - \frac{\square}{6} = \frac{\square}{6}$

Now simplify it, $\frac{\square}{6} = \frac{\square}{\square}$

Ambai's Idea

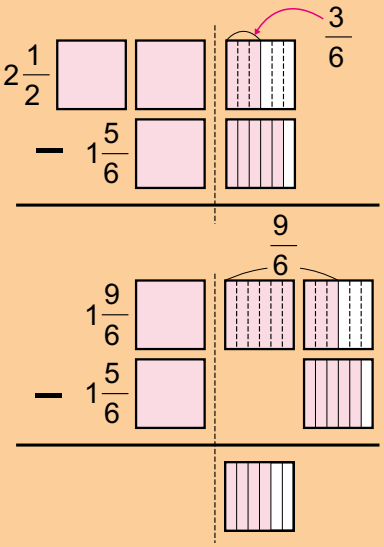
Calculate the parts of whole numbers and proper fractions, respectively.

$2\frac{1}{2} - 1\frac{5}{6} = 2\frac{3}{6} - 1\frac{5}{6}$

We cannot subtract $\frac{5}{6}$ from $\frac{3}{6}$,

Borrow 1 from 2. $2\frac{3}{6} = 1\frac{9}{6}$

$1\frac{9}{6} + 1\frac{5}{6} = \frac{\square}{6} = \frac{\square}{\square}$



Exercise

① $4\frac{7}{8} - 1\frac{1}{7}$ ② $7\frac{3}{4} - 2\frac{1}{6}$ ③ $5\frac{2}{3} - 2\frac{1}{6}$

④ $5\frac{1}{3} - 2\frac{3}{4}$ ⑤ $5\frac{1}{6} - 3\frac{9}{10}$ ⑥ $7\frac{1}{4} - 6\frac{11}{12}$

EXERCISE

1 Let's calculate.

Pages 122 to 128

① $\frac{2}{7}+\frac{1}{4}$ ② $\frac{3}{5}+\frac{4}{7}$ ③ $\frac{1}{4}+\frac{5}{6}$

④ $\frac{5}{6}+\frac{2}{3}$ ⑤ $1\frac{3}{8}+1\frac{1}{2}$ ⑥ $2\frac{5}{6}+4\frac{9}{14}$

⑦ $\frac{7}{9}-\frac{1}{6}$ ⑧ $\frac{11}{12}-\frac{7}{8}$ ⑨ $\frac{8}{7}-\frac{3}{4}$

⑩ $\frac{4}{3}-\frac{1}{4}$ ⑪ $6\frac{5}{7}-2\frac{2}{5}$ ⑫ $3\frac{3}{4}-1\frac{5}{6}$

2 Laka has $\frac{3}{4}$ m rope. Ani has $\frac{4}{5}$ m rope.

Pages 123 to 125

① Which is longer and by how many metres?

② What is the total length when you put the two ropes together?

3 Is the following calculation correct? If it is wrong, explain why?

Pages 123 to 125

$\frac{1}{3}+\frac{2}{5}=\frac{3}{8}$

Grade 5

Do you remember?

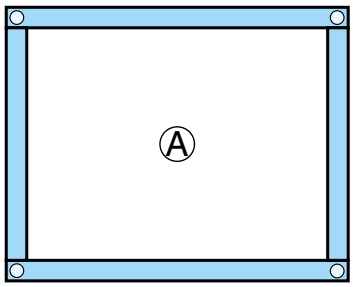
Let's calculate.

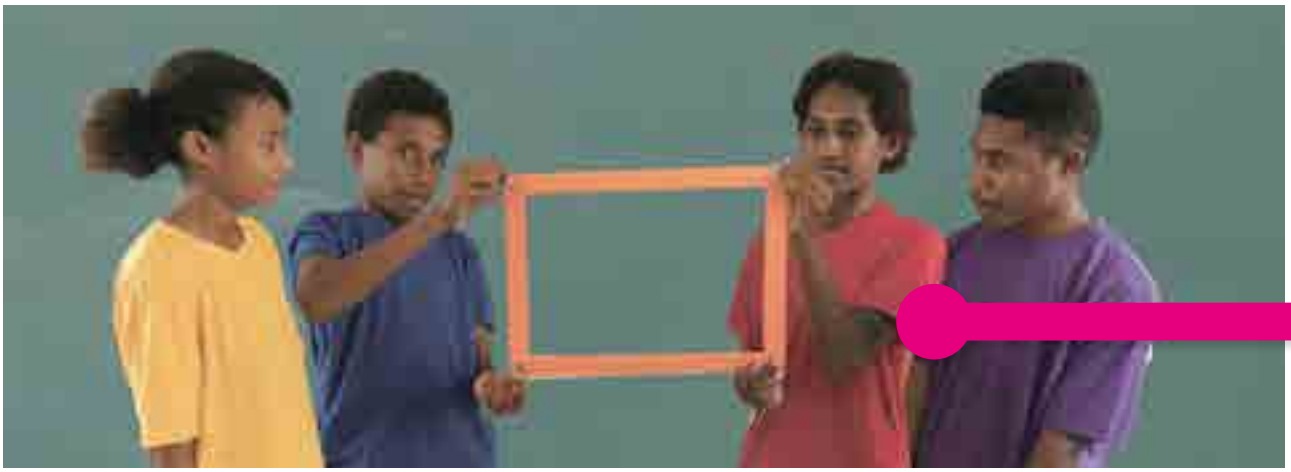
① 4.9×1.3 ② 3.4×0.7 ③ 0.7×0.4 ④ 3.01×4.2

⑤ $24\div1.2$ ⑥ $3.3\div5.5$ ⑦ $2.45\div0.7$ ⑧ $3.25\div1.3$

10 Area of Figures

Lora made a frame out of cardboard as shown on the right.
The frame can change freely by moving.
Let's think about the area of quadrilaterals made by the frame.



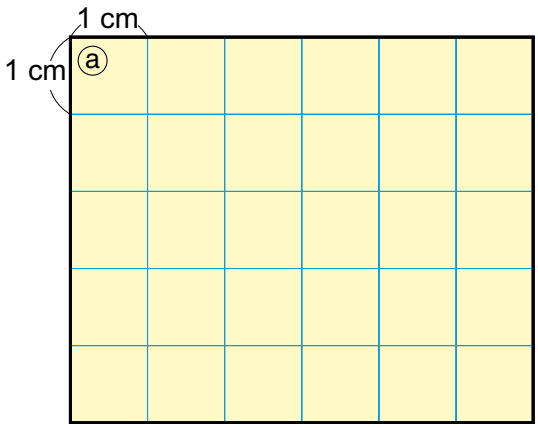


1 Area of Parallelograms

1 There are quadrilaterals ⓐ, ⓑ and ⓒ.

1 Let's measure the length of all sides of quadrilaterals respectively.

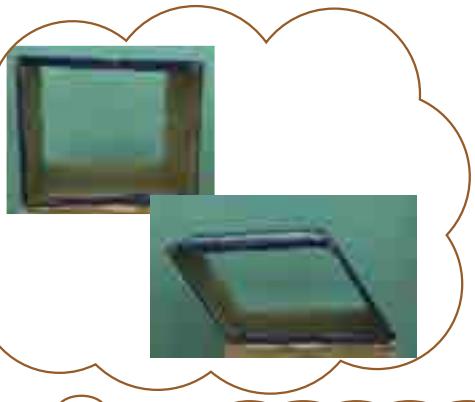
Are the lengths of all the perimeters equal?

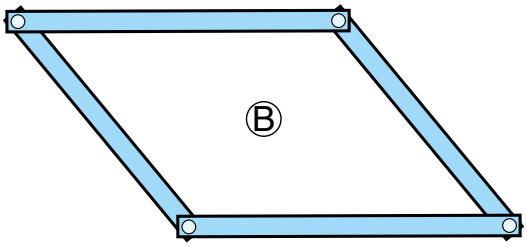


2 Let's compare the areas of all quadrilaterals ⓐ, ⓑ and ⓒ.

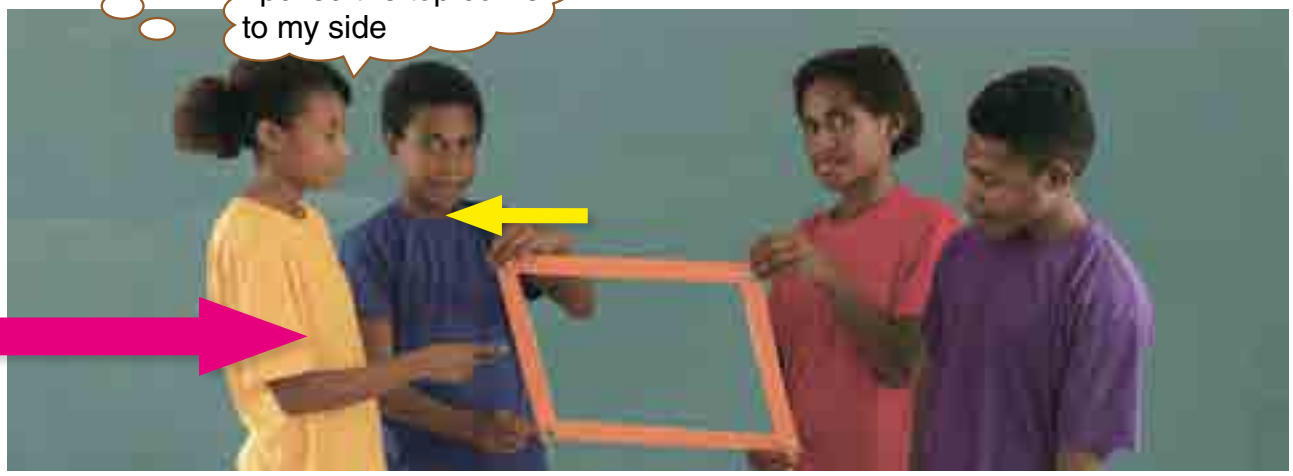
The areas look different.

Which shape has the larger area of quadrilaterals Ⓐ or Ⓑ?

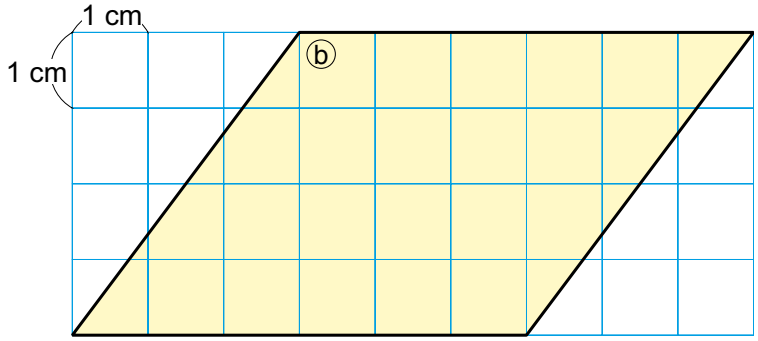


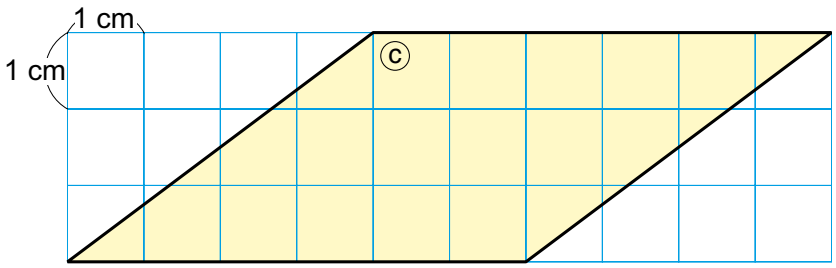


I pulled the top corner to my side



What does the area of a parallelogram depend on?





③ Let's think about how to calculate the area of each parallelogram.

Let's think about how to find the area of triangles and parallelograms.

Activity

Vavi's Idea

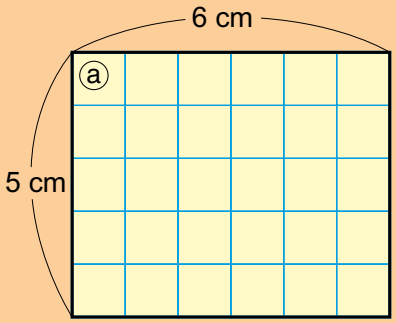
Since ⓐ is a rectangle, the area is calculated by the formula.

Area of ⓐ = length × width

= ☐ × ☐

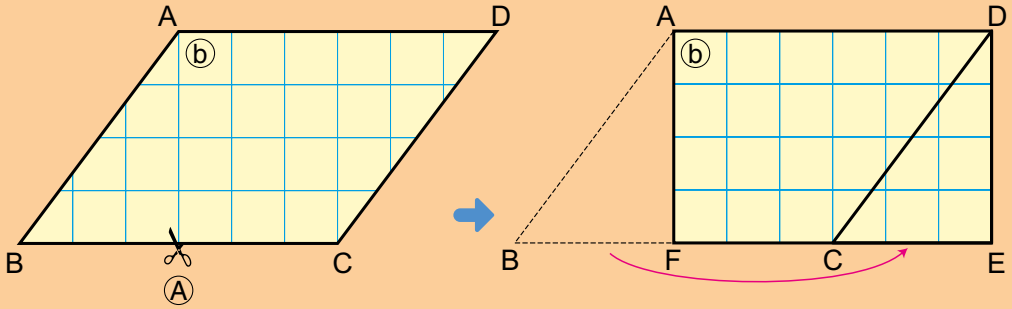
= ☐

Answer ☐ cm²



Naiko's Idea

If we change a parallelogram into a rectangle,we can calculate.



The area of the parallelogram ABCD is the same as the area of rectangle AFED.

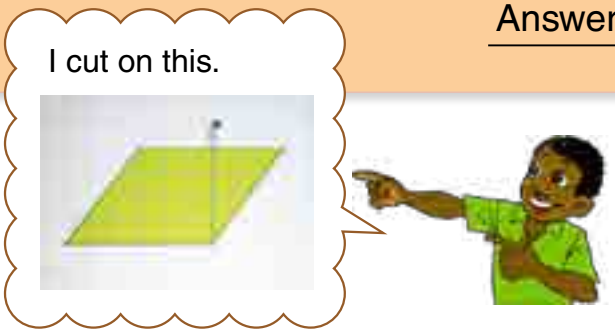
The area of parallelogram ⓑ = the area of rectangle AFED

= AF × FE

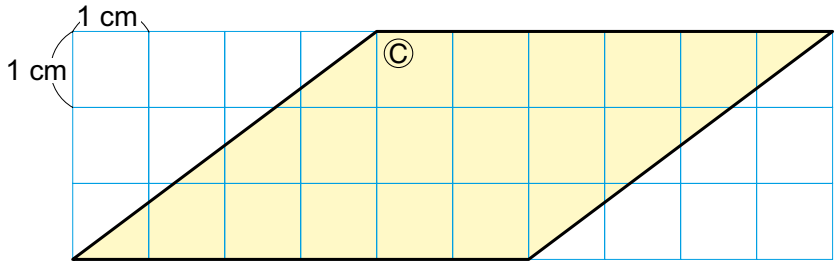
= ☐ × ☐

= ☐

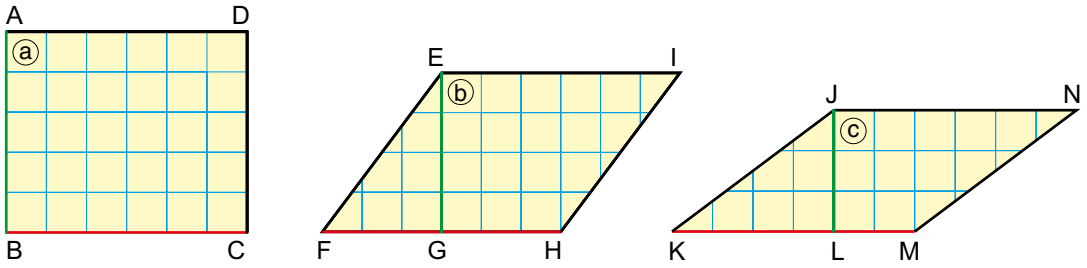
Answer ☐ cm²

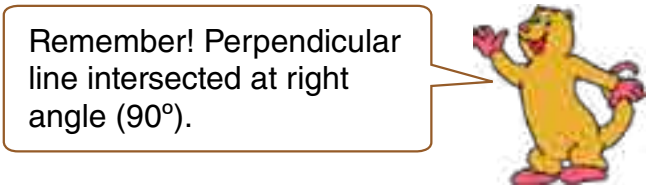


4 Check the lengths of the parallelogram used in ⓒ to find the height and the area.

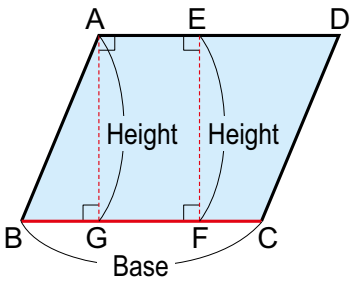


5 Which lengths do you use to find the area of quadrilaterals ⓐ, ⓑ and ⓒ?



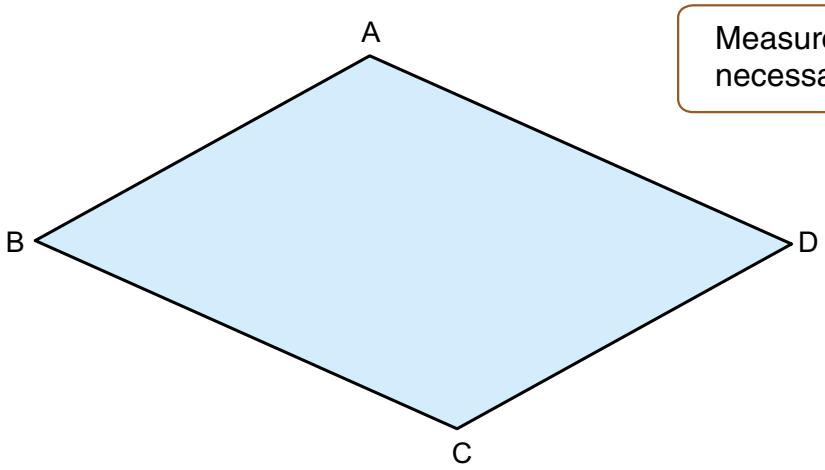


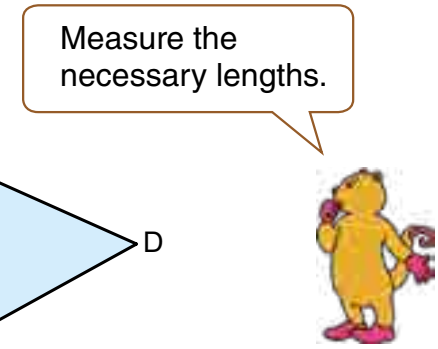
Mark one side of a parallelogram the **base**.
Lines AG, EF and other lines,
which are perpendicular to base BC,
are all the same length.
The length of these line are called
height against the base BC.



The area of parallelogram = base × height

2 Let's find the area of the parallelogram below.





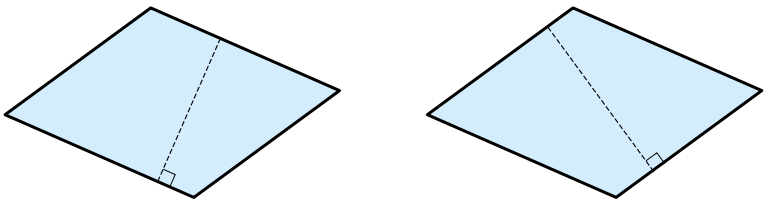
1 When side BC is the base, find the area by measuring the height.

Area = ☐ × ☐ = ☐ (cm²)

2 When side CD is the base, find the area by measuring the height.

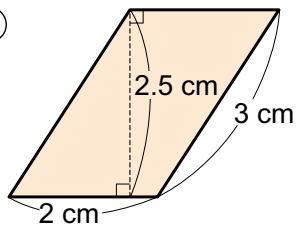
Area = ☐ × ☐ = ☐ (cm²)

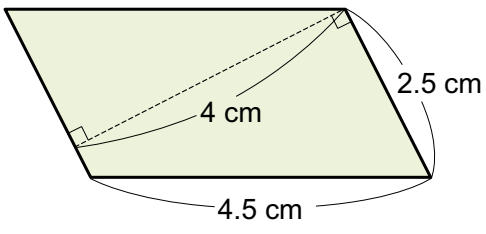
The height depends on the base.



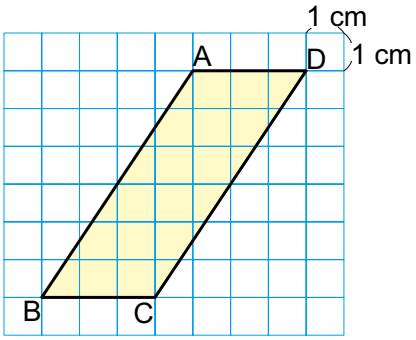
Exercise

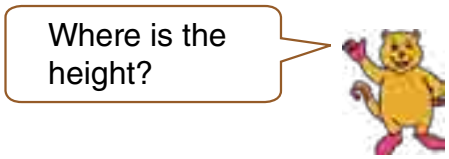
Let's find the area of the following parallelograms.

① 

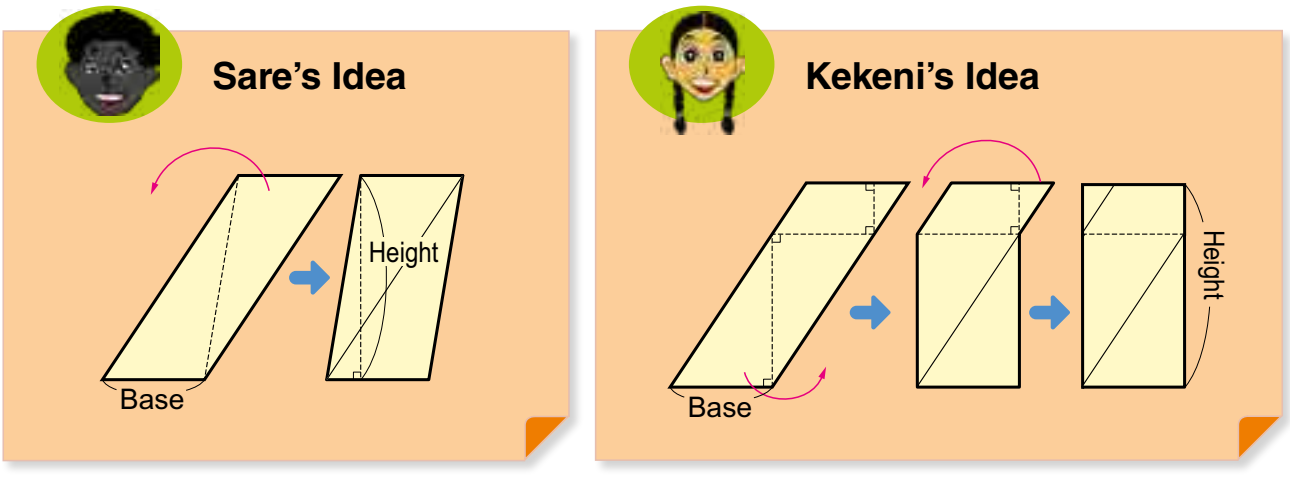
② 

3 Let's think about how to find the perpendicular height of the parallelogram with side BC as the base.



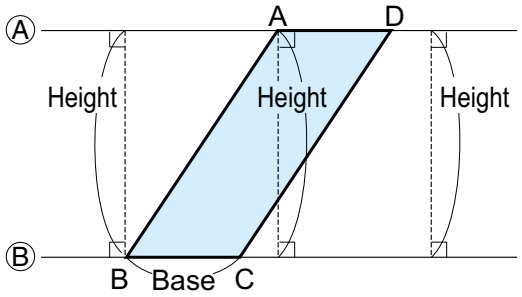


1 Explain how to find the perpendicular height by looking at the figures below.

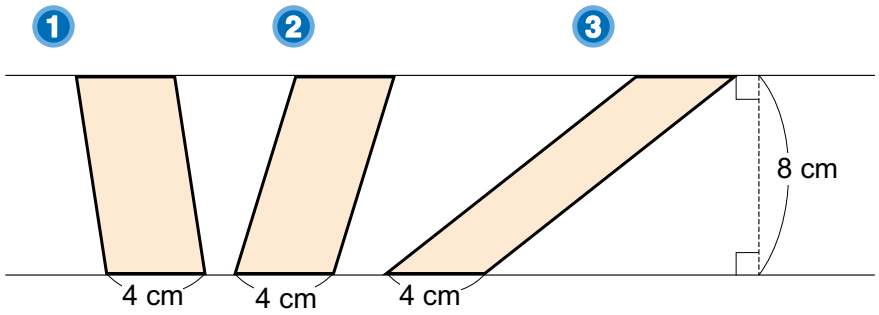


2 What is the area of the parallelogram in cm²?

When side BC is the base, the distance between lines Ⓐ and Ⓑ is the height of parallelogram ABCD.

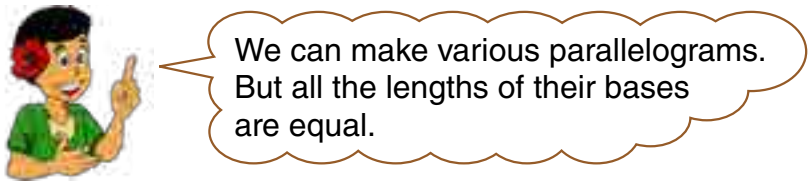


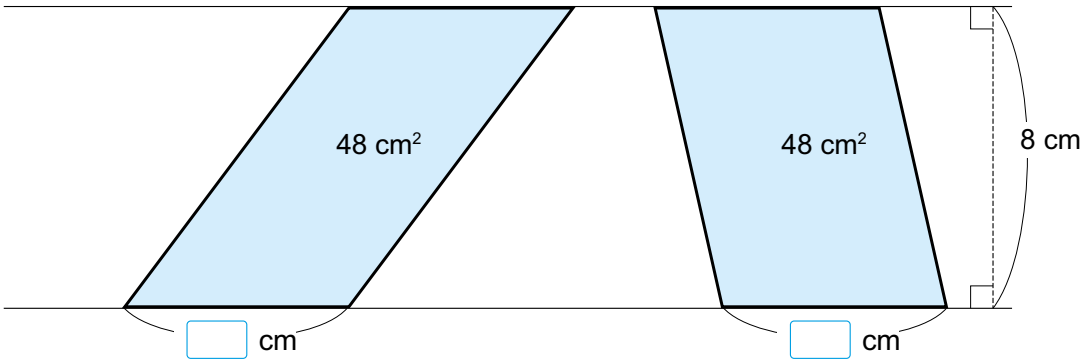
4 Let's find the area of each parallelogram below.



If the lengths of bases and heights of parallelograms are equal, their areas are also equal.

5 We want to make a parallelogram with an area of 48 cm² and a height of 8 cm. How long should be the base in cm?

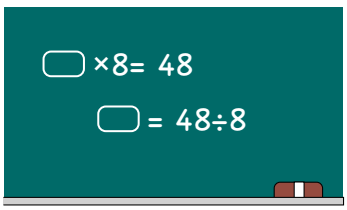




Let's think about how to find the base by using the formula for the area of parallelogram.

□ × 8 = 48

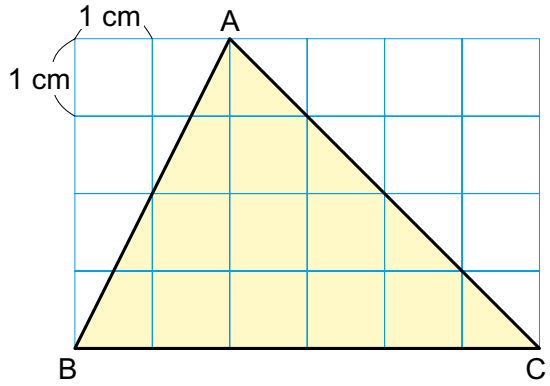
Base Height Area

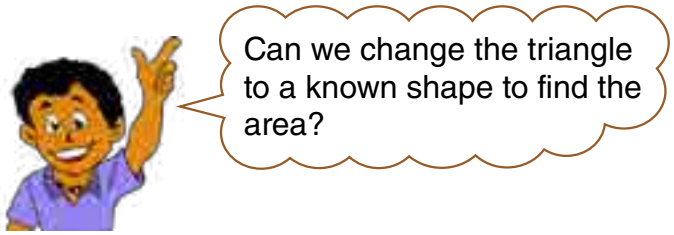


2 Area of Triangles

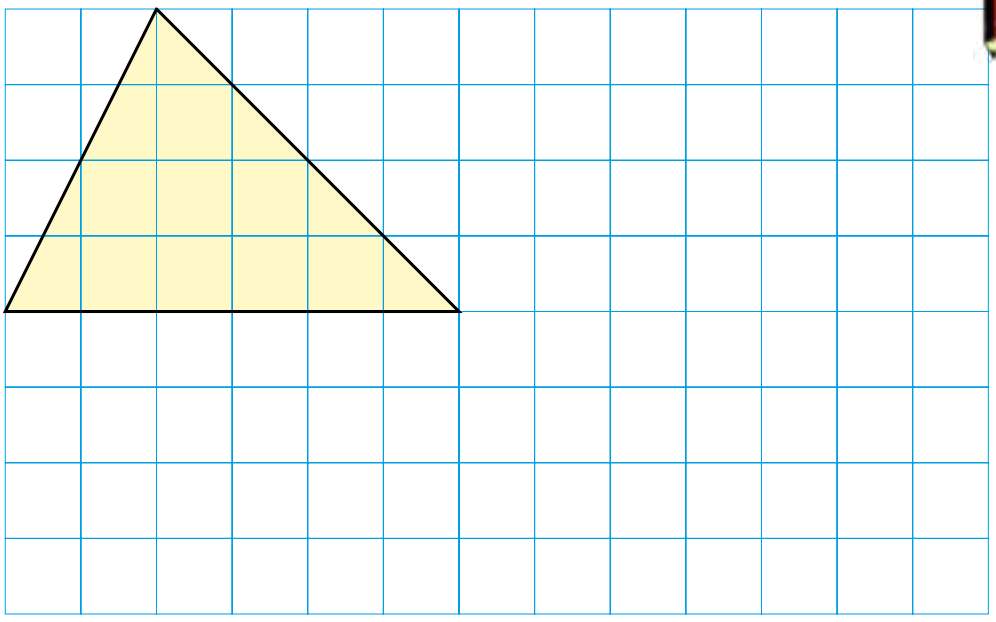
1 Let's find the area of the triangle below.

1 Let's think about how to find the area.



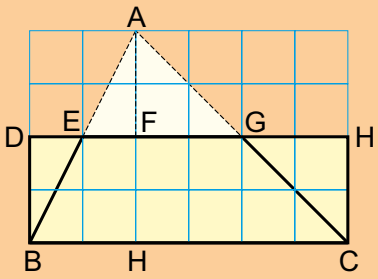


Write down your idea.

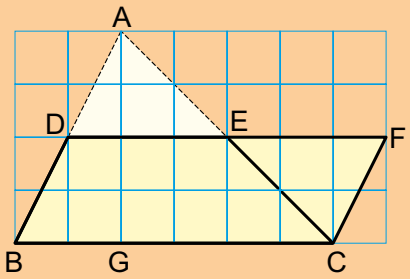


2 Explain the ideas of the 4 children.

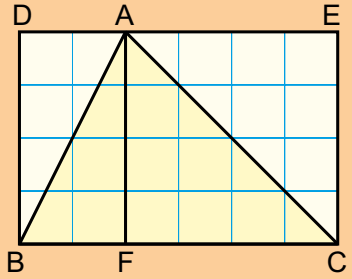
Ambai's Idea



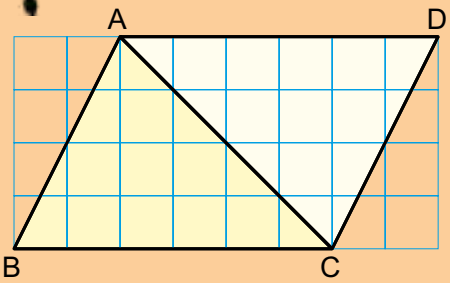
Gawi's Idea



Naiko's Idea



Kekeni's Idea



3 Which of the ideas of the 4 children in **2** are similar or different?

Ⓐ Whose idea changes the triangle into a rectangle?

Ⓑ Whose idea changes the triangle into a parallelogram?

Ⓒ Whose idea changes the triangle into another figure with the same area?

Ⓓ Whose idea changes the triangle into another figure with 2 times its area?

4 Look at the ideas that change the triangle into a rectangle or a parallelogram and find the sides that have the same length as in the original triangle.

5 Think about how to find the area of a triangle.

Ambai's Idea

Since the length of the rectangle is half of AH,
(AH ÷ 2) × BC

Gawi's Idea

Since the height of the parallelogram is half of AG,
Base × (AG ÷ 2)

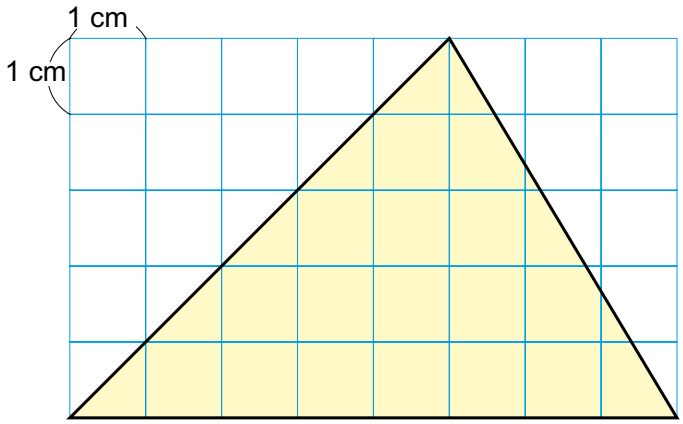
Naiko's Idea

Since the area of the triangle is half of the area of rectangle DBCE and the length of the rectangle is AF,
(AF × BC) ÷ 2

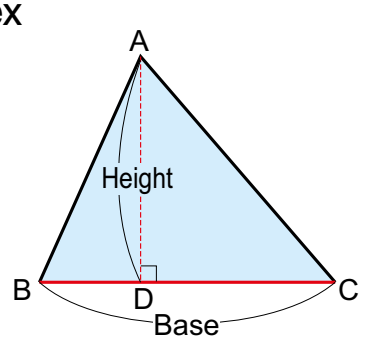
Kekeni's Idea

The area is half of the area of parallelogram ABCD,
Base × Height ÷ 2

2 Measure the lengths needed to find the area of the triangle below and then calculate the area.

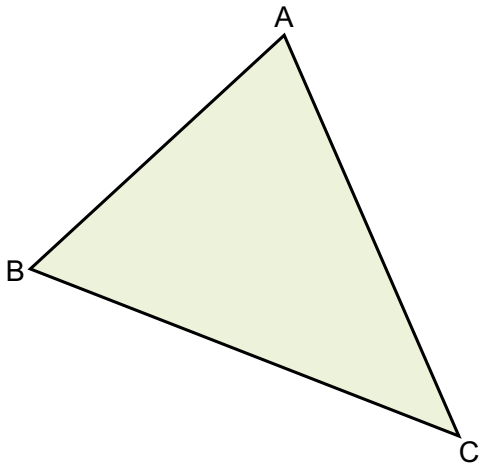


Draw a perpendicular line AD from the vertex A to the opposite side BC of the triangle. Side BC is called the base and line AD is called the **height** of the triangle.



Area of triangle = (base × height) ÷ 2

3 Let's find the area of the triangle below by measuring the necessary lengths.



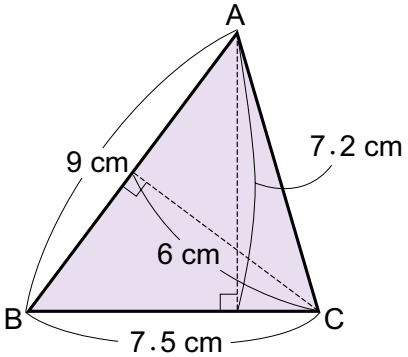
When each of the 3 sides is the base, what are the heights of the triangles, respectively?

Exercise

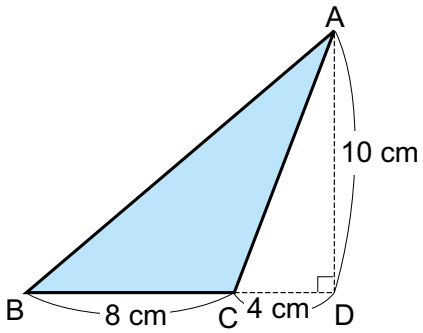
Let's find the area of triangle, as follows:

① when side BC is the base.

② when side AB is the base.

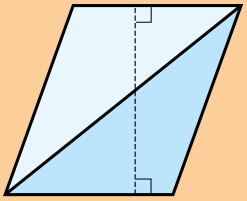


4 Let's think about how to find the area of a triangle with side BC as the base on the right.

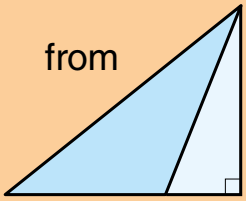


1 Explain Sare's and Yamo's ideas.

Sare's Idea

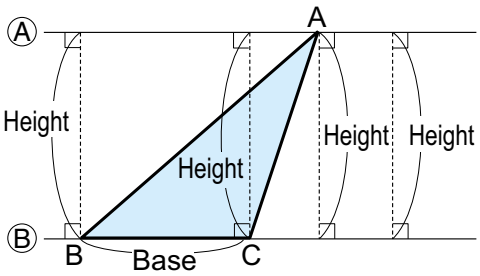


Yamo's Idea

Subtract  from 

2 Find the area of triangle that has a base of 8 cm and a height of 10 cm by using the area formula and then compare with the result obtained in **1**.

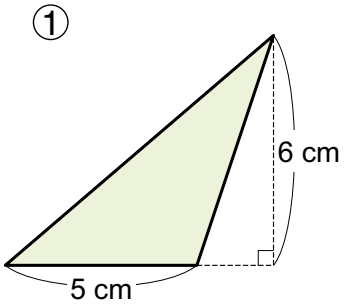
Draw a straight line Ⓐ through vertex A and parallel to side BC. The distance between line Ⓐ and line Ⓑ is the height of the triangle when side BC is the base.



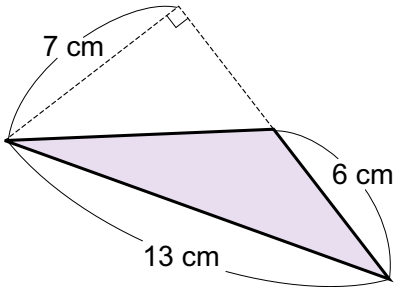
Exercise

Let's find the area of these triangles.

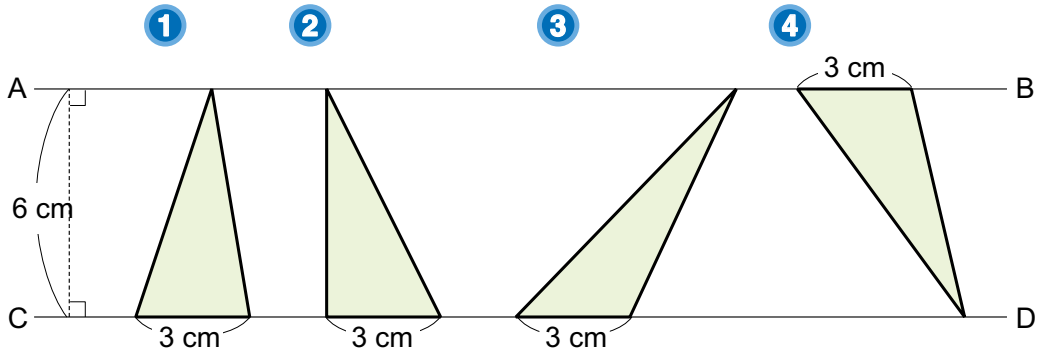
①



②



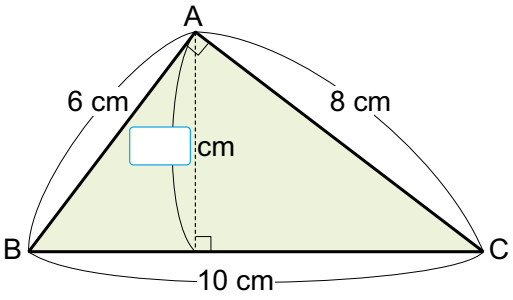
5 In the figure below, straight lines AB and CD are parallel.
Let's find the area of each triangles below.



If the lengths of bases and heights of triangles are equal, their areas are equal.

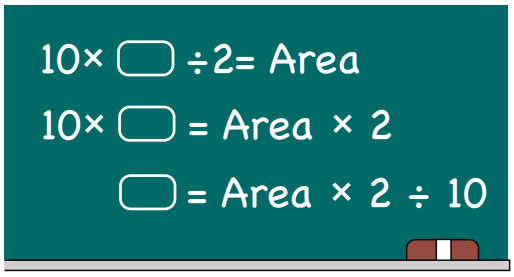
6 The figure on the right is a right angle triangle.

1. Let's find the area.
2. When side BC is the base, calculate the height of the triangle.



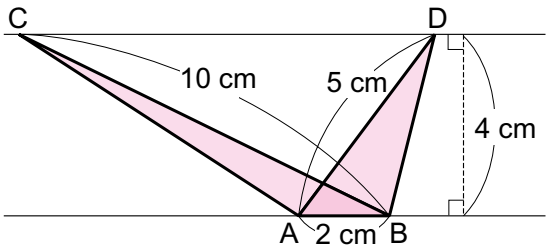
10 × ☐ ÷ 2 = Area

Base Height



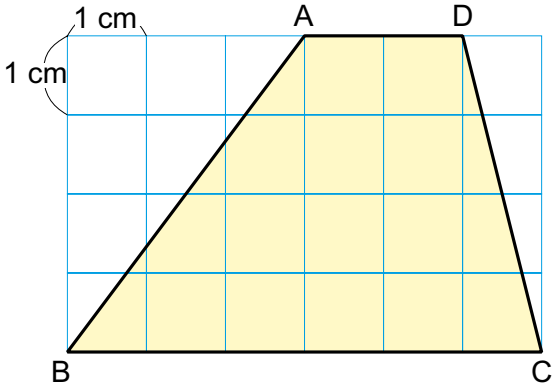
Exercise

Let's find the area of these triangles when sides AD and BC are the base, respectively.



3 Area of Trapezoids

1 Let's think about how to find the area of the trapezoid below.

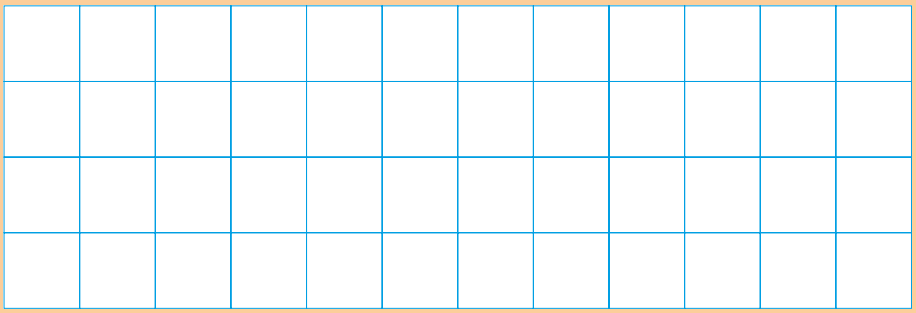


What known shapes can be used to find the area?

Vavi's Idea

I changed a trapezoid into a parallelogram.

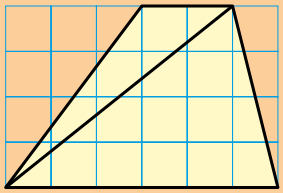
How does she think after that? Let's explain Vavi's idea using expressions and figures.



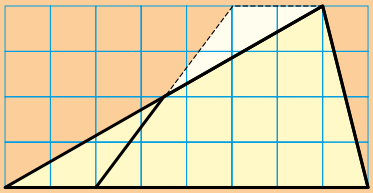
Activity

1 Let's explain the ideas of the 4 friends below and write expression to find the area.

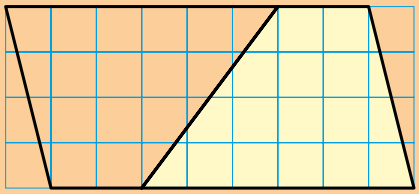
Ambai's Idea



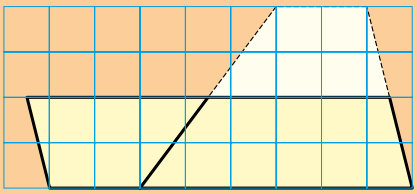
Gawi's Idea



Sare's Idea



Yamo's Idea



2 Discuss how the ideas of 4 friends are similar or different.

3 Let's think about a formula to find the area of the trapezoid using the ideas in 1.

Mero's Idea

Using the area formula of triangle,

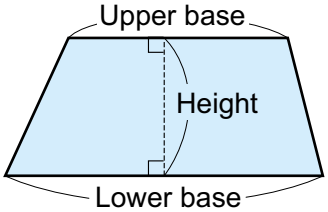
Base × Height ÷ 2

(2 + 6) × □ ÷ 2

(lower side + upper side) × Height ÷ 2

Using other ideas, how can the formula be represented?

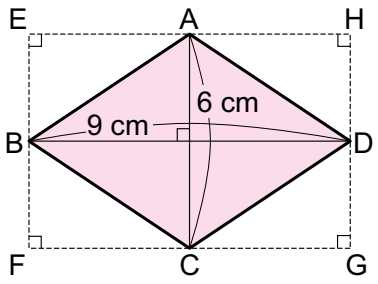
The 2 parallel sides of trapezoid are called the **upper base** and the **lower base**, the distance between their sides is called the **height**.



Area of trapezoid = (upper base + lower base) × height ÷ 2

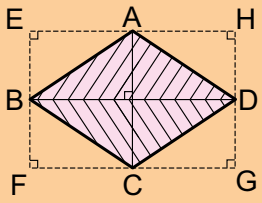
4 Area of Rhombuses

1 Let's think about how to find the area of a rhombus.



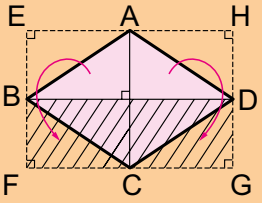
Gawi's Idea

Divide a rhombus into 2 triangles,
$9 \times (6 \div 2) \div 2 \times 2$
Area of triangle



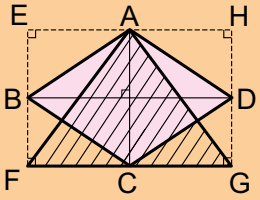
Kekeni's Idea

Change a rhombus into the rectangle, since the area can be calculate by length × width,
$(6 \div 2) \times 9$



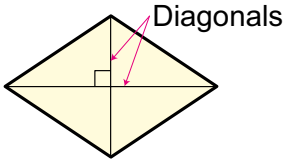
Naiko's Idea

Change a rhombus into the triangle, since the base is FG and the height is AC,
$9 \times 6 \div 2$

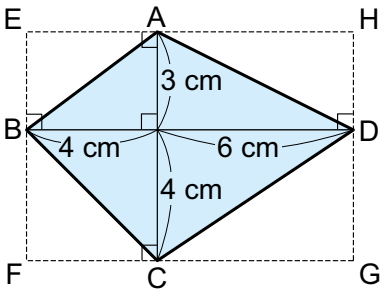


The area of rhombus can be found by using the length of 2 diagonals.

Area of rhombus = (diagonal × diagonal) ÷ 2

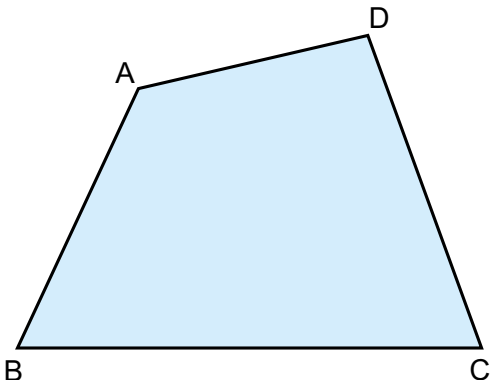


2 Let's think about how to find a quadrilateral with diagonals that have a perpendicular intersection, as shown on the right.



5 Think About How to Find the Area

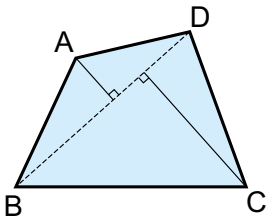
1 How can we find the area of the quadrilateral as shown on the right?



Can I divide this shape into other known figures?

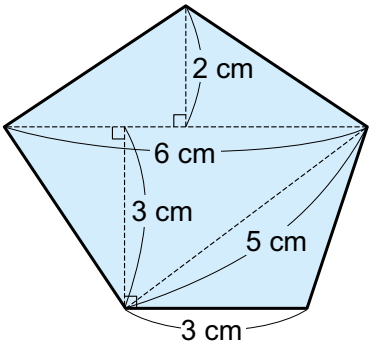
Let's find the area by measuring the necessary lengths.

The area of quadrilaterals and pentagons can be found by dividing into several triangles.

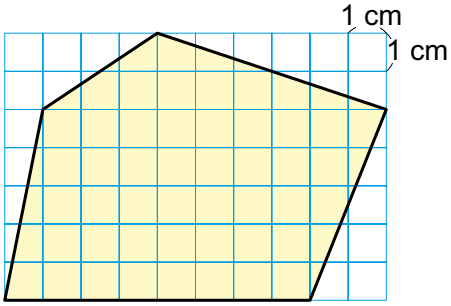


2 Let's find the area of pentagons below.

1



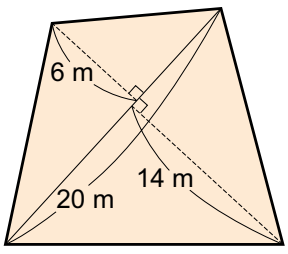
2



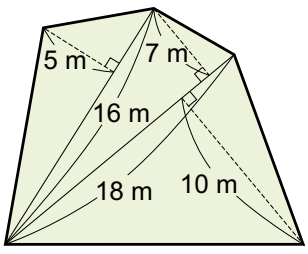
Exercise

Let's find the area of a quadrilateral and a pentagon as shown on the right.

1



2

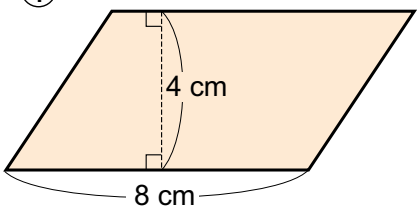


EXERCISE

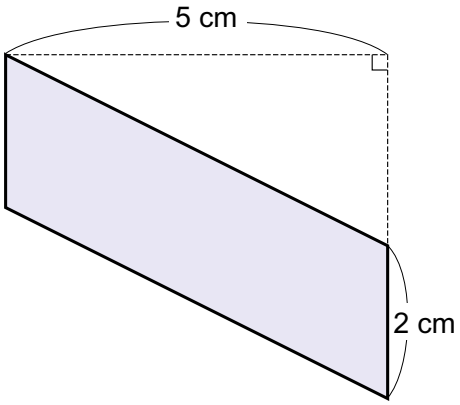
1 Let's find the area of these parallelograms.

Pages 130 to 136

①



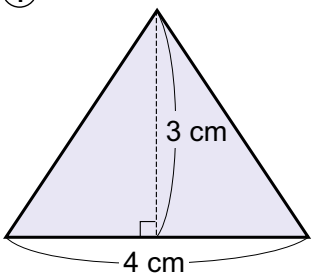
②



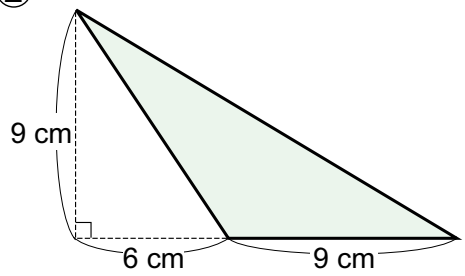
2 Let's find the area of these triangles.

Pages 137 to 142

①



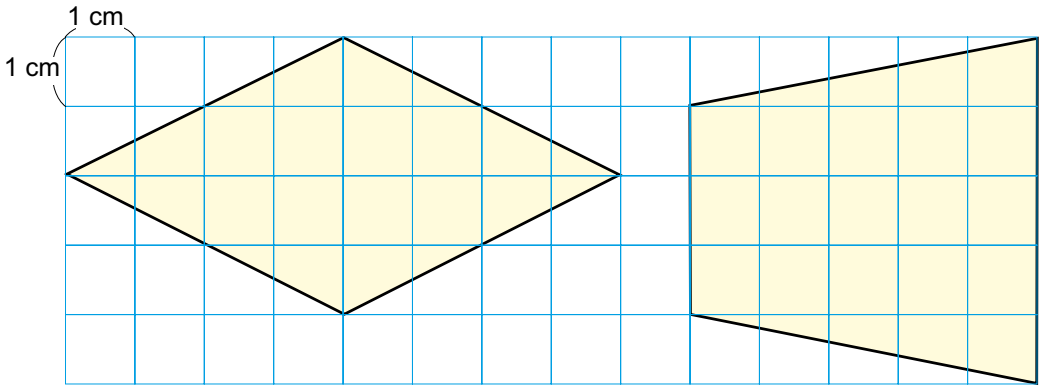
②



3 Let's find the area of these figures.

Pages 143 to 146

① ②



Grade 4

Do you remember?

Let's calculate.

① $32 \div 2$ ② $48 \div 4$ ③ $60 \div 15$ ④ $84 \div 21$

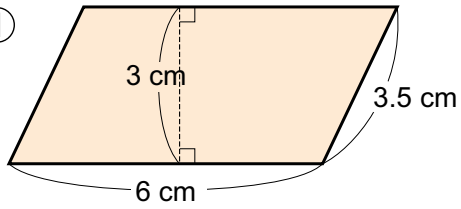
⑤ $258 \div 3$ ⑥ $624 \div 4$ ⑦ $306 \div 17$ ⑧ $837 \div 31$

PROBLEMS

1 Let's find the area of these shapes.

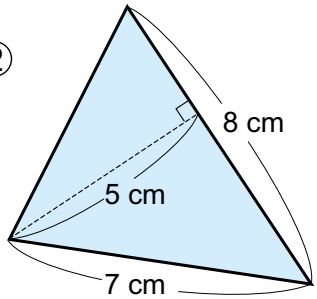
● Finding the base and the height, and using formula.

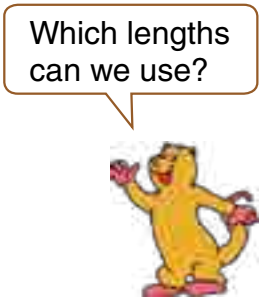
①



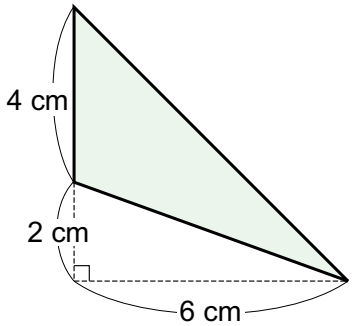
Parallelogram

②

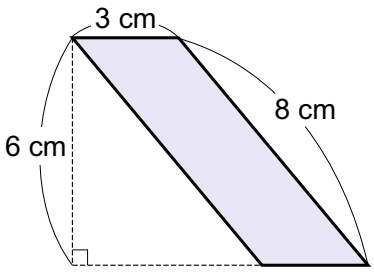




③



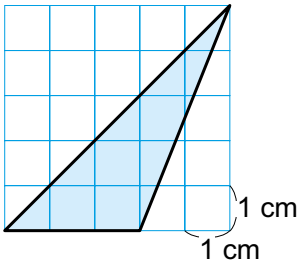
④



Parallelogram

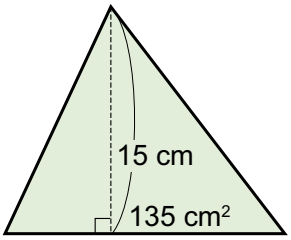
2 Let's draw a triangle with an area same as the area of the triangle on the right and explain the reason why they are equal.

● Drawing a triangle with the same area.



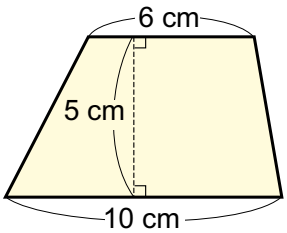
3 The triangle on the right has a height of 15 cm and an area of 135 cm^2.
How many cm long is the base?

● Finding the height or the base when the area is given.

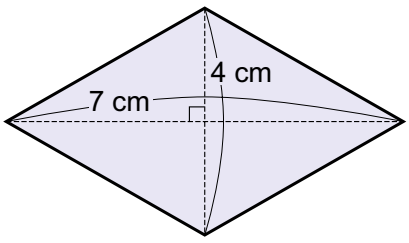


4 Let's find the area of these shapes.

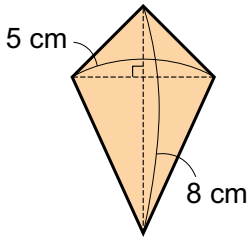
● Finding the area.



Trapezoid



Rhombus



Mathematics Practices in Papua New Guinea

Topic 3: Traditional Measuring System

In the past, people had no idea what the Metric System was. They did not use modern means of measurement such as rulers or tape measures to measure distances, watches or clock to measure time and scale or balances to measure weights. In traditional mathematics, people used simple materials. Nature and their body parts to measure distances or length, time and mass. To measure time they used the sun by reading their shadow, the chickens crowing and the sounds of birds. They also used bush ropes to tie knots which represented the days or months. When measuring distances or length they used ropes, arm length and pacing. Pacing was very useful when building houses. They measured the weight of something by lifting and comparing with another thing which is heavy or light. There weren't any units used for length, time and mass. All these means of measurement in traditional mathematics were simple and without cost.

Sticks used to measure area.

Traditional ropes used in making bilums.

Although the metric system was introduced recently in our societies, people still value and use these traditional measuring systems. The application of the skills and knowledge are passed on to the next generation for use. The skills involved develops the ability of a person to make good estimations in calculations.

Let's think of other ways to measure in which your people used in the past.

Share what your people used in the past with your friends.

Source: Ethnomathematical Lessons for PNG by Mathematics students of UPNG-Goroka campus, 1993.

11 Multiplication and Division of Fractions

1 Operation of Fractions × Whole Numbers

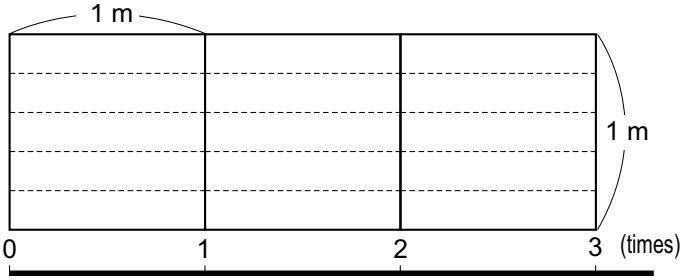
1 Flowerbeds are sprinkled with a bucket of water. When we use a large bucket, we can sprinkle 2 m² for each time. When we use a small bucket, we can sprinkle $\frac{2}{5}$ m² for each time.

Area (m²)	2	?
Number of sprinkles(times)	1	3

(×3 above, ×3 below)

(1) If we sprinkle three times with a large bucket, what m² can we sprinkle water?
Write an expression and find the number.

(2) If we sprinkle three times with the small bucket, how many m² can we get? Let's colour in the figure below.



Area (m²)	$\frac{2}{5}$	?
Number of sprinkles (times)	1	3

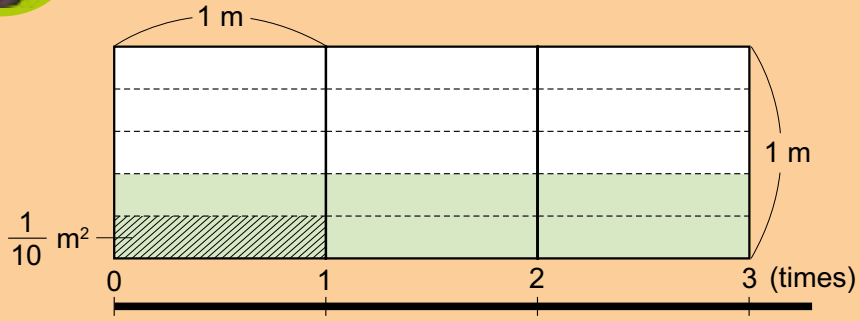
(×3 above, ×3 below)

(3) Let's write an expression of (2). ☐

(4) Let's think about how to calculate.

Let's think about situations where you multiply fraction by a whole number and how to calculate it.

Sare's Idea



$\frac{2}{5}$ m² is 2 sets of $\frac{1}{5}$ m². $\frac{2}{5}\times 3$ is 3 sets of $\frac{2}{5}$ m².

So, $\frac{2}{5}\times 3$ is (2×3) sets of $\frac{1}{5}$. $\frac{2}{5}\times 3=\frac{2\times 3}{5}=$ ☐.

Yamo's Idea

Represent this fraction by division,

we get $\frac{2}{5}=2\div 5$.

$\frac{2}{5}\times 3=(2\div 5)\times 3$

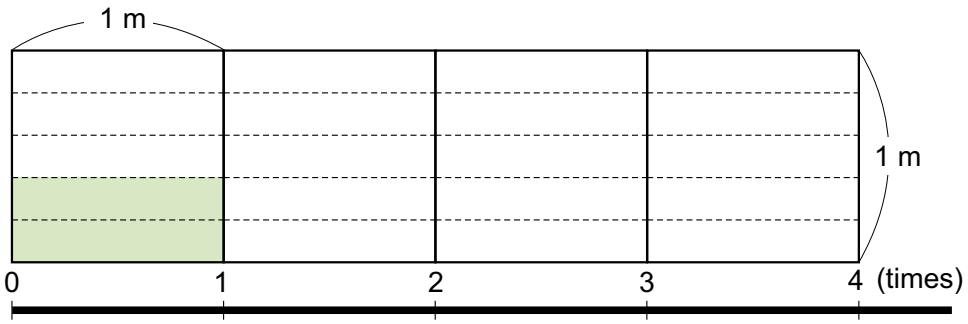
$=(2\times 3)\div 5$

Represent this expression as one fraction,

we get $\frac{2}{5}\times 3=\frac{2\times 3}{5}=$ ☐.

$(2\div 5)\times 3=0.4\times 3=1.2$
$(2\times 3)\div 5=6\div 5=1.2$
so, the $\div 5$ and $\times 3$ part can be switched.

2 Sprinkling 4 times with the small bucket in **1**, how many m² can you water? Let's write an expression and calculate.



When we multiply a proper fraction by a whole number, multiply the numerator by the whole number and leave the denominator as it is.

$$\frac{\blacktriangle}{\bullet} \times \blacksquare = \frac{\blacktriangle \times \blacksquare}{\bullet}$$

3 Let's compare method Ⓐ with Ⓑ for calculating $\frac{2}{9} \times 3$.

Ⓐ $\frac{2}{9} \times 3 = \frac{2 \times 3}{9}$

$= \frac{\overset{2}{\cancel{6}}}{\underset{3}{\cancel{9}}}$

$= \square$

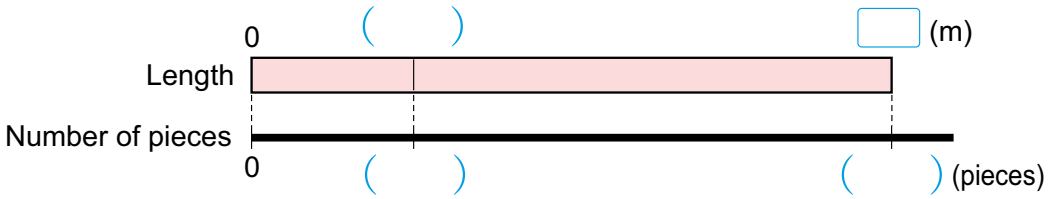
Ⓑ $\frac{2}{9} \times 3 = \frac{2 \times \overset{1}{\cancel{3}}}{\underset{3}{\cancel{9}}}$

$= \square$

The calculation will be simpler if you simplify the fraction as you calculate.

4 We make 4 pieces of rope that are $\frac{7}{5}$ m long each.
What is the total length of the 4 pieces of ropes?

1 The diagram below shows this problem situation.
Fill in the ( ) with a number.



2 Let's calculate the length of the rope.

Exercise

① $\frac{2}{5} \times 2$ ② $\frac{5}{3} \times 4$ ③ $\frac{3}{8} \times 2$ ④ $\frac{7}{6} \times 4$

5 We make 4 pieces of rope that are $1\frac{2}{5}$ m long each.
What is the total length of the 4 pieces of rope?

1 Write an expression to find the total length of the rope.

2 Approximately how long is the length of the 4 pieces of rope?

3 Let's think about how to calculate.

Length (m)	$1\frac{2}{5}$	?
Number of pieces	1	4

×4 ×4

Gawi's Idea

Calculate by splitting $1\frac{2}{5}$ into 1 and $\frac{2}{5}$.

$1\frac{2}{5}\times 4 \left\langle \begin{matrix} 1\times 4 \\ \frac{2}{5}\times 4 \end{matrix} \right\rangle$ $\square\frac{\square}{\square}$

$= \square\frac{\square}{\square}$

Kekeni's Idea

Calculate by changing $1\frac{2}{5}$ into an improper fraction.

$1\frac{2}{5}\times 4 = \frac{7}{5}\times 4$

$= \square$

$= \square\frac{\square}{\square}$

It's easy to estimate the approximate value in Gawi's idea.

To represent mixed fraction is simpler to understand the size.

When multiplying a mixed fraction by a whole number, you can calculate as same as proper fraction × whole number by changing mixed fractions to improper fractions.

Exercise

① $1\frac{3}{7}\times 2$ ② $1\frac{5}{8}\times 4$ ③ $2\frac{2}{3}\times 15$ ④ $2\frac{5}{6}\times 12$

2 Operation of Fractions ÷ Whole Numbers

1 When sprinkling flowerbeds with a bucket of water, some buckets can sprinkle ☐ m² two times. How many m² can these buckets sprinkle at once?

1 Complete the problem by filling in the ☐.

It is easy if it is an even whole number. For example, if it is 4 m² you can calculate 4 ÷ 2.

I can also calculate 0.8 m² easily by 0.8 ÷ 2.

Can we calculate in the case of fractions?
If it is $\frac{4}{5}$ m², what happens?

2 When ☐ is $\frac{4}{5}$ m², write an expression.

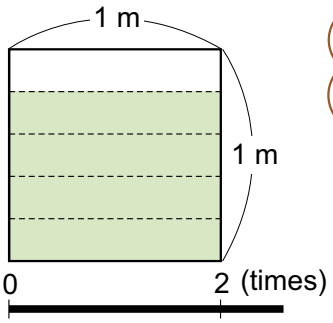
Area (m²)	?	$\frac{4}{5}$
Number of sprinkles (times)	1	2

÷2 (Area (m²): ? → $\frac{4}{5}$)

÷2 (Number of sprinkles (times): 1 → 2)

3 Let's think about how to calculate.

Can we calculate the expression by following the rule of division.



How many $\frac{1}{5}$ are in the diagram?

We can calculate the expression in the same method as multiplying fractions.

Activity

Phrase

"For example, ~"

When we express a general idea concretely, we use it.

Ambai's Idea

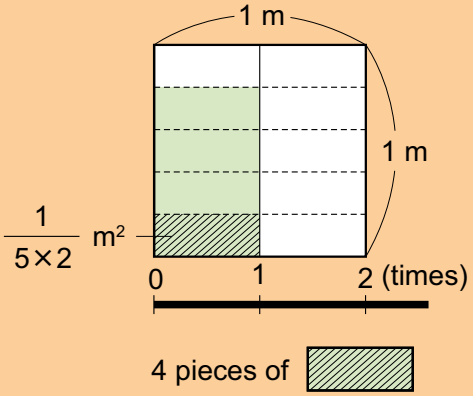
The amount of ▨ is $=\frac{1}{5\times2}$ m².

The amount sprinkled once is

4 of $\frac{1}{5\times2}$ m²

$\frac{4}{5}\div2=\frac{4}{5\times2}$

$=$ ☐



Gawi's Idea

In division, there is a rule that the quotient is changed if we multiply divisor and dividend by the same number, respectively.

$\frac{4}{5}\div2=\left(\frac{4}{5}\times5\right)\div(2\times5)$

$=4\div(2\times5)$

$=4\div(5\times2)$

Represent the expression by the fraction,

$\frac{4}{5}\div2=\frac{4}{5\times2}$

$=$ ☐

Vavi's Idea

In multiplication of fraction × whole number, since we multiply a numerator by whole number.
Using this idea, we divide a numerator by whole number.

$\frac{4}{5}\div2=\frac{4\div2}{5}$

$=$ ☐

$\frac{4}{5}$ m² are 4 sets of $\frac{1}{5}$ m².
Then, if we divided it equally into, ….

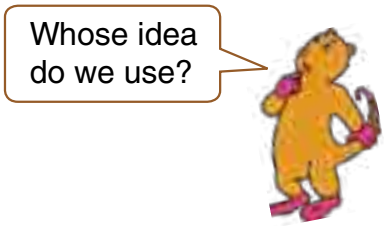
2 To make a juice of $\frac{3}{4}$ L, we need 5 oranges.
How much juice can we make with 1 orange?

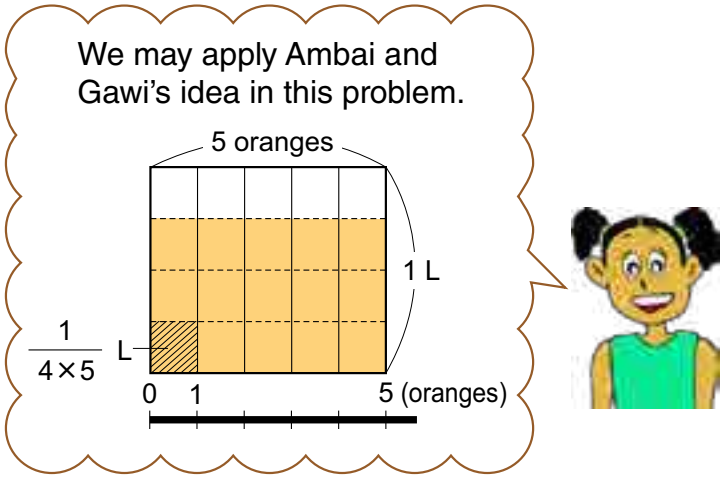
1 Write a mathematical expression.

Amount of juice (L)	?	$\frac{3}{4}$
Number of oranges	1	5

÷5 ÷5

2 Let's calculate.

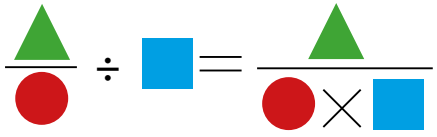




3 Calculate using Vavi's idea on the left.
Change it into a fraction that has the same value and the numerator is divisible by 5.

$$\frac{3}{4}\div5=\frac{3\times5}{4\times5}\div5$$
$$=\frac{3\times5\div5}{4\times5}$$
$$=\frac{3}{4\times5}$$
$$=\square$$

When we divide a proper fraction by a whole number, we multiply the denominator by the whole number and leave the numerator as it is.



3 Let's compare method Ⓐ with Ⓑ for calculating $\frac{10}{7} \div 4$.

Ⓐ $\frac{10}{7} \div 4 = \frac{10}{7 \times 4}$

$= \frac{\cancel{10}^{5}}{\cancel{28}_{14}}$

$= \square$

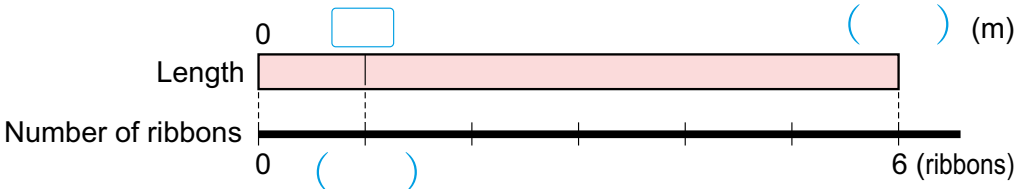
Ⓑ $\frac{10}{7} \div 4 = \frac{\cancel{10}^{5}}{7 \times \cancel{4}_{2}}$

$= \square$

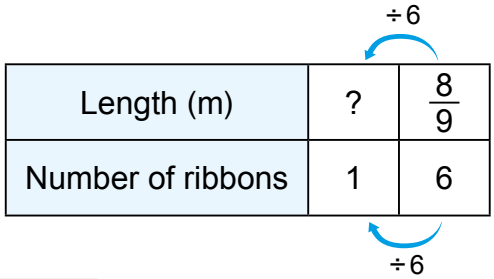
The calculation will be easier if you reduce the fraction as you calculate.

4 There is a $\frac{8}{9}$ m long tape.
We make 6 ribbons which are all the same in length from this tape.
How many metres is each ribbon?

1 The diagram shown below expresses the situation.
Let's fill in the ( ) with numbers.



2 Calculate the length of each ribbon.

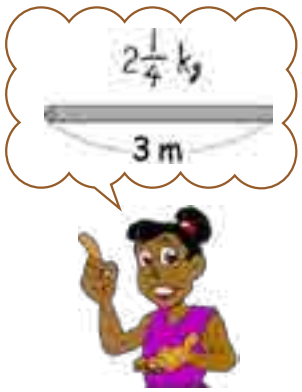


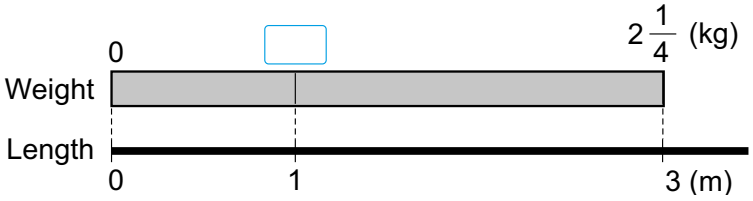
Exercise

① $\frac{1}{2} \div 4$ ② $\frac{3}{4} \div 2$ ③ $\frac{5}{6} \div 4$ ④ $\frac{7}{8} \div 5$

⑤ $\frac{2}{3} \div 2$ ⑥ $\frac{6}{7} \div 3$ ③ $\frac{7}{4} \div 3$ ④ $\frac{8}{3} \div 4$

5 There is an iron rod which is 3 m long and weighs $2\frac{1}{4}$ kg.
How much does 1 m weigh?





1 Let's write a mathematical expression.

2 Is the weight per metre greater than 1 kg?

3 Let's think about how to calculate.

	÷3	
Weight (kg)	?	$2\frac{1}{4}$
Length (m)	1	3
	÷3	

$$2\frac{1}{4}\div 3=\frac{\square}{4}\div 3$$
$$=\frac{\square}{4\times 3}$$
$$=\frac{\square}{4}$$

Where you can simplify the fraction, please do so.

When you divide a mixed fraction, you can calculate in the same way as proper fraction ÷ whole number by changing a mixed fraction to an improper fraction.

4 Let's calculate by splitting into whole number and fraction.

$$2\frac{1}{4}\div 3 \begin{cases} 2\div 3=\frac{2}{3} \\ \frac{1}{4}\div 3=\frac{1}{4\times 3}=\frac{1}{12} \end{cases} \rangle \quad \frac{2}{3}+\frac{1}{12}=\square+\square$$
$$=\square$$

Exercise

① $1\frac{2}{3}\div 4$ ② $2\frac{5}{8}\div 6$ ③ $2\frac{2}{7}\div 8$ ④ $3\frac{1}{2}\div 7$

EXERCISE

1 Summarise how to calculate fraction × whole number and fraction ÷ whole number.

Pages 152 and 156

① $\frac{2}{7} \times 3 = \frac{\square \times \square}{\square}$

$= \square$

② $\frac{5}{7} \div 3 = \frac{\square}{\square \times \square}$

$= \square$

2 Let's calculate.

Pages 152 and 153

① $\frac{2}{5} \times 5$ ② $\frac{7}{9} \times 6$ ③ $\frac{7}{6} \times 8$ ④ $2\frac{3}{4} \times 12$

⑤ $\frac{5}{12} \times 3$ ⑥ $\frac{3}{7} \times 28$ ⑦ $\frac{9}{14} \times 7$ ⑧ $3\frac{3}{10} \times 30$

3 Gilbert drinks $\frac{5}{6}$ L of milk each day.
How many litres will be drank in 3 days?

Page 152

4 Let's calculate.

Pages 152 to 158

① $\frac{5}{6} \div 4$ ② $\frac{4}{7} \div 2$ ③ $\frac{3}{10} \div 6$ ④ $\frac{2}{5} \div 7$

⑤ $\frac{3}{2} \div 2$ ⑥ $\frac{10}{7} \div 10$ ⑦ $1\frac{3}{8} \div 3$ ⑧ $2\frac{5}{8} \div 3$

5 Divide $\frac{7}{6}$ L of pineapple juice equally into 3 bottles.
How many L will there be in each bottle?

Page 158

Let's find a volume of the figures below.

Grade 5
Do you remember?

① 2 cm, 4 cm, 6 cm

② 2.5 cm, 2.5 cm, 2.5 cm

③ 3 m, 6 m, 3 m, 7 m, 5 m

PROBLEMS 1

1 Find wrong calculations below and correct them.

● Understanding how to calculate.

① $\frac{2}{5} \times 10 = \frac{\cancel{2}^{1}}{5 \times \cancel{10}_{5}} = \frac{1}{25}$

② $\frac{7}{8} \div 4 = \frac{7 \times \cancel{4}^{1}}{\cancel{8}_{2}} = \frac{7}{2}$

2 Let's calculate.

● Calculating fraction × whole number and fraction ÷ whole number.

① $\frac{1}{6} \times 5$ ② $\frac{5}{8} \times 6$ ③ $\frac{7}{6} \times 12$

④ $\frac{4}{9} \div 3$ ⑤ $\frac{12}{13} \div 4$ ⑥ $\frac{10}{9} \div 6$

3 There is a $\frac{7}{10}$ m long tape. Divide the tape equally among 5 students. How many m of the tape will each student receive?

● Writing an expression of fractions and answering.

4 The length of a rectangle is $\frac{11}{6}$ cm and the width is 3 cm. Find the area of the rectangle.

● Finding the area with fraction.

PROBLEMS 2

1 Let's represent time as a fraction.

● Represent the time using fractions.

① How many hours are there in 20 minutes? Express as a fraction. Write the reason.

② How many days are there in 8 hours? Express as a fraction.

③ How many minutes are there in $\frac{15}{4}$ seconds? Write an expression and calculate.

Square Calculation

① Fill in the table below.
Calculate horizontal number with the vertical number, (multiplier × multiplicand).

×	0	1	2	3	4	5	6	7	8	9	10
0	0		0		0		0		0		0
10	0		20		40		60		80		100
2	0		4		8		12		16		20
5		5		15		25		35		45	
8	0		16		32		48		64		80
3		3		9		15		21		27	
6	0		12		24		36		48		60
7		7		21		35		49		63	
4	0		8		16		24		32		40
9		9		27		45		63		81	
1		1		3		5		7		9	

② Think about what rules are there and discuss with your friend.

③ If there are differences in the order of multiplication, discuss and compare.

④ What happens to the products when the multiplicands and the multipliers are reversed?

12 Proportions

(1) The length and the width of rectangles which are made by the same rope.

(2) The length and weight of wires.

1 Quantities Changing Together

There are quantities when one quantity changes, the other quantity also changes together in our surrounding.

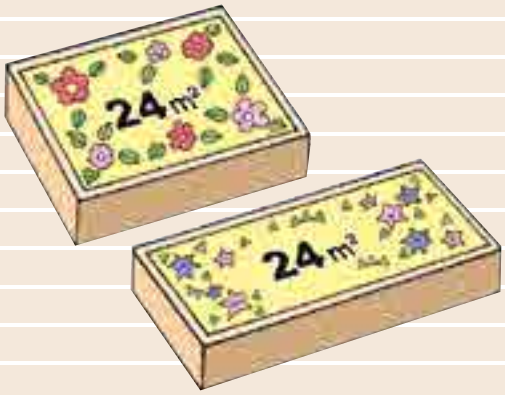
1 Yawa transferred 100 oranges from a box to a basket sent by his grandmother.

1. Let's illustrate to explain the situation.
2. Write down the number of oranges in a box, the number of oranges in a basket and the total in the table.

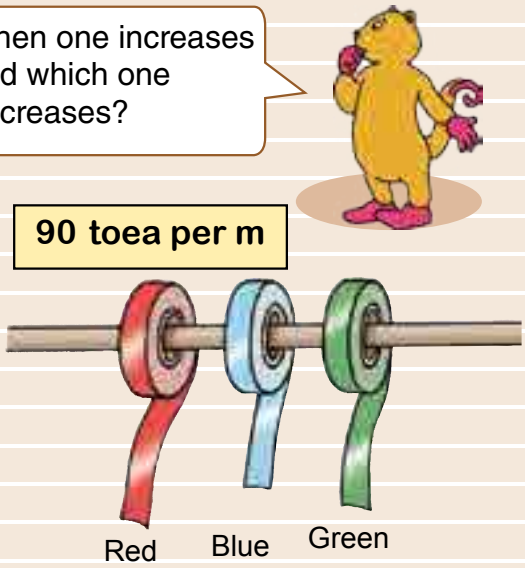
Numbers of Oranges in a Box and in a Basket

Number of oranges in a basket	0	20	40	60	80	100
Number of oranges in a box	100	80				
Total	100	100				

3. When they transferred oranges from a box to a basket, which quantities changed together?
   Which quantities remain unchanged?
4. Put the number of oranges in a basket □ and the number of oranges in a box ○, write a mathematical sentence with the relationship between □ and ○.



(3) The length and the width of rectangles which have the same area.



(4) The length and the cost of ribbons.

2 There are many boxes of the same shapes and sizes.
Pile up the boxes on a stand with a 10 cm height table and measure the whole height.

1. Let's illustrate to explain the situation.
2. Write down the number of boxes, the height of boxes piled up and the whole height on the table.

Number of Boxes and Height

Number of boxes	0	1	2	3	4	5	6	7
Height of boxes (cm)	0	6	12	18				
Whole height (cm)	10	16	22	28				

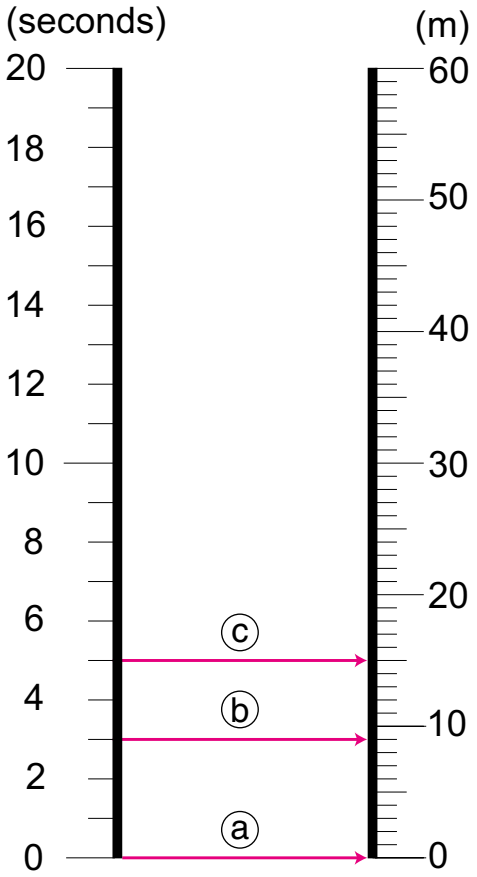
3. When we pile up 1 box, how many cm does the height increase?
4. When we pile up 7 boxes, what cm is the whole height?
5. When we pile up boxes, which quantities change?
Which quantity remains unchanged?
6. Put the number of boxes □ and the whole height ○ cm, then write a mathematical sentence with the relationship between □ and ○.
7. Let's calculate the whole height in 8 boxes by using the mathematical sentence.

2 Proportions

1 In Port Moresby, a hotel has 19 floors and people use elevators to move up and down.

The height of the building is 60 m from ground level.

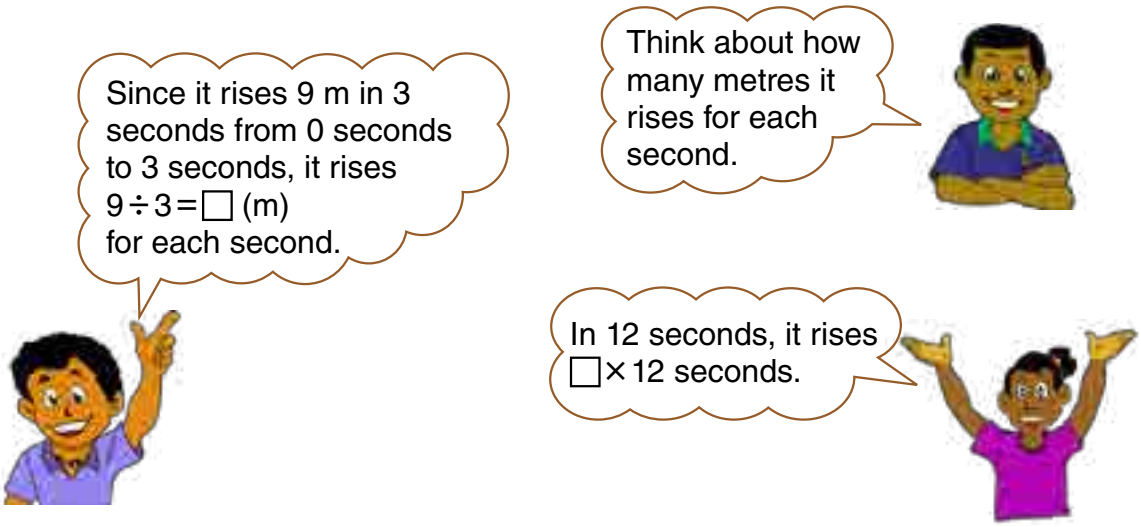
When the elevator moves up, we recorded the time and the height on the table.



The Time and the Height

Time (seconds)	0	3	5	9	10	16	18	20
Height (m)	0	9	15	27	30	48	54	60
	ⓐ	ⓑ	ⓒ					

1. When the time is 3 seconds, we represent it with an arrow (→) that the height is 9 m as shown in ⓑ in the diagram on page164. Its height is 9 m.
2. How many metres does the elevator rise in one second?
3. How can you tell the heights when the times are 12 seconds and 15 seconds respectively?



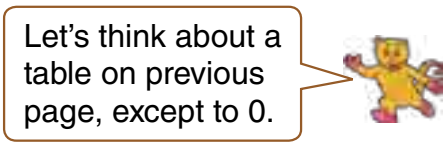
4. Draw a table between the time spent from the start and the height risen by the elevator.

The Time and the Height

Time (seconds)	0	1	2	3	4	5	6	7
Height (m)								

The time spent from the start is □ seconds and the height risen is ○ m. When the time □ increases, then the height ○ also increases.

5 When the time □ seconds increases 2 times, 3 times, 4 times and so on, we record how the height changes together. Fill in the ▭ with a number.



4 times
3 times
2 times

Time □ (sconds)	1	2	3	4	5	6	7	8
Height ○ (cm)	3	6	9	12	15	18	21	24

▭ times
▭ times
▭ times

6 When the time □ seconds increases 2 times, 3 times, 4 times and so on, how does the height change?

If there are 2 changing quantities □ and ○, □ **changes 2 times, 3 times** and so on and ○ **also changes 2 times, 3 times** and so on, then ○ is **proportional** to □.

Exercise

The cost of □ laplap that cost, 15 kina each is ○ kina.

① When □ are 1, 2, 3 and more, find the corresponding values and write the results in the table.

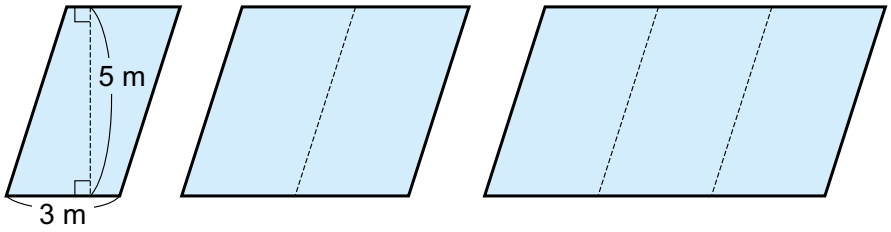
The Number of Laplap and Their Cost

The Number of laplap □	1	2	3	4	5	6	7	8
Costs ○ (kina)	15							

② What is the cost of laplap proportional to?

2 There are some congruent parallelograms that have 3 cm base and 5 cm height.

Make larger parallelograms by connecting them as shown below and find their areas.



1 Write the formula for the area of parallelogram

□ = □ × □

Let's investigate which 2 quantities change together and which quantity remains unchange?

2 Write the mathematical sentence by using □ cm as the base and ○ cm² as the area.

3 Write down the relationship between the base and the area of parallelogram on the table.

The Base and the Area of a Parallelogram

Base (cm)	3	6				
Area (cm²)						

4 Is the area of parallelogram proportional to the base?

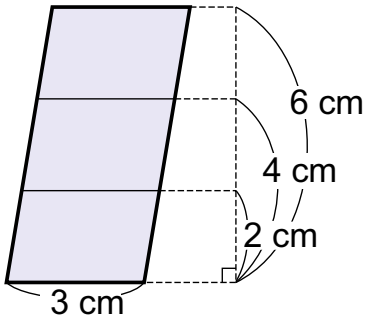
Let's write the reason.

Exercise

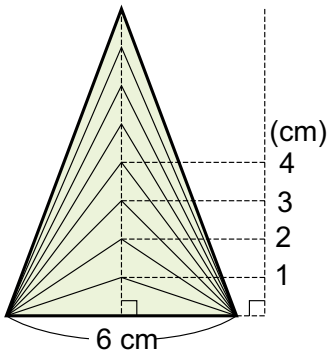
The height of a parallelogram is increased as shown on the right.

① Write the relationship between the height and the area on a table.

② Let's write what you have learned from the table.



3 The height of the triangle is increased in steps of 1 cm as shown on the right. Find the area of each triangle.



1 Write the formula for the area of the triangle and investigate which quantities change together. What remains unchanged?

[ ] = [ ] × [ ] ÷ [ ]

2 Write down the relationship between the height and the area of the triangle on the table.

The Height and the Area of the Triangle

Height (cm)	1	2	3						
Area (cm²)	3								

3 Is the area of triangle proportional to the height? Let's write the reason.

4 Write a simpler expression using □ cm as the height and ○ cm² as the area in **1**.

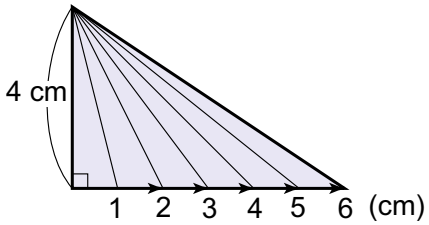
5 When the area of the triangle is 30 cm², what is the height in cm?

Exercise

The base of the right triangle on the right is extended in the steps shown below.

① Write the relationship between the base and the area of the triangle on a table.

② When the area of the triangle is 16 cm², what is the base in cm?



PROBLEMS

1 In the 2 quantities in ①, ② and ③, which quantity is proportional to the other?

If 2 quantities are proportional, write the mathematical sentence as the relationship of □ and ○.

● Understanding the meaning of proportion.

① □ cm as the side and ○ cm² as the area of a square.

② □ cm as the length and ○ cm² as the width of rectangle with 26 cm long around.

③ □ balls and its total cost ○ kina when we buy balls that cost 30 kina each.

2 Let's investigate the relationship between length in metres and weight in grams of wire that weights 20 g for 1 m.

● Representing expressions as quantities which are directly proportional.

① Write down the relationship □ m long and ○ g weight on the table.

The Length and the Weight of the Wire

Length □ (m)	1	2	3	4	5	6
Weight ○ (g)						

② What will be directly proportional to what?

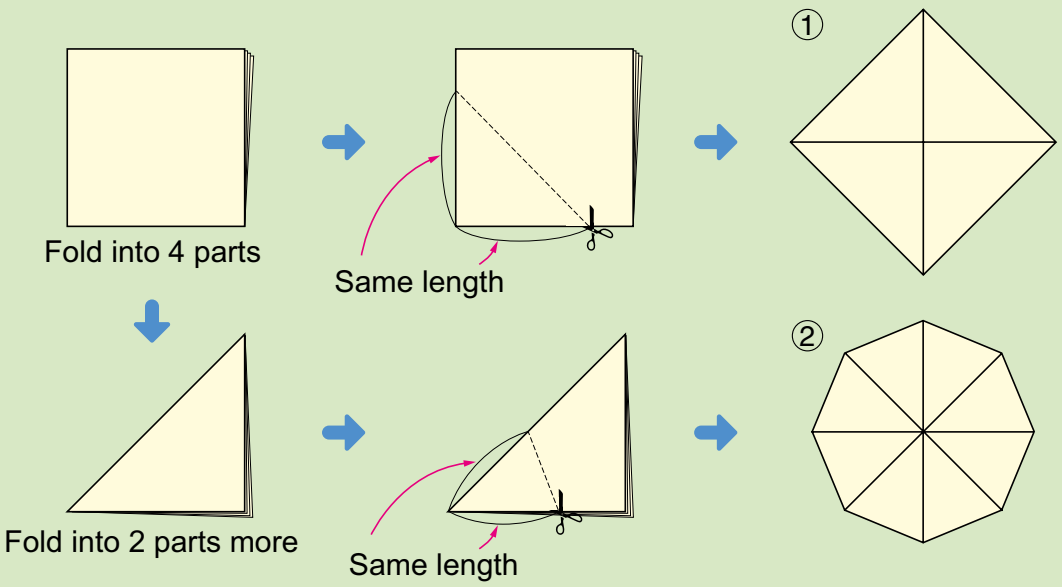
③ When □ increases by 1, by how much does ○ increase?

④ Write the mathematical sentence as the relationship of □ and ○.

⑤ When the length is 2.4 m, find a corresponding weight.

13 Regular Polygons and Circles

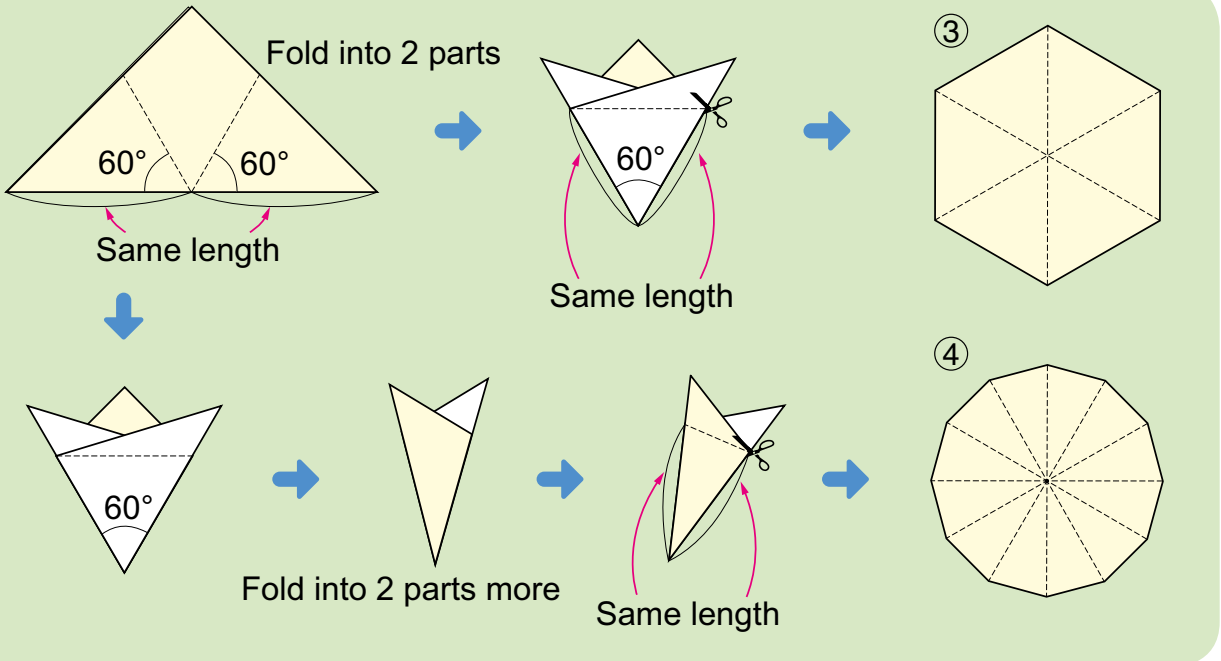
Let's fold papers as follows, cut and spread to make shapes.



Activity

1 Have you seen the shapes in ① to ④?
Let's look for those shapes around you.

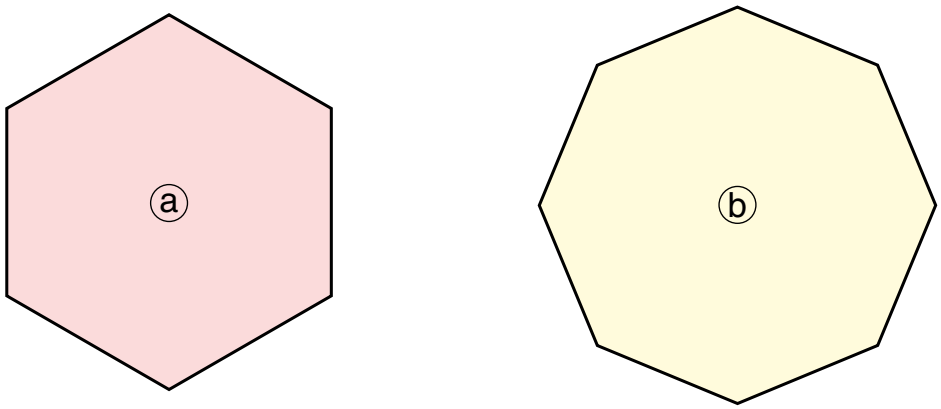
Japanese lunch box



2 What is common amongst the 4 shapes ① to ④?
What are the differences?

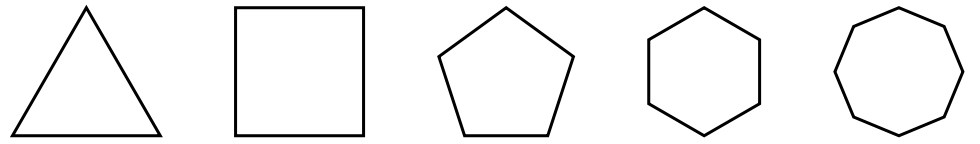
1 Regular Polygons

1 The polygons below were made in the previous pages. Let's look at their sides and the angles.



1. How many sides and angles are there, respectively?
2. Measure the length of sides of these polygons.
3. Measure the size of the angles of these polygons.

A polygon with all equal sides and all equal size of angle is called regular polygon.



Let's investigate properties of regular polygon and how to draw them.

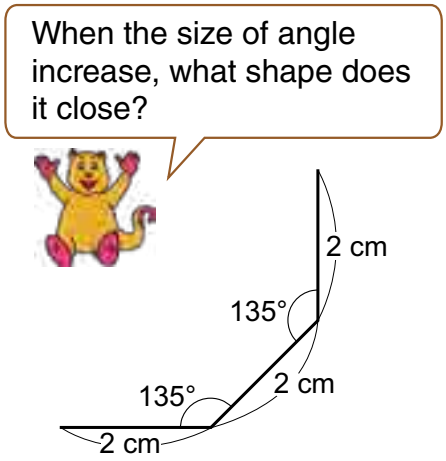
2 Summarise the number of sides and the size of an angle of regular polygons.

	Equilateral triangle	Regular quadrilateral (square)	Regular pentagon	Regular hexagon	Regular octagon
Number of sides					
Size of angle					

3 Let's investigate the regular polygons.

1 Draw three regular polygons with 2 cm sides and the following sizes of angles.

Ⓐ 90° Ⓑ 120° Ⓒ 135°

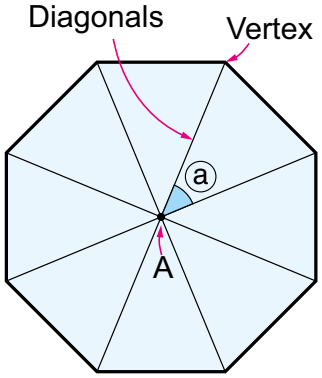


2 In regular polygons drawn, draw diagonals by connecting the opposite vertices.

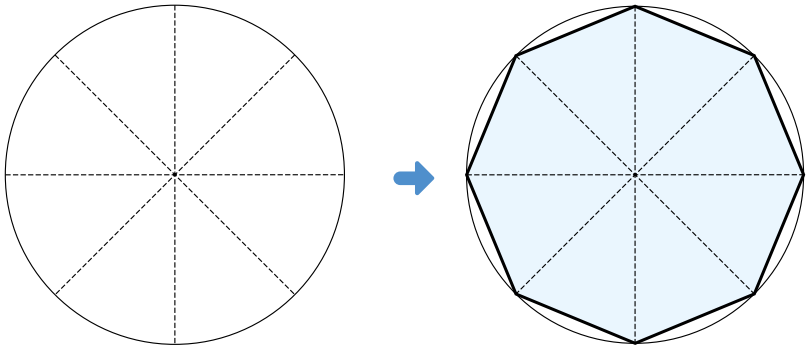
3 Compare the lengths between point A and vertices : Point A is the intersection of diagonals.

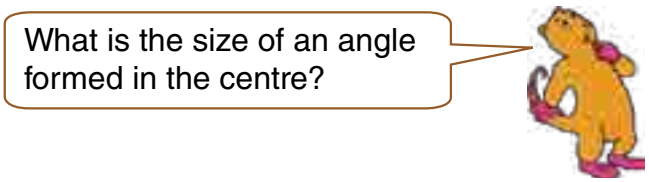
4 What kind of triangle is formed by diagonals? Are they congruent?

5 What is the size of an angle ⓐ of a regular octagon on the right?

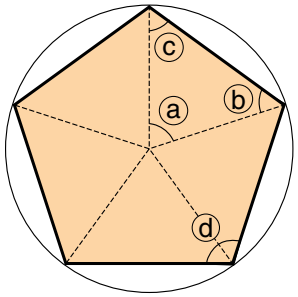


6 Divide the angle around the center of circle into 8 equal parts, draw a regular octagon.





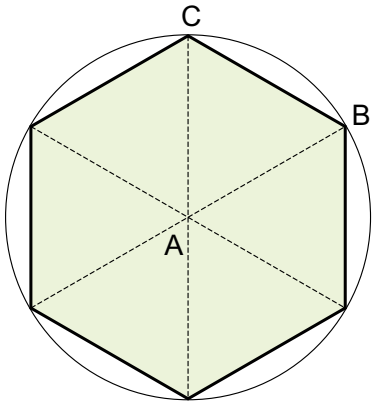
4 Let's draw a regular pentagon by dividing the angles around centre of circle into 5 equal parts.



1. What is the size of angle ⓐ?
2. Find the size of angles ⓑ, ⓒ and ⓓ.
3. Write down the properties of a regular pentagon in your exercise book.

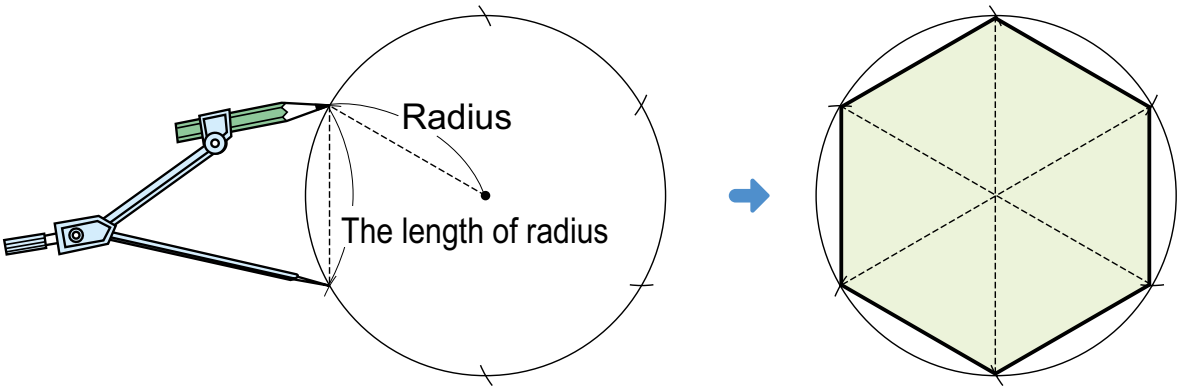
5 Let's think about how to draw a regular hexagon.

1. Draw a regular hexagon by dividing the angle around the centre of the circle into 6 equal parts.



What kind of a triangle is formed by ABC?

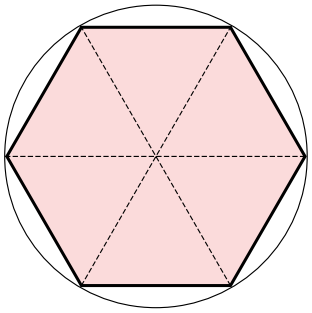
2. Draw a regular hexagon by dividing the circumference by the length of radius, using a compass below.



3. Explain the reason why we can draw by using a compass.
4. Write down the properties of a regular hexagon in your exercise book.

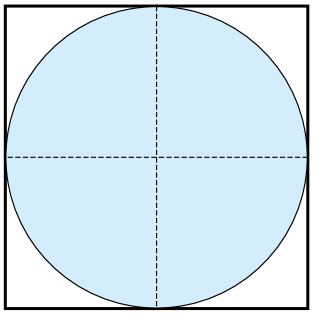
2 Diameters and Circumferences

1 Draw a regular hexagon into which a circle with a 2 cm radius fits.



1. How many times is the length around a regular hexagon to the diameter of the circle ?
2. Let's compare the length around a circle with the length around a regular hexagon.

2 Draw a square into which a circle with 2 cm radius fits.



1. How many times is the diameter of the circle to the length around the square?
2. Let's compare the length around the circle with the length around the square.

The distance around of a circle is called a **circumference**.
The line that bends like a circumference is called the **curve**.

Let's investigate the relationship between the diameter of the circle and its circumference.

3 From 1 and 2, what do we know about the relationship between the diameter of the circle and its circumference?

Fill in the ☐ with an inequality sign.

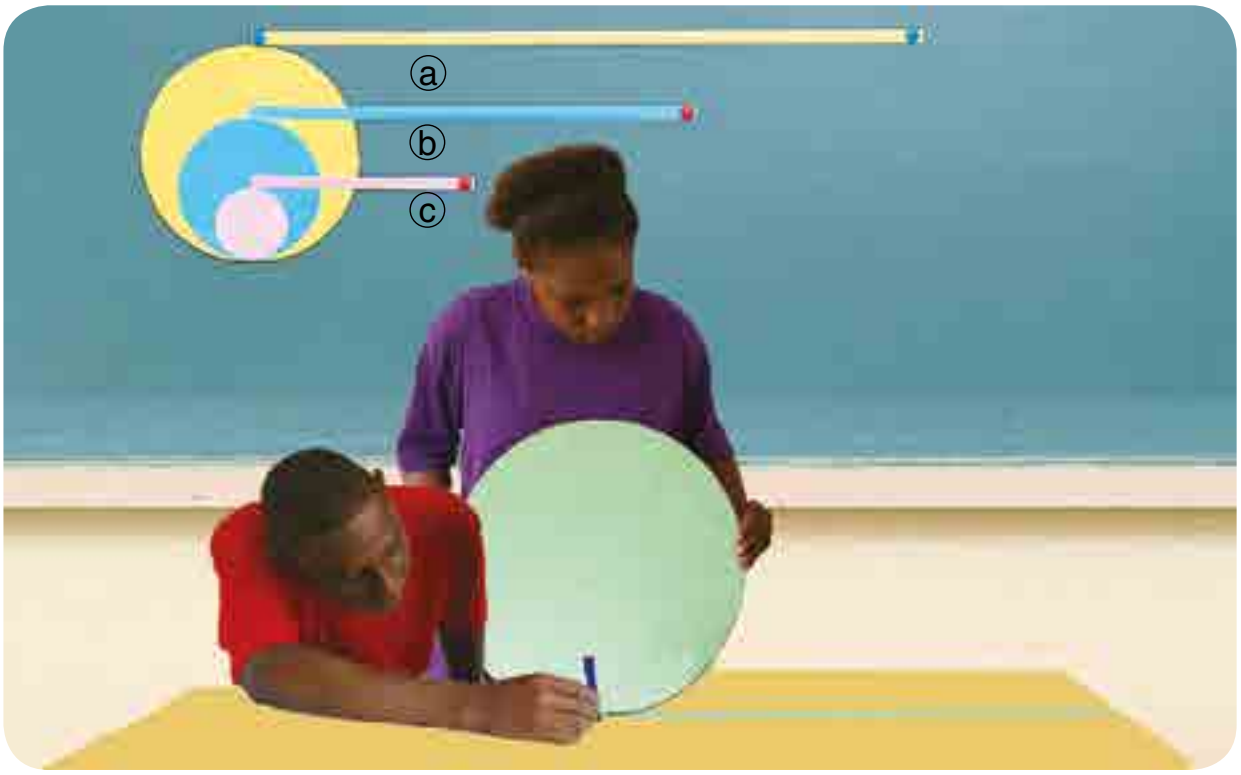
Diameter × 3 ☐ Circumference

Diameter × 4 ☐ Circumference

What do they mean above?

Let's explain by writing in your exercise book.

4 Cut a piece of cardboard to make circle ⓐ, ⓑ and ⓒ which have diameters of 10 cm, 20 cm and 30 cm respectively. Then, roll them one complete rotation and investigate how far they advance.



1. Talk about the distance of the circle rolled and what does it relate to.
2. Estimate how many centimetres a circle with a 40 cm diameter will advance in one rotation.
3. Make sure how many centimetres a circle with a 40 cm diameter advance.
4. Write the results in the table.

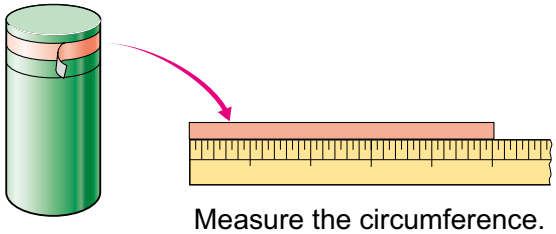
	ⓐ	ⓑ	ⓒ	
Diameter (cm)	10	20	30	40
Circumference (cm)				

5. When the diameter increases by 2 times, 3 times and 4 times, how does the circumferences change?

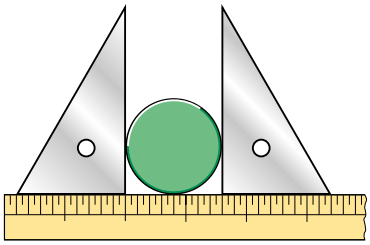
Activity

5 Let's investigate the relationship between the circumferences and diameters of various circles.

1 Measure the circumferences and diameters easily.



Measure the circumference.



Measure the diameter.

2 Write the results on the table.

	Cardboard ⓐ	Cardboard ⓑ	Cardboard ⓒ	Can	Packing tape	
Circumference (cm)						
Diameter (cm)	10	20	30			

3 Is the circumference and the diameter proportional?

If the diameter increases by 2 times, then the circumference also increases by 2 times.

If the diameter increases by 3 times and 4 times, then the circumference also increases by….
It seems that 2 quantities are proportional.

4 What do we have to know to find the circumference from the diameter?

I can find it, if I know the circumference with 1cm diameter.

÷10

Circumference (cm)			
Diameter (cm)	1	10	

÷10

For example, divide the circumference with 10 cm diameter by 10.
I can find the circumference with 1cm diameter.

Activity

5 Approximately, how many times is the diameter to the circumference? Calculate to the nearest hundredth by rounding the thousandth.

	Cardboard ⓐ	Cardboard ⓑ	Cardboard ⓒ	Can	Packing tape	
Circumference (cm)						
Diameter (cm)	10	20	30			
Circumference ÷ Diameter						

Circumference ÷ Diameter is the same number regardless of a circle's size.

The above number is called ratio of circumference.

Ratio of circumference = circumference ÷ diameter

The ratio of circumference is a number that continues infinitely like 3.14159 ……, we usually use 3.14.

6 Let's write an expression of the relationship between ◯ and □, where the circumference is ◯ cm and the diameter is □ cm.

6 How many cm long is the circumference of the circle with the diameter of 8 cm?

Circumference = diameter × 3.14

Exercise

Let's find the circumference of these circles.

① A circle with a 15 cm diameter.

② A circle with a 25 cm radius.

7 The circumference of a figure as shown on the picture is 62.8 cm.

1. If the diameter of the figure is ◯ cm, write the mathematical sentence by using the formula in **6**.
2. What is the diameter of the figure in cm?

◯×3.14=62.8

Exercise

1 Let's find the diameter of a circle with these circumferences.

① 28.26 cm ② 31.4 cm ③ 37.68 cm

2 The photograph on the right shows an image of the mining site at Porgera Gold Mine in Enga Province. The circumference of this opencast mine is 1550 m. Let's find the diameter to the nearest whole number by rounding to the tenths.

How Many Metres is the Diameter of this Rain tree?

Six students formed a circle around a big rain tree as shown in the picture on the right.
Approximately, how many metres is the diameter of this tree?
Each student covers a length of about 1.4 m. Let's calculate the diameter by 3 instead of 3.14 as the ratio of circumference.

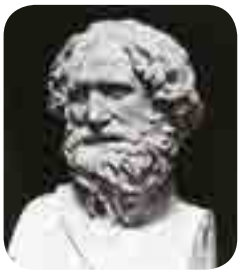
The History of the Ratio of Circumference

Can you remember the ratio of circumference shown above continuously?

The ratio of circumference is represented as decimal numbers 3.14159265358979…, which continues without end. Nowadays, this number has been computed to the 1 trillion 241 billion and 100 million digits by the supercomputer. But it was very difficult to calculate this number in ancient times.

(1) Many years ago, 3 was used as the ratio of circumference.

(2) About 4000 years ago, $3\frac{1}{8}$ and $3\frac{31}{81}$ were used in Egypt and some other countries.



Archimedes

(3) About 2000 years ago, Archimedes in Greece found that the ratio of circumference is larger than $3\frac{10}{71}$ and smaller than $3\frac{1}{7}$.

(4) In China about 1500 years ago, Zu Chongzhi used the fractions $\frac{22}{7}$ and $\frac{355}{113}$.

(5) In Japan about 300 years ago, Takakazu Seki calculated the ratio of circumference that was slightly smaller than

$$3.14159265359$$

Takakazu Seki

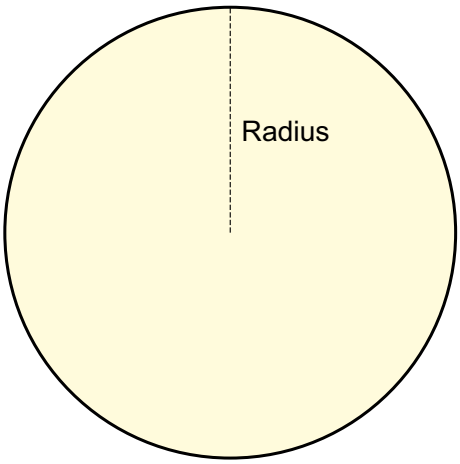
Let's change the fractions in (2) to (4) into decimal numbers.

EXERCISE

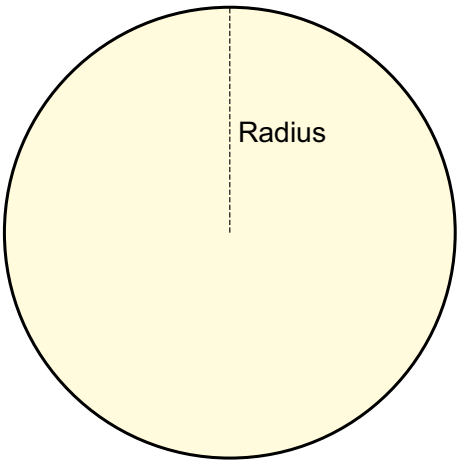
1 Let's draw regular polygons based on a circle.

Pages 173 to 175

① Regular hexagon



② Regular pentagon



2 Let's find the circumferences of these circles.

Pages 176 to 178

① A circle with a 6 cm diameter.

② A circle with a 5 cm radius.

3 Let's find the diameters of these circles.

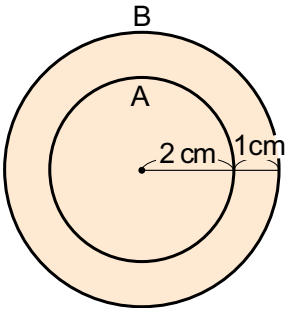
Pages 175 to 179

① A circle with a 6.28 circumference.

② A circle with a 12.56 circumference.

Pages 176 to 178

4 There are 2 circles A and B as shown on the right. One has a 2 cm radius, and the other has a radius 1 cm larger than the radius of circle A. How many cm is the circumference of circle B larger than the circumference of circle A?



Grade 5

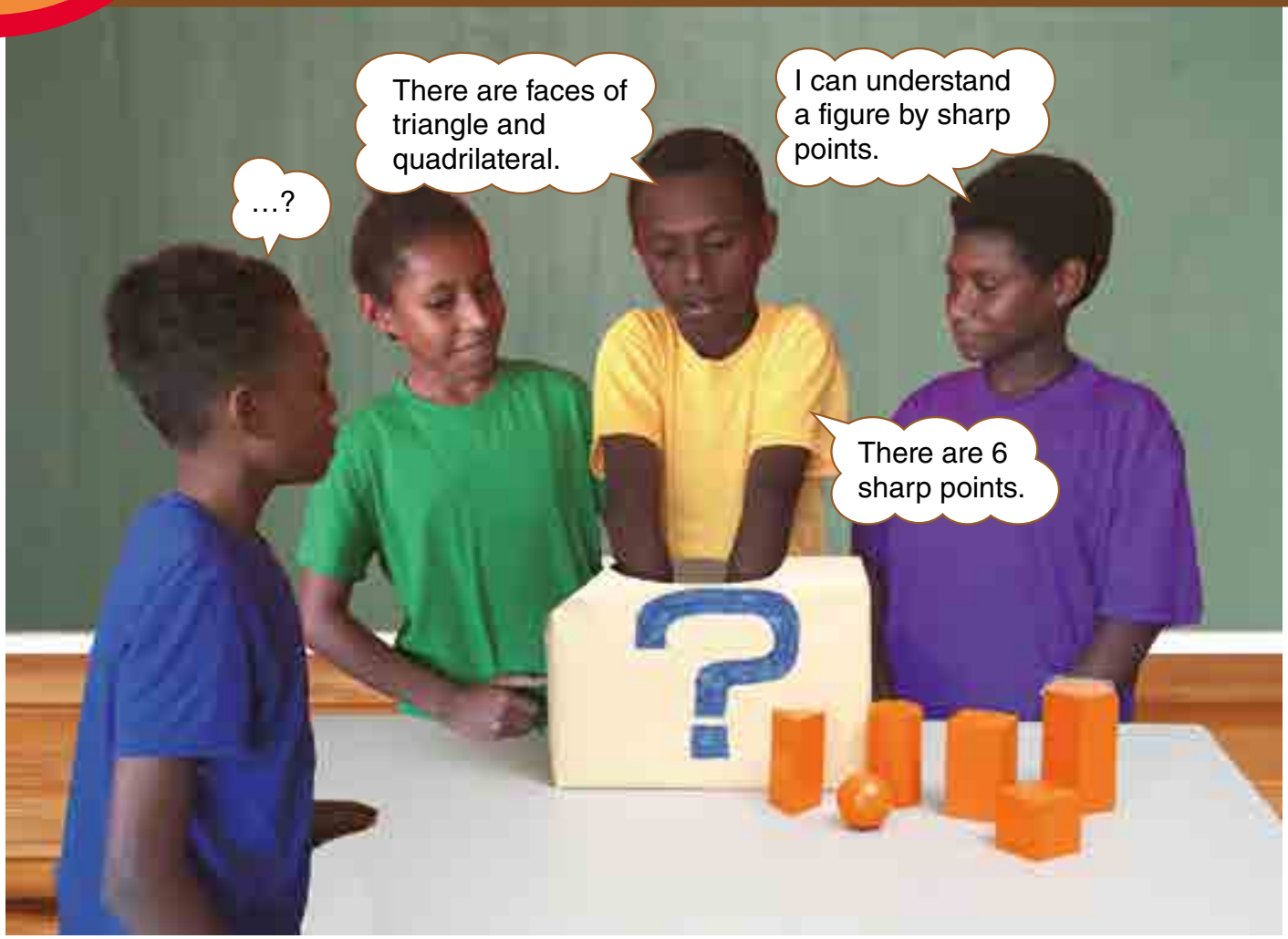
Do you remember?

Let's calculate.

① 5×1.6 ② 28×3.5 ③ 17×0.78

④ 1.2×2.3 ⑤ 7.6×4.3 ⑥ 3.18×6.2

14 Solids



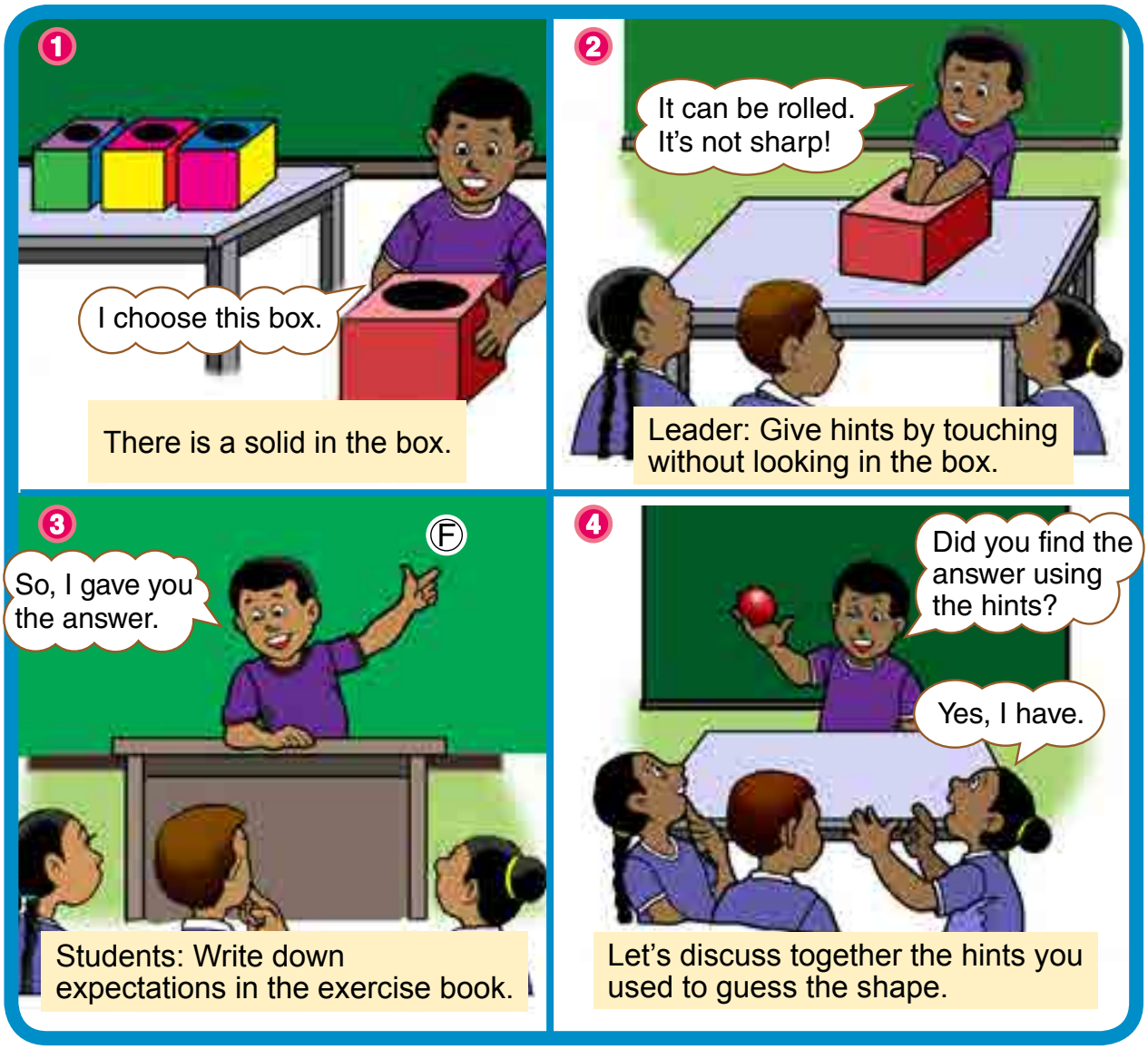
Play a shape guessing game.

Let's explore shape in the box by using hints.

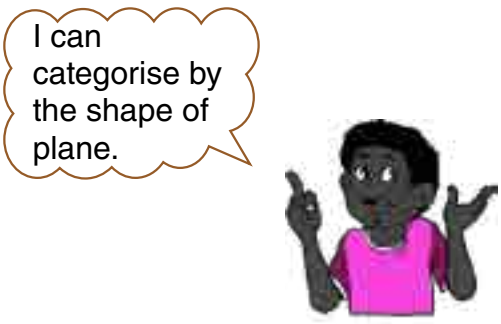
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

Activity

The surface that bends and is not plane is called a **curved surface**. The shape that is covered by planes or curved surfaces is called a **solid**.



Let's categorise solids Ⓐ to Ⓕ in various ways. Write "how to categorise" and "the reason".



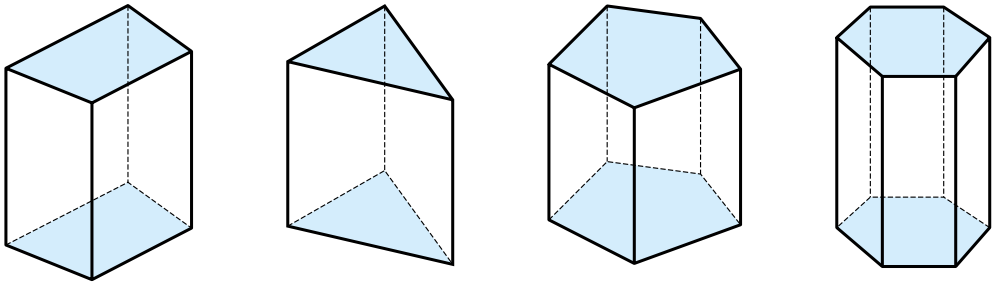
Let's investigate properties of solids.

Activity

1 Prisms and Cylinders

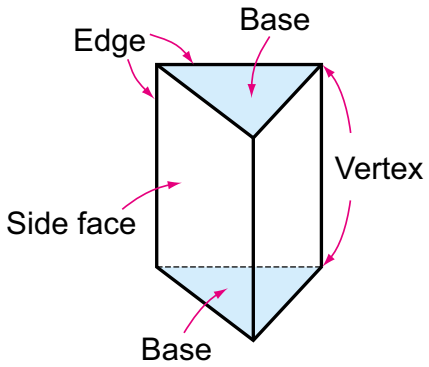
1 In solids covered by planes only, let's look at the following solids that have parallel faces.

Ⓐ Ⓑ Ⓒ Ⓓ



1. For each solid, what is the shape of the coloured parallel faces? Compare the sizes of each pair, respectively.
2. What is the shape of the faces that are not coloured? How many are there?
3. Which faces are perpendicular?

The solids like Ⓐ, Ⓑ, Ⓒ and Ⓓ are called **prisms**.
The 2 parallel congruent faces of prism are called **bases** and the rectangular faces around the bases are called **side faces**.



When the bases are triangles, quadrilaterals or pentagons, their prisms are called **triangular prism, quadrilateral prism or pentagonal prism**, respectively.
Cubes and rectangular prisms are types of prisms.

4 Say the names of the shapes Ⓐ, Ⓑ, Ⓒ and Ⓓ.

5 Summarise the vertices, edges and faces of prisms.

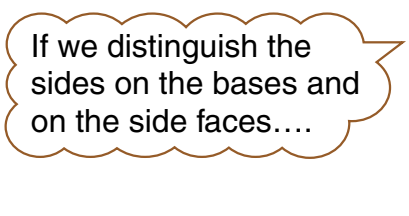
	Triangular prism	Quadrilateral prism	Pentagonal prism	Hexagonal prism
Shape of bases	Triangle			
Shape of side faces	Rectangle			
Number of vertices	3×2=6			
Number of edges	3×2+3=9			
Number of faces	2+3=5			

Let's look at each row of the table made in 1, 5 above.

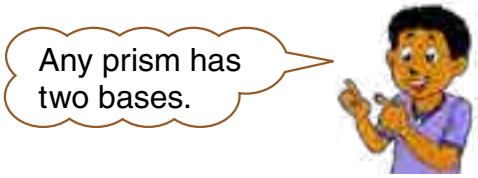
2 Put primes as triangular prism, quadrilateral prism and so on □ side faces in prism, the number of vertices is represented as follows.

Number of vertices =□×2

1 Represent the number of edges by using □.

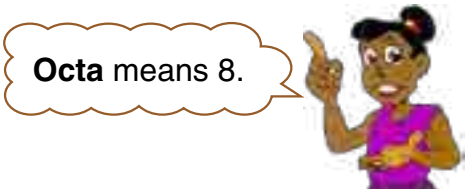


2 Represent the number of faces by using □.



Skytower West Tokyo
(Nishi-Tokyo City, Tokyo)

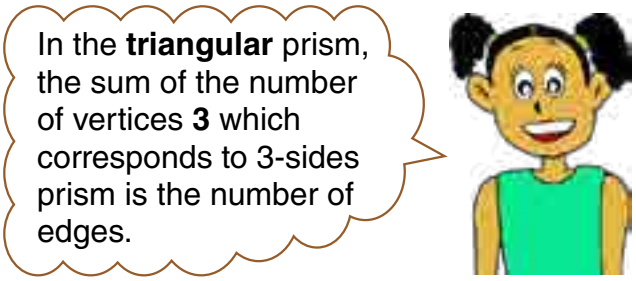
3 Check expressions to find the number whether they one correct, in the case of octagonal prism.



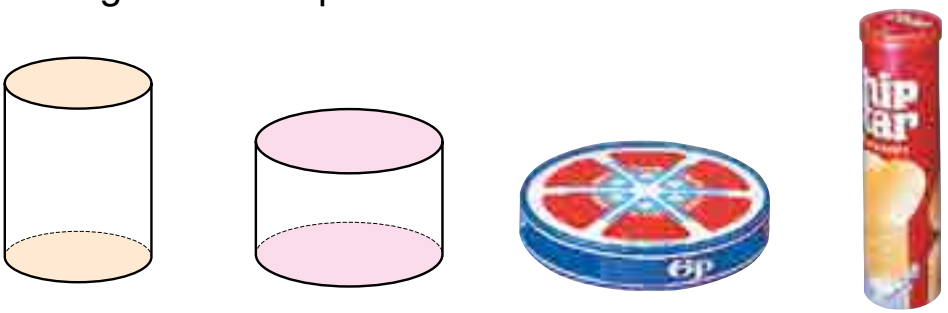
Activity

3 Let's look at each column of the table made in **1** and activity **5** on page 185.

Let's discuss what the relationships are among the numbers of vertices, edges, faces and □ side faces in the prisms.



4 Let's investigate the shapes below.



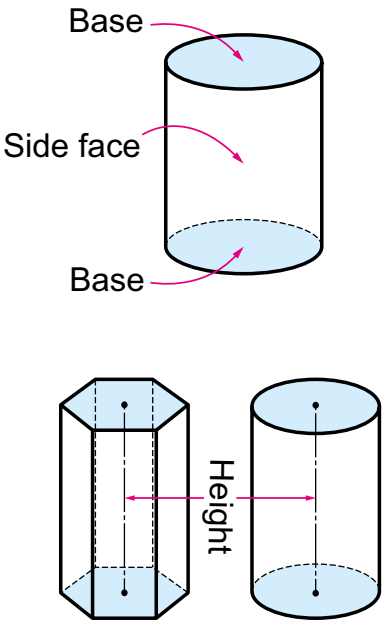
1 What types of faces are they covered by?

2 Compare the shapes and the sizes of the 2 parallel faces.

The shape shown on the right is called a **cylinder**.

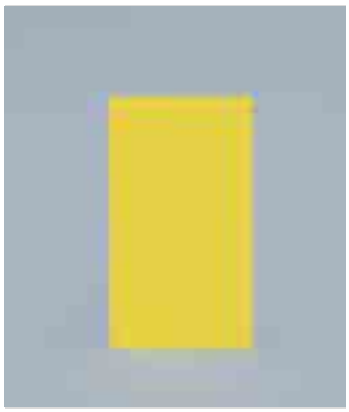
The 2 parallel congruent faces shaped as circle of a cylinder are called **bases** and the curved surface around the bases is called **side face**.

The length of the line that are between the 2 bases and perpendicular to the 2 bases of prism or cylinder is called **height** of prism or cylinder, respectively.

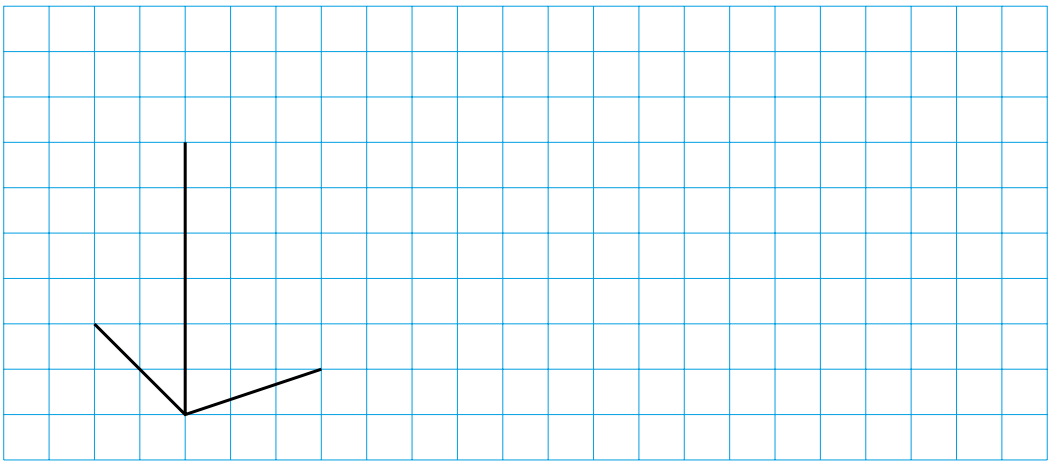


2 Sketches and Nets of Prisms and Cylinders

Sketch



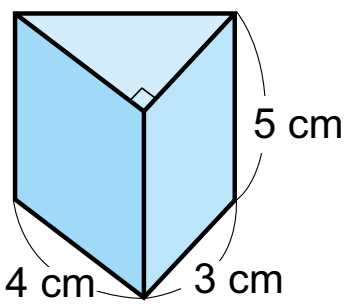
1 Let's draw a sketch so that you can see the whole triangular prism at once.



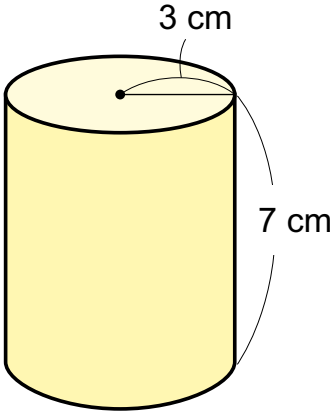
Exercise

Let's draw the sketch of these solids.

①

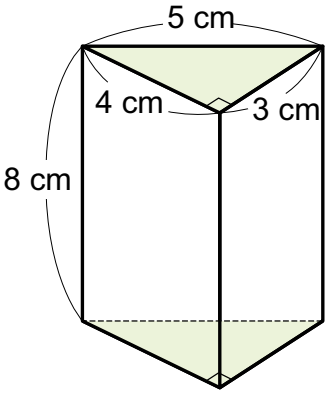


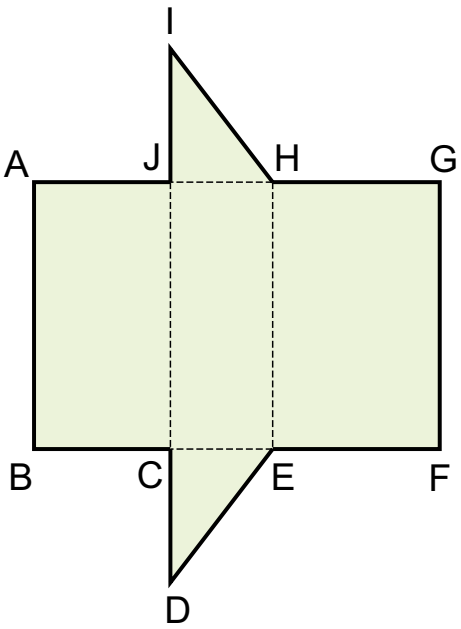
②

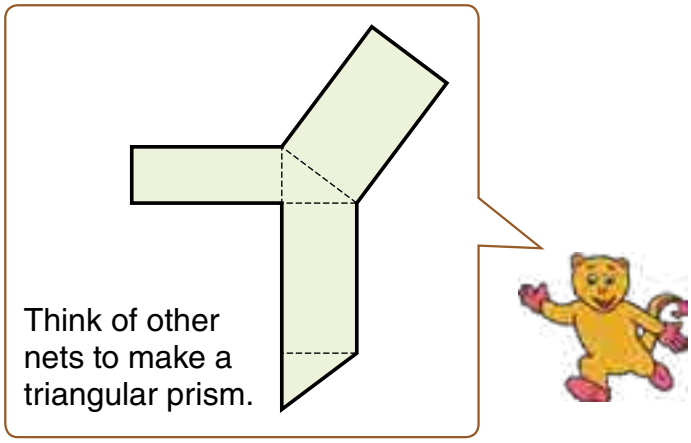


Net

2 Let's draw the **net (development)** on the cardboard to make a triangular prism as shown on the right.



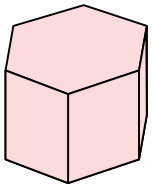


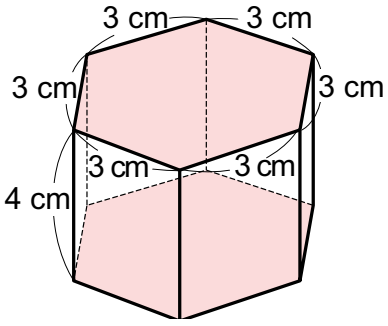


1. Which parts are the bases and the side face in a net?
2. Where does the height correspond in a net?
3. How many cm are the lengths of side AB, BC and DE?
4. When you make the shape, which points does point A overlap?
5. Fold the net.

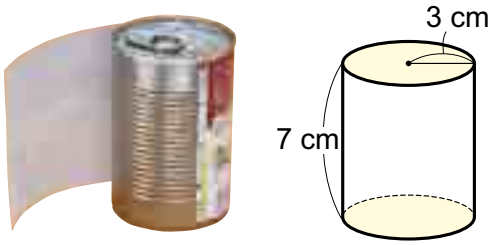
Exercise

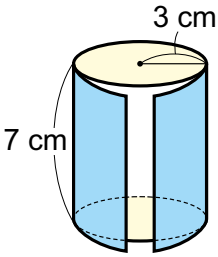
The solid on the right shows a hexagonal prism with the base of a regular hexagon. Let's draw the net and make it.



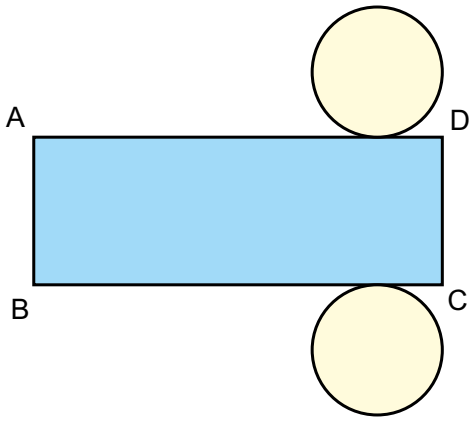


3 Let's think about how to draw the net of the cylinder as shown on the right.





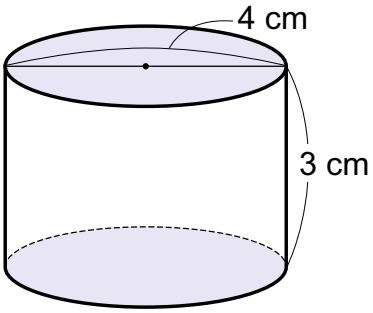
1. First roll up a sheet of paper with side face as shown on the right and then spread the paper to draw the net. What is the shape of the net of the side face?
2. Which are the height of a cylinder equal to in a net. How many cm is it?
3. Which part of the base is the length of line AD equal to?
4. Fold the net.



The **net** of side face of a cylinder is rectangular, the length is equal to the height of a cylinder and the width is equal to the circumference of the base.

Exercise

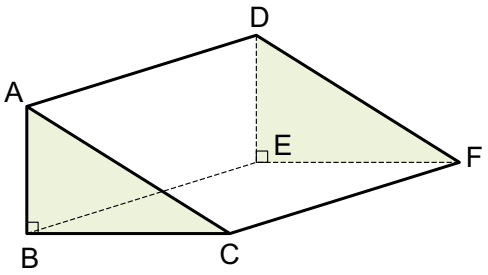
Let's draw the net of the cylinder on the right and fold it.



EXERCISE

1 There is a solid as shown on the right.

Pages 184 to 186



① What type of shape is it?

② How many faces and edges are there respectively?

③ Which faces are parallel to face ABC and are perpendicular to face ABC, respectively?

④ Which sides of the solid are used to measure the height?

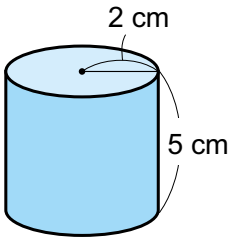
2 Let's summarise prisms in the table below.

Page 186

	Heptagonal prism	Octagonal prism	Nonagonal prism	Decagonal prism
Number of vertices				
Number of edges				
Number of faces				

3 Let's look at the solid shown on the right.

Pages 186 and 189



① Name the solid.

② Find the width of side face when you draw the net.
Calculate the number using 3.14 as the ratio of circumference and round this to the nearest hundredth.

③ Draw a net.

Grade 5

Do you remember?

Let's calculate.

① $8 \div 0.5$ ② $18 \div 4.5$ ③ $56 \div 1.6$

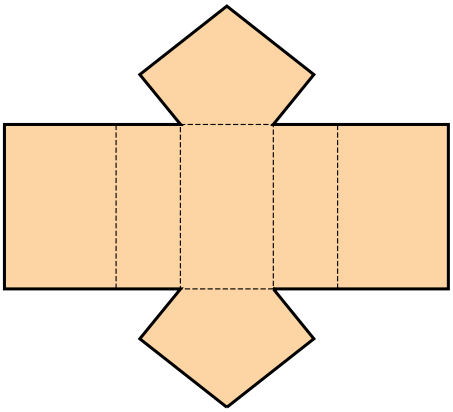
④ $6.4 \div 0.8$ ⑤ $8.06 \div 3.1$ ⑥ $45.9 \div 5.1$

PROBLEMS

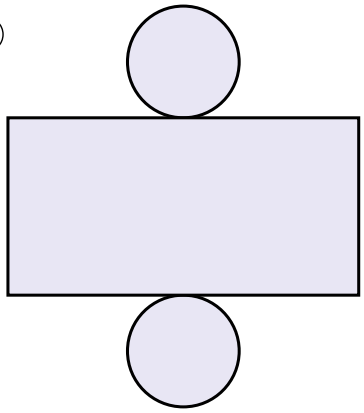
1 What solids can we make the shapes from these nets?

● Imagine the solid from a net.

①



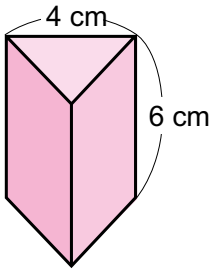
②



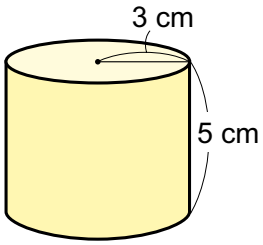
2 Let's draw the following net.

● Drawing the net.

① A triangular prism that has the base of an equilateral triangle with 4 cm side and 6 cm height.

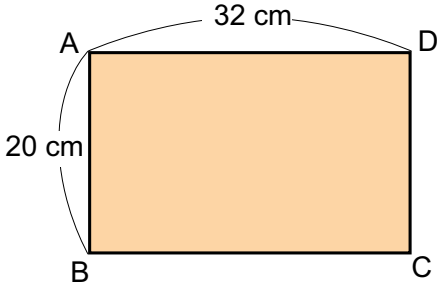


② A cylinder that has the base of a circle with 3 cm radius and 5 cm height.



3 Using a rectangular cardboard as shown below, make a cylinder by overlapping sides AB and CD.
How many cm is the diameter of the circle to make the bases?
Calculate using 3.14 as the ratio of the circumference and round this to the nearest hundredth.

● Finding a diameter of circle of the base.



15 Rates and Graphs

A group of students played a netball game The table below shows the shooting data of Jaydan and others.

Jaydan	○	×	○	×	○	○	×	○		
Tom	○	○	×	×	○	×	○	×	×	○
Madu	×	○	○	○	×	×	○	○	×	○

○ Scored shots
× missed shots

Let's think about how to compare the results and discuss about your opinions.

If I compare the numbers of scored shots,…

Although the number of shots is different, is this enough?

Let's think about how to compare the result of shots.

Activity

1 Rates

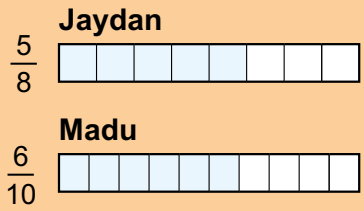
1 Let's compare the shooting record on page 192 by expressing as numbers.

	Jaydan	Tom	Madu
Number of score	5	5	6
Total Number of shots	8	10	10

1. Compare Jaydan's results with Tom's.
2. Compare Tom's results with Madu's.
3. Think about how to compare the Jaydan's with Madu's.

Mero's Idea

Express them on graphs of the same length.



Yamo's Idea

Change fractions to decimal numbers.

Jaydan $\frac{5}{8} = 5 \div 8$
$= 0.625$

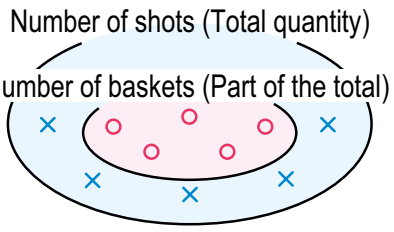
Madu $\frac{6}{10} = 6 \div 10$
$= 0.6$

Kekeni's Idea

Reduce fractions.

Jaydan $\frac{5}{8} = \frac{25}{40}$ Madu $\frac{6}{10} = \frac{24}{40}$

4. Explain the ideas of the 3 students by using words.
5. Express the Tom's result as number.



If we put the total number as the number of shots, the number of scores will be one part of this total.

Shooting result = Number of scores ÷ Number of shots

Number of scores: Part of the total
Number of shots: Total quantity

2 The table below shows the record of Sandra's shot.
Express the result as numbers.

Game 1	○ ○ ○ ○ ○
Game 2	× × × × × × ×

The number expressing the result of the shots is between 0 and 1.

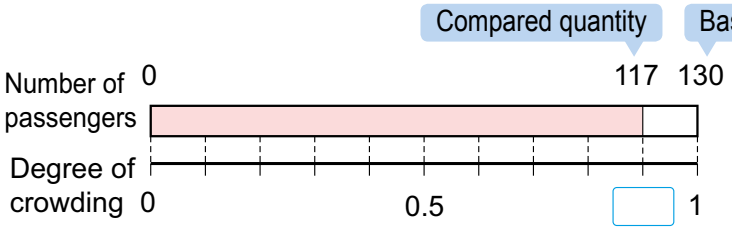
3 Let's investigate the number of passengers on planes in a day.
Which plane is more crowded?

Number of Passengers and Seats

	Small plane	Large plane
Number of passengers	117	442
Number of seats	130	520

The degree of crowding is represented as a number that allows comparing the number of passengers when the number of seats is made 1.

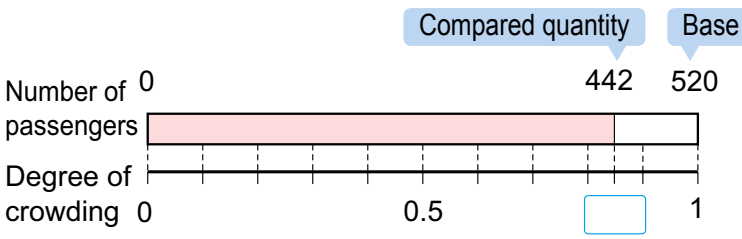
1 Let's find the degree of crowding for the small plane.



Number of passengers	130	÷130	117 ÷130
Degree of crowding	1		?

117 ÷ 130 = ☐

2 Let's find the degree of crowding for the large plane.



Number of passengers	520	÷520	442 ÷520
Degree of crowding	1		?

☐ ÷ ☐ = ☐

The result of the shots in 1 is expressed by how many the derived quantities when the base quantity is made 1.

A number that is expressed by the derived quantity when the base quantity is made 1, like a shooting result or crowding, is called rate.

Rate = compared quantity ÷ base quantity

The degree of crowding for the small plane in the previous page is

$117 \div 130 = 0.9$

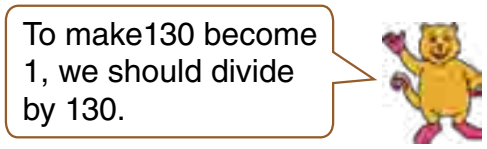
A degree of crowding for the 0.9 means that the number of passengers is 0.9 when we make the total number of seats 1.

Small Plane

	Number of seats		Number of passengers	
Number of passengers	130	÷130	117	÷130
Rate	1		0.9	

Large Plane

	Number of seats		Number of passengers	
Number of passengers	520	÷520	442	÷520
Rate	1		0.85	



Exercise

1 Let's find the rates.

① A rate of correct answer, when 6 out of 10 problems were answered correctly.

② A rate of games won when a team won 6 out of 6 soccer games.

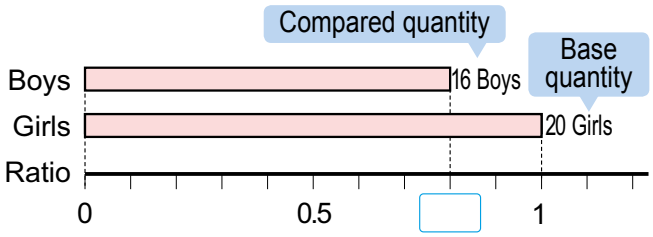
③ The rate of winning goals, when Tali missed 7 goals out of 7 shots.

2 There are 75 students at a party including Ben. There are 15 students from the grade 5. Let's find the rate of the grade 5 students based on the total number of the students at the party.

The Rate of two Quantities

We can express the proportion between two quantities even if one of them is not a part of the other.

4 There are 16 boys and 20 girls in Kuman's class. Let's find the rate of the number of boys to the number of girls.



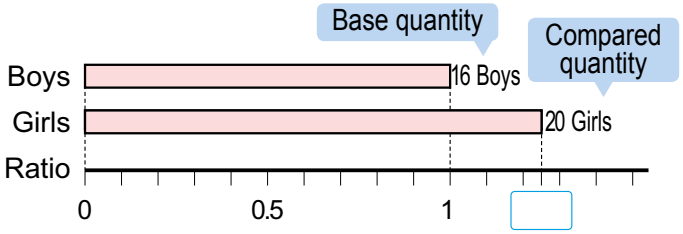
	Boys	Girls
Number of students	16	20
Rate	?	1

÷20 (Boys → Rate), ÷20 (Girls → 1)

16 ÷ 20 = □

Compared quantity: 16 Boys　Base quantity: 20 Girls　Rate: □

5 In Kuman's class in **4**, let's find the rate of the number of girls to the number of boys.



	Boys	Girls
Number of students	16	20
Rate	1	1.25

÷16 (Boys → Rate), ÷16 (Girls → 1.25)

20 ÷ 16 = □

Compared quantity: 20 Girls　Base quantity: 16 Boys　Rate: □

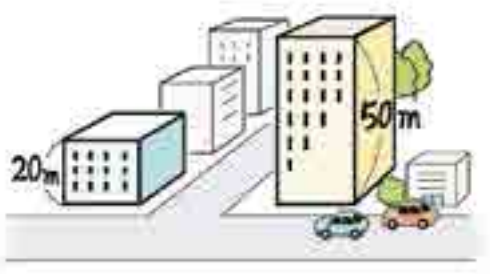
The rate will change if we change the base quantity. In some cases, the rate will become larger than 1.

Exercise

A 50 m building was constructed across the street from a 20 m building.

① Find the rate of the height of the 20 m building based on the 50 m building.

② Find the rate of the height of the 50 m building based on the 20 m building.



2 Percentages

1 There are 40 passengers in a bus that has 50 seats.

1 Find the degree of crowding in the bus.

$40 \div 50 =$ ☐

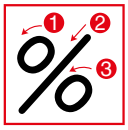
2 Let's express this rate by making the basic quantity 100.

2 times

$40 \div 50 =$ ☐ $\div 100$

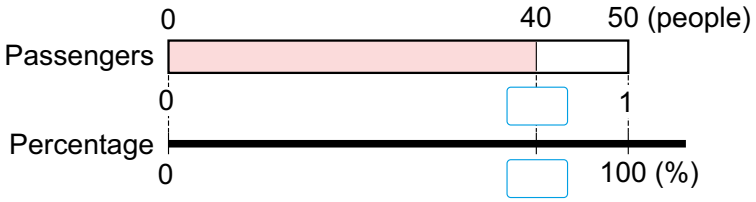
☐ times

We often express a rate by making the basic quantity 100.
This expression is called percentage.
The rate 0.01 is a decimal number, which is called 1 percent and is written as 1%.



Percentage = Rate × 100

3 If we multiply a rate that is expressed as a decimal number by 100, it will become a percentage.
Let's express the degree of crowding of the bus as a percentage.



Number of passengers (people)	40	÷50	50	÷50
Rate (decimal numbers)	?	×100	1	×100
Percentage (%)	?		100	

$40 \div 50 \times 100 =$ ☐ (%)

2 Patrick and his friends kept a record of the vehicles on the road in front of their school for 20 minutes.

Record of Type of Vehicles

	Number of vehicles	Percentage (%)
Cars	63	45
Trucks	35	
Buses	21	
TAXI	7	
Others	14	
Total	140	

1. Let's express the rate of each type of vehicle to the total number of vehicles.
2. What is the total of all the percentages?

Exercise

Let's change the following rate from decimal numbers to percentages, and from percentages to decimal numbers.

① 0.75 ② 0.8 ③ 0.316 ④ 16 % ⑤ 2 %

Rates Larger than 100 %

3 Conference rooms in Steven's guest house can hold 120 people. Let's find the degree of crowding in each conference room.

1. Find the degree of crowding for the Kumul conference room.
   $108 \div 120 \times 100 =$ ☐ (%)
2. Find the degree of crowding for the Muruk conference room.
   $144 \div 120 \times 100 =$ ☐ (%)

Today's Number of guests in conference rooms.

Kumul : 108 guests
Muruk : 144 guests

When the number of guests is more than the capacity, the percentage is larger than 100 %.

Exercise

Investigate the degree of crowding on the bus for one day.

Number of Passengers and Capacity of the Bus

	AM 8:00	AM 10:00	Afternoon
Number of passengers (people)	65	18	26
Capacity (people)	50	50	50

① Let's express the degree of crowding at each time.

② At what time is the bus most crowded?

4 Henry made 1 run in 4 turns at batting in a softball game. The rate of the total number of runs to bats is called **batting average**.

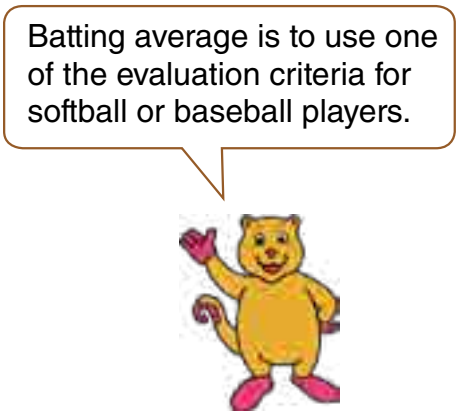
1 Let's find Henry's batting average.

Runs		Bats		Batting average
⋮		⋮		⋮
1	÷	4	=	

Result of Softball

	Bats	Runs
Henry	4	1
Takale	5	2
Sam	5	5

2 Let's find the batting average for Takale and Sam's batting average.



3 Problems Using Rates

Problems of Finding Compared Quantities

1 Jonah is painting a wall that has an area of 24 m².
He has painted 25 % of the wall.
How many m² did he paint?

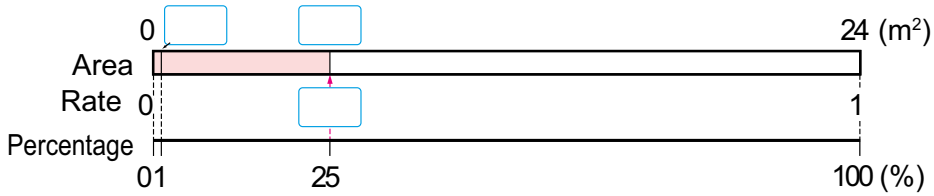
1 Let's find by using these ideas.

① If he painted 24 m², it would be 100 % of the total area.

② 1 % of the area is $24 \div 100 = 0.24$

③ 25 % of the area is $0.24 \times 25 =$ ☐.

	Base quantity	1 %	Compared quantity
Area (m²)	24	0.24	?
Percentage (%)	100	1	25
	①	②	③



2 Find by changing 25 % to a decimal number.

24 (Base quantity) × 0.25 (Rate) = ☐ (Compared quantity)

Area (m²)	24	?
Rate	1	0.25

×0.25 ×0.25

Compared quantity = Base quantity × Rate

Exercise

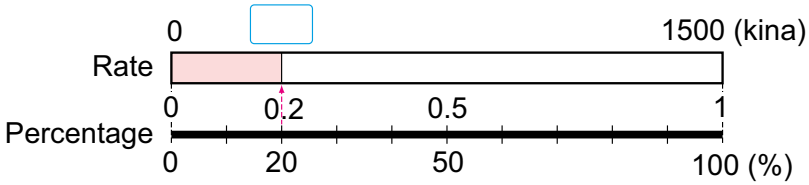
1 In a lottery, 5 % of the tickets are prize winning tickets.
If they make 80 tickets, how many prizes will be needed?

2 A conference room has a capacity of 80 guests in each row. When the degree of crowding is 110%, how many guests are there in each row?

2 A home centre is having a clearance sale.

1 Sonia's father bought a water tank at a 20 % discount that had an original price of 1500 kina.

How much did he pay less than the original price?



1500 × 0.2 = ☐

Base quantity　Rate　Compared quantity

Cost	1500	?
Rate	1	0.2

×0.2 ×0.2

2 If the original price of the water tank was 1500 kina, how much did he pay?

Find the cost by using the ideas of these 2 students.

Vavi's Idea

Since it is a 20 % discount,

1500 × 0.2 = ☐

is the amount discounted.

1500 − ☐ = ☐

Naiko's Idea

Since it is a 20 % discount, he can buy the water tank at 80 % of the original price.

1500 × (1 − 0.2)

= 1500 × 0.8

= ☐

Exercise

When we buy something from the store, we have to pay a GST (Goods & Services Tax) that is 5 % of the sales price. When we buy a bicycle for 500 kina, how much do we have to pay in total?

Problems Finding Basic Quantities

3 Namari's family has a flower garden that is part of a large field. The area of the garden is 60 m², which is 20 % of the total area of the field.
How many m² is the field?

1 Let's find the area by using these ideas.

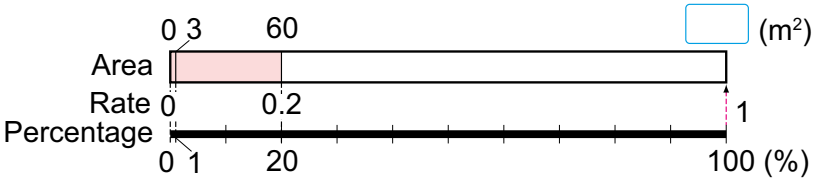
① 20 % of the area of the field is 60 m².

② 1 % of the area is $60 \div 20 = 3$

③ 100 % of the area is $3 \times 100 =$ ☐

	Base quantity	1 %	Compared quantity
Area (m²)	?	3	60
Percentage (%)	100	1	20

(× 100 from Base quantity to 1 %; ÷ 20 from 1 % to Compared quantity; ③ × 100; ② ÷ 20; ①)



2 Put the total area of the field in m². Write a mathematical expression to calculate the area of the flower garden and then find the correct number for ☐ using the calculation of **3**, **1**.

① Since 20 % of the area is 0.2, ☐ × 0.2 = ☐.

② 60 ÷ 0.2 = ☐

Base quantity / Rate / Compared quantity

Area (m²)	?	60
Rate	1	0.2

(÷ 0.2 from Area (m²) to Rate; ÷ 0.2)

Exercise

1 There is a fundraising where 15 % of the tickets sold are winning tickets. If there are 30 winning tickets, how many tickets are needed in all?

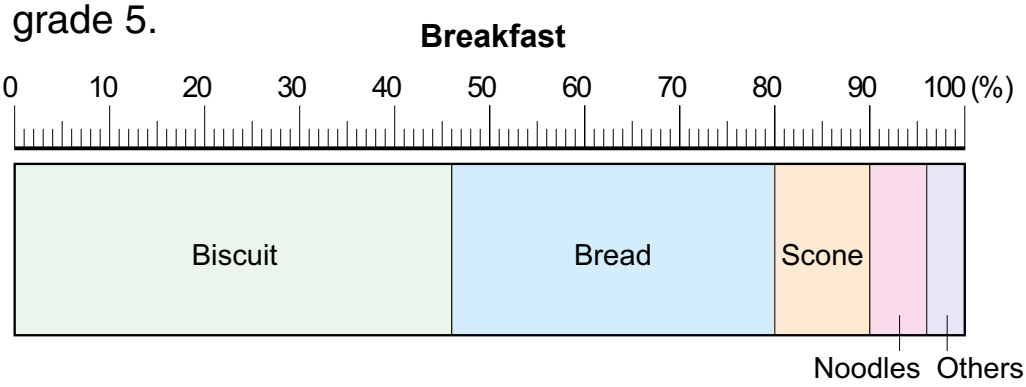
2 A boat carried 122 passengers on Friday. The degree of crowding was 120 %. What is the required number of passengers the boat should carry?

Biscuit Bread Scone Noodles

4 Graphs Expressing Rates

Band Graph

1 The graph below shows the result of breakfast taken by students in grade 5.



1. What is the percentage of biscuit compared to the total number of students?
2. What percentage is bread, cereal and noodles compared to the total number of students, respectively?
3. There are 50 students in the grade 5.
   Let's find the number of students for each type.

A graph that expresses the total as a rectangle-like band is called **band graph**.
With a band graph, it is easy to see the rate of each part of the total because the size of each part is shown by the area of its rectangle.

How to Draw a Band Graph

2 The tables below show the types of traffic accidents causes by students in Eriku, Lae.
Let's draw band graphs to express these numbers.

Causes of Accidents in Grade 1

Cause	Number of students	Percentage (%)
Running out on the street	11	
Crossing the street outside a crosswalk	4	
Crossing the street on a red light	3	
Walking behind and in front of cars	3	
Others	2	
Total	23	

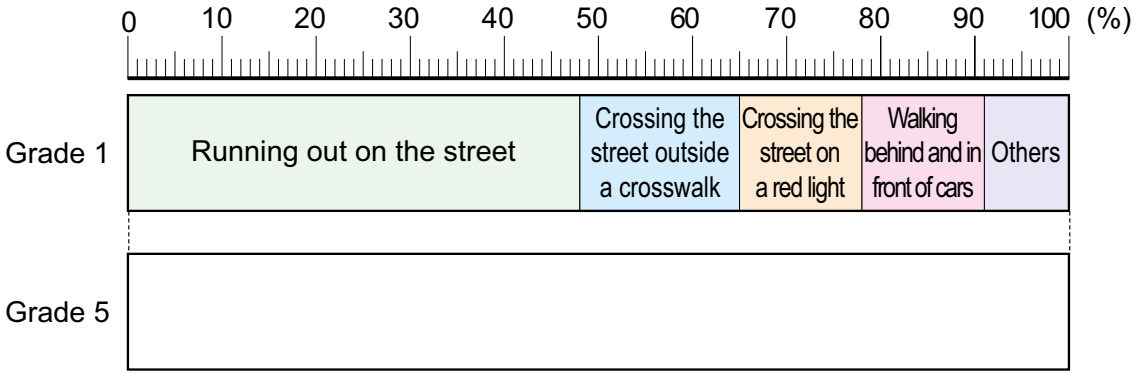
Causes of Accidents in Grade 5

Cause	Number of students	Percentage (%)
Running out on the street	8	
Crossing the street outside a crosswalk	9	
Crossing the street on a red light	4	
Walking behind and in front of cars	2	
Others	5	
Total	28	

1 Let's find the rate of each cause of accidents to the nearest hundredth by rounding to the thousandth.
Then find each percentage and write them in the table.

2 Draw a band graph of the grade 5.
Other is drawn last even if it is a large number.

Number of Children by Cause of Accident

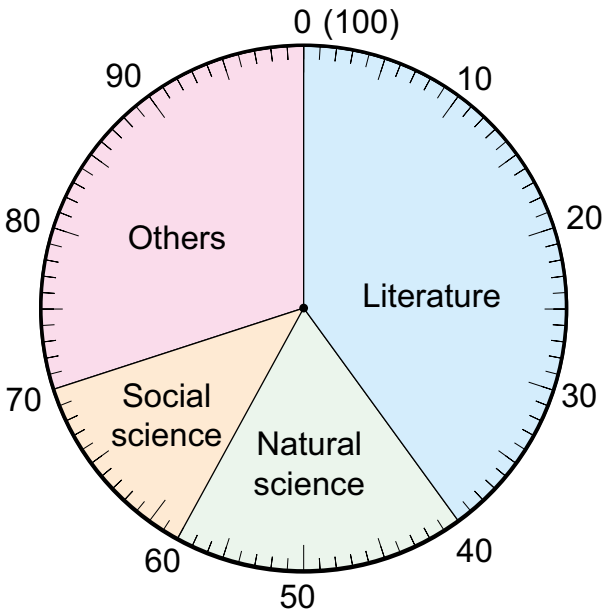


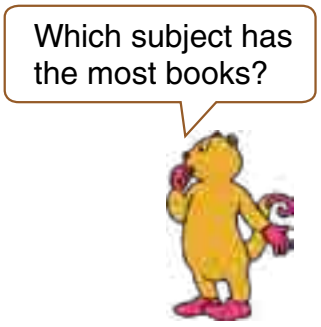
3 Let's discuss your findings based on the two band graphs.

Circle Graph

3 The graph below shows the types of library books at Ray's school and their rates.

Library Books





1. What is the percentage of literature compared to the total number of books?
2. What are the percentages of natural sciences and social science books compared to the total number of books?
3. There are 3 600 books at the library.
   How many books are there in each field?

A graph that is drawn as a circle is called a **pie graph**.
With a pie graph, it is easy to see the rate of each part of the total because the size of each part is shown by its area.

How to Draw a Circle Graph

4 The table below shows the types of injuries that occurred during a year at Asaro Primary School. Draw a pie graph to show these numbers.

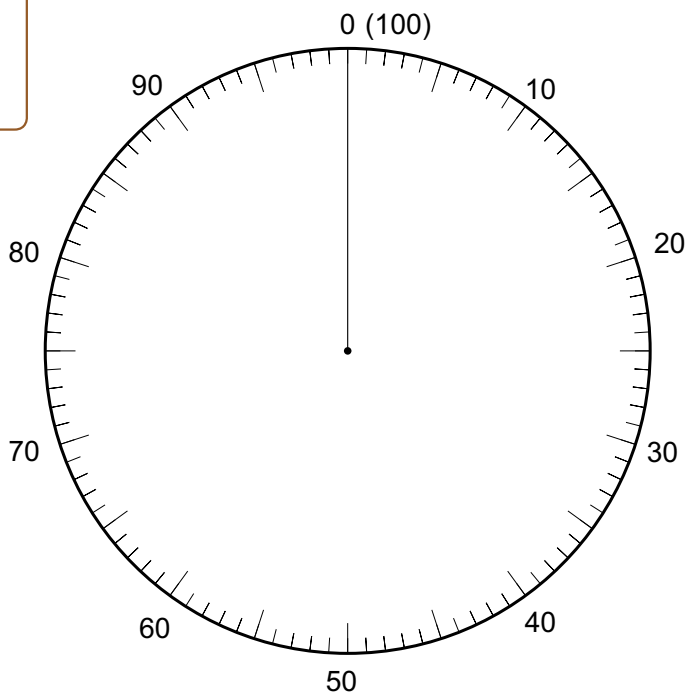
Types of Injuries

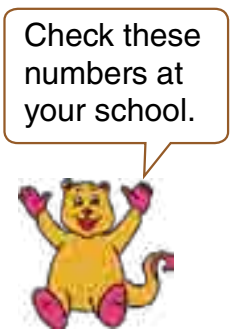
Injuries	Number	Percentage (%)
Cuts	250	
Bruises	202	
Scratches	176	
Sprains	75	
Fractures	58	
Others	89	
Total	850	

1 Let's find the total rate of each injury to the nearest tenth by rounding to the hundredth. Then find their percentages and write them in the table.

2 Let's draw the pie graph. "Others" is drawn last even if its rate is large.

Types of Injuries





EXERCISE

1 Let's find the following rates.

Page 195

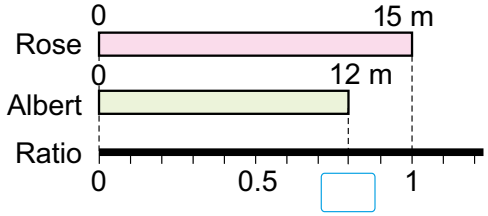
① When there are 7 correct answers for 10 problems, what is the rate of correct answers?

② They played 4 games and won all 4. What is the rate of winning games?

2 Rose has a 15 m tape. Albert has a 12 m tape.

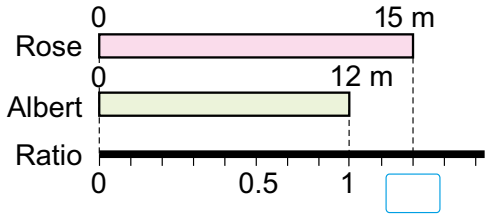
Page 196

① Let's find the rate of the length of Albert's tape to the length of Rose's tape.



② Let's find the Rate of the length of Rose's tape to the length of Albert's tape.

Pages 200 and 201



3 Mikes buys a bicycle that has a price of 600 kina, he has to pay 630 kina because of the Good & Service Tax.
What percentage of the selling price is the money you pay?

4 There are 300 eggs, 4 % of the eggs are broken.
How many eggs are broken?

Page 197

Grade 5
Do you remember?

Let's calculate.

① $\frac{1}{5}+\frac{7}{10}$ ② $\frac{5}{6}+\frac{2}{9}$ ③ $1\frac{1}{2}+2\frac{1}{4}$ ④ $2\frac{3}{8}+1\frac{5}{12}$

⑤ $\frac{3}{4}-\frac{1}{2}$ ⑥ $\frac{9}{10}-\frac{3}{4}$ ⑦ $\frac{7}{6}-\frac{2}{3}$ ⑧ $5\frac{1}{7}-2\frac{4}{5}$

16

Summary of Grade 5

Applying mathematics in daily life

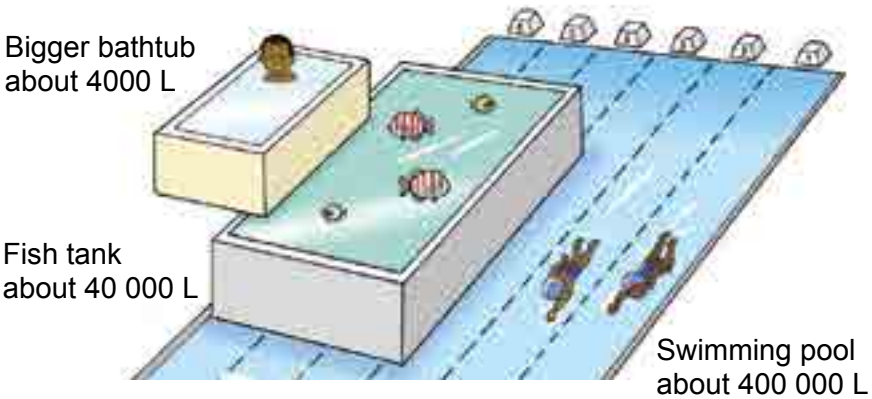
Different types of garbage come from the kitchen every day. There is much more garbage than packing materials and vegetables. Water used to wash rice, leftover noodle soup, tea and the oil used to fry fish will all eventually reach rivers, seas and the ocean. As bodies of water are polluted, fish and other living things will no longer be able to survive.

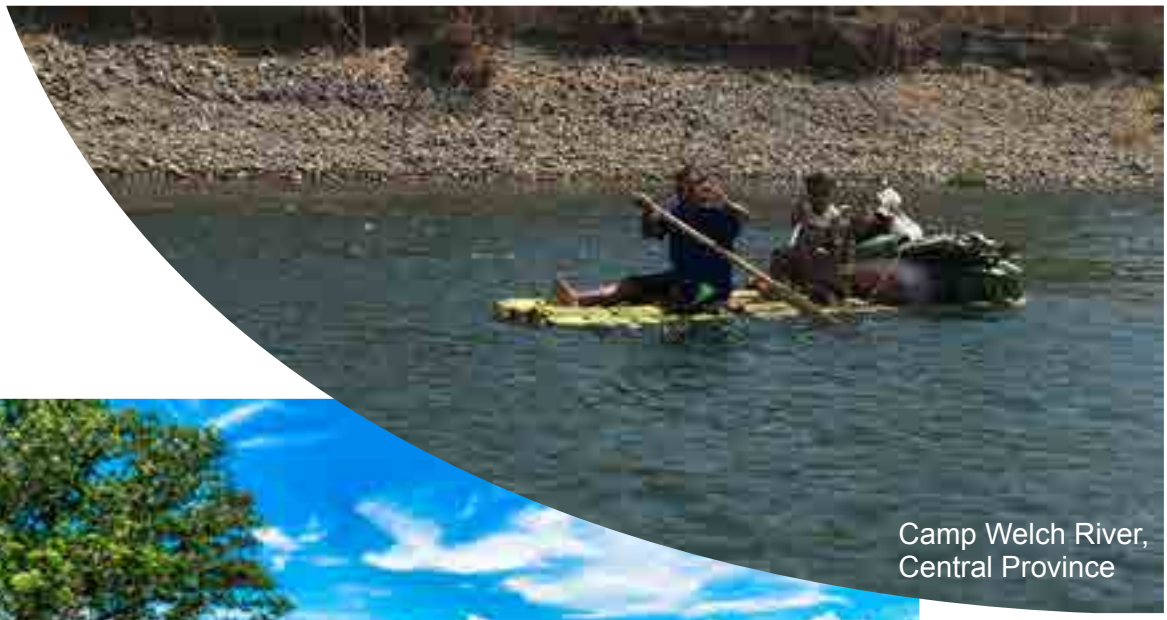
1 When I wash rice, I wash it four times and pour away the rice water. When this rice water is poured the first time down the drain, it must be mixed with water to make it clean. I use water from 0.9 cup of a bathtub which contains 300 L of water to make the water clean. The table below shows the amount of water to make the water clean. When the rice water is poured down four times, how many L do we need to make the water clean?

Amount of Water to Clean Rice Water

Number of washing of rice	1	2	3	4
Amount of water to clean rice water(cups)	0.9	0.9	0.6	0.5
Amount of water (L)				

Swimming pool,
Port Moresby, NCD





Camp Welch River,
Central Province

Jais Aben,
Madang Province

2 A bowl of noodle soup is poured down the kitchen sink. About 750 L of water is needed to make the leftover soup clean enough for fish to survive. If a person pours a bowl of noodle soup down the drain every day for a year, how much is the amount of water needed to make the soup clean?

3 A table spoon of oil is 15 mL. When this oil is poured down the drain, it must be mixed with about 5100 L of water to make the water clean.

1. How much water is needed as multiple of the oil?
2. If we use 450 mL of cooking oil in a pot and pour it directly down the drain, how much water will be needed to clean this oil?

Let's think about what we can do to keep the water clean.

Numbers and Calculations

① 

1 Let's calculate 100 times and $\frac{1}{100}$ of the following numbers.

① 5.18　② 0.407　③ 13.4　④ 3600

2 Let's calculate. ③ ⑤ ⑧ ⑪ 

① 8×1.6　② 5×2.2　③ 32×6.4

④ 2.4×1.5　⑤ 5.72×8.1　⑥ 0.4×0.28

⑦ $9 \div 0.5$　⑧ $48 \div 1.6$　⑨ $54 \div 1.8$

⑩ $1.2 \div 0.3$　⑪ $8.05 \div 3.5$　⑫ $0.03 \div 0.15$

⑬ $\frac{3}{4} + \frac{1}{8}$　⑭ $\frac{2}{5} + \frac{3}{7}$　⑮ $2\frac{1}{8} + 1\frac{5}{12}$

⑯ $\frac{5}{6} - \frac{2}{3}$　⑰ $\frac{8}{15} - \frac{4}{9}$　⑱ $3\frac{3}{16} - 1\frac{7}{8}$

⑲ $\frac{3}{7} \times 2$　⑳ $\frac{3}{2} \times 3$　㉑ $\frac{2}{9} \times 3$

㉒ $\frac{3}{5} \div 2$　㉓ $\frac{4}{7} \div 2$　㉔ $\frac{8}{9} \div 4$

3 Let's summarise the properties of whole numbers. ⑦ 

① How many common multiples of 4 and 6 are there between 50 and 100?

② Let's find the least common multiples and greatest common divisor of the following pairs.

Ⓐ (12, 18)　Ⓑ (8, 16)

③ What is the biggest prime number between 1 and 100?

⑧ 

4 Arrange the following fractions and decimal numbers from the smallest to the largest.

$\frac{4}{5}$　$\frac{17}{8}$　0.7　1.6　$1\frac{3}{4}$　3.08

5 A 7.2 cm wire weighs 3.6 g.

1. How many g is the weight of 1cm of this wire?
2. How many g is 3.6 m of this wire?

③⑤

The Secret of □ ÷ 7

Write whole numbers in order in the □ of □ ÷ 7 and calculate the numbers.

1 ÷ 7 = □

2 ÷ 7 = □

3 ÷ 7 = □

4 ÷ 7 = □

5 ÷ 7 = □

6 ÷ 7 = □

7 ÷ 7 = □

8 ÷ 7 = □

9 ÷ 7 = □

⋮

```
0.1428571
7 )1.0
  7
  30
  28
   20
   14
    60
    56
     40
     35
      50
      49
       10
        7
        3
```

What do you see?

Measurement

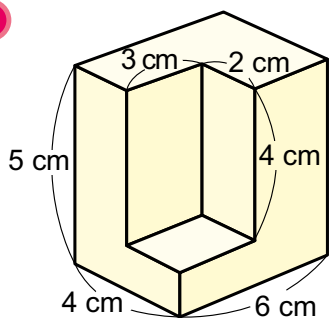
2

1 There are 966 students playing in the large field that has an area of 1680 m².

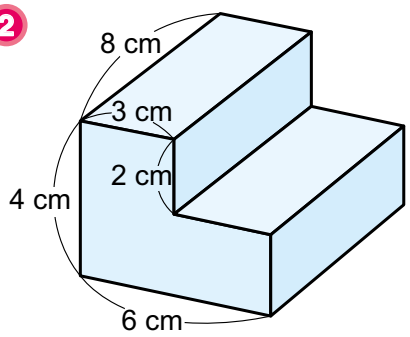
There are 105 students playing in the small field that has an area of 200 m². Which field is more crowded?

2 Let's find the volume of these figures. 6

1

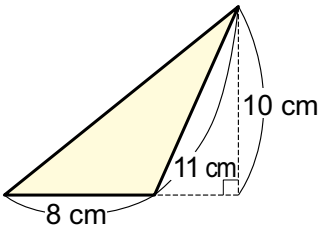


2

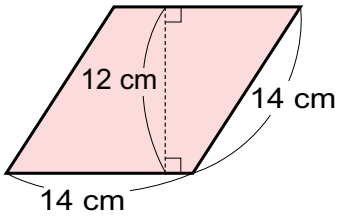


3 Let's find the area of these shapes. 10

1

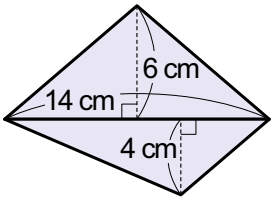


2

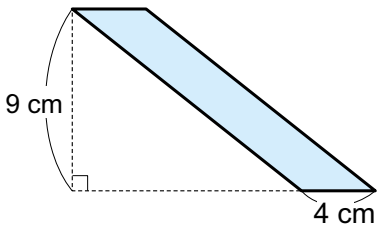


Parallelogram

3

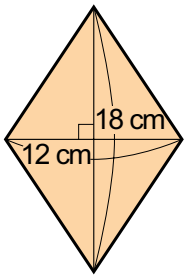


4



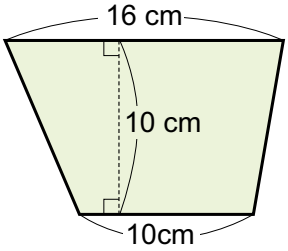
Parallelogram

5



Rhombus

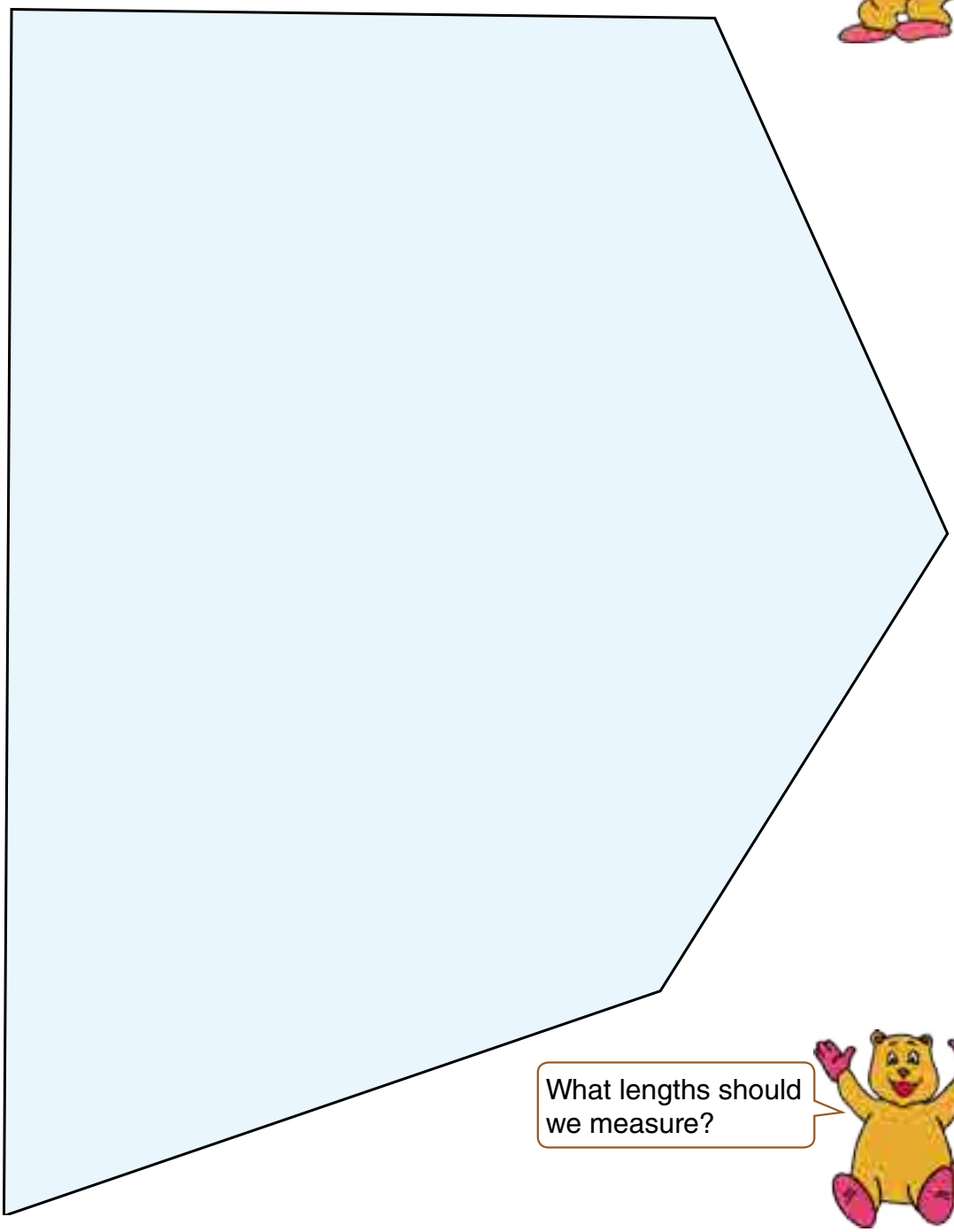
6



Trapezoid

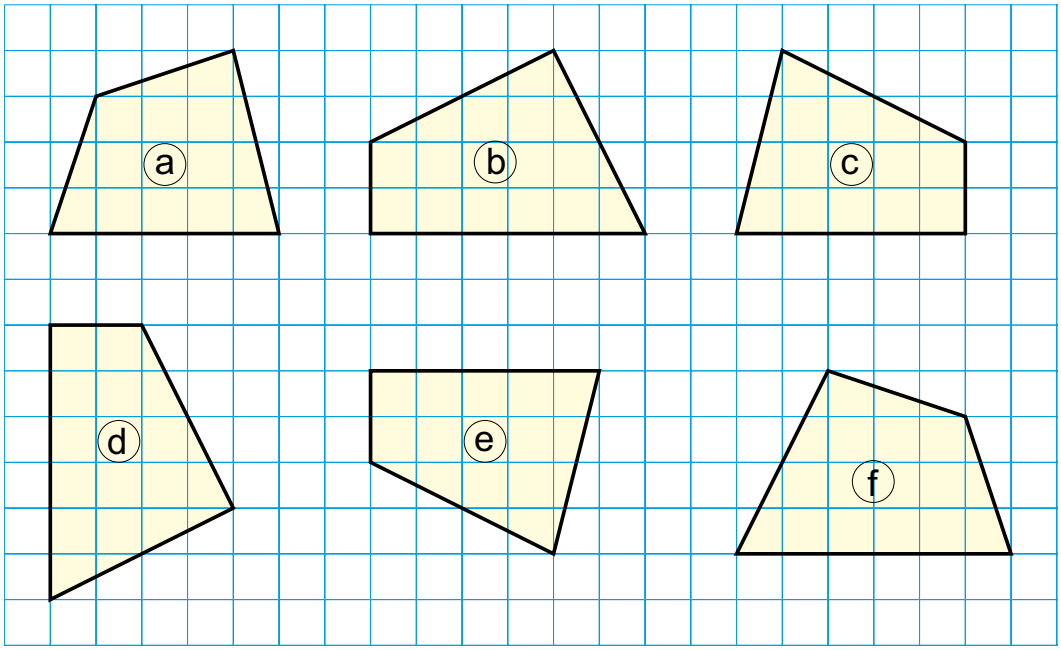
Let's Find the Area of Various Shapes !

Let's find the area of the following shape by using what we learned.



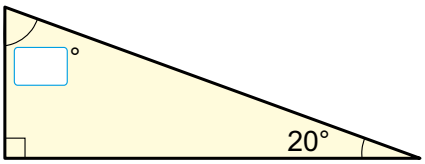
Shapes and Figures

1 Let's find the congruence figures. ④

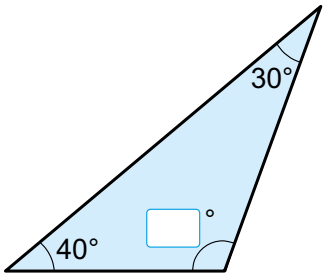


2 Fill the ☐ with a number. ④

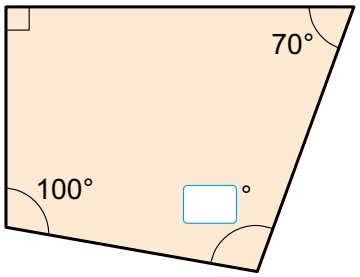
1



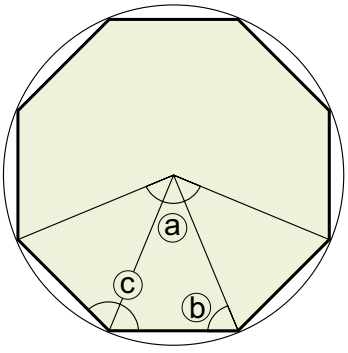
2



3



3 We draw a regular octagon by dividing the angle around the centre of the circle into 8 equal parts. ⑬



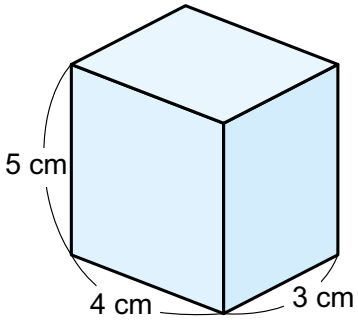
1. What is the size of angle ⓐ?
2. What is the size of angle ⓑ?
3. What is the size of angle ⓒ?

4 Let's find the circumference of these circles.

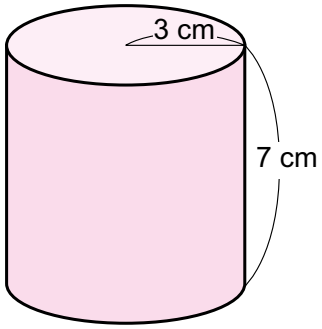
1. A circle with 4 cm diameter.
2. A circle with 5 cm radius.

5 Let's draw the net of these solids.

1.

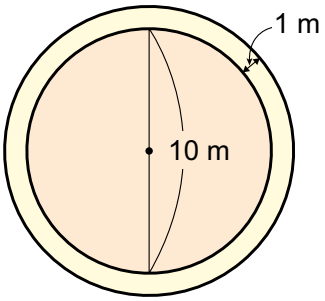


2.



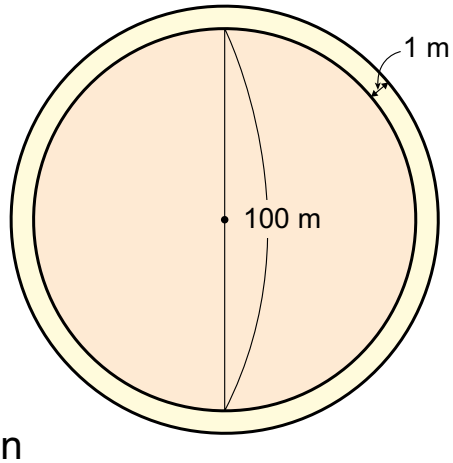
Circles Separated by 1 m

Draw a circle with a 10 m diameter and then draw another circle that is 1 m outside that circle.
How many metres longer is the circumference of the outer circle than the inner circle?



Try to guess the answer first.

Draw a circle that is 1 m outside a circle with a 100 m diameter.
How many metres longer is the circumference of the outer circle than the inner circle?



Relationships among Quantities

1 Fill in the ☐ with a number. (15)

(1) 36 kg is ☐ % of 48 kg.

(2) 80 % of 2.5 m is ☐ m.

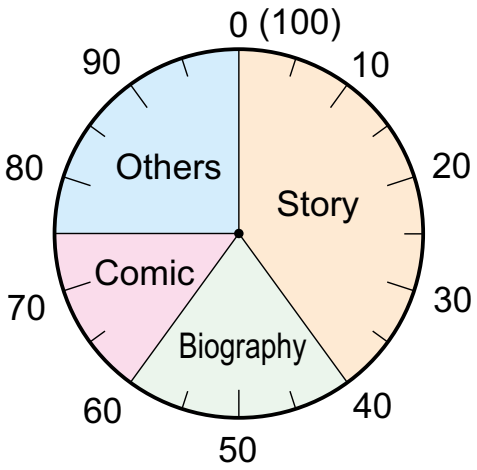
(3) 35 % of ☐ Kina is 1400 Kina.

2 There are 160 books on a shelf. (15)

This graph shows the ratio of each type of books.

How many story, biography and comic books are there?

Each Type of Books



Math Adventure

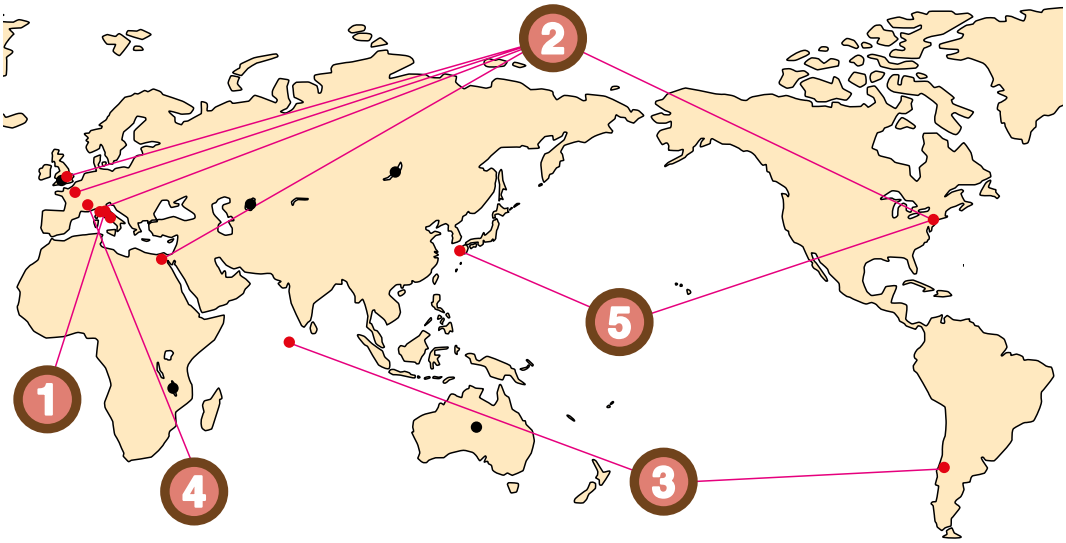
Part 1

All over the world. people are trying to keep valuable buildings and natural environment as 'World Heritage'. Now, let's go on a journey by plane to clear up mysteries in the world.

Professor Steven

The places of the fragments

1. Cathedral from Birds' Eyes
2. World Heritage Site – Comparing Height
3. Sinking Islands
4. Roman Empire Cities with Water Supply
5. Pentagon by Fractions

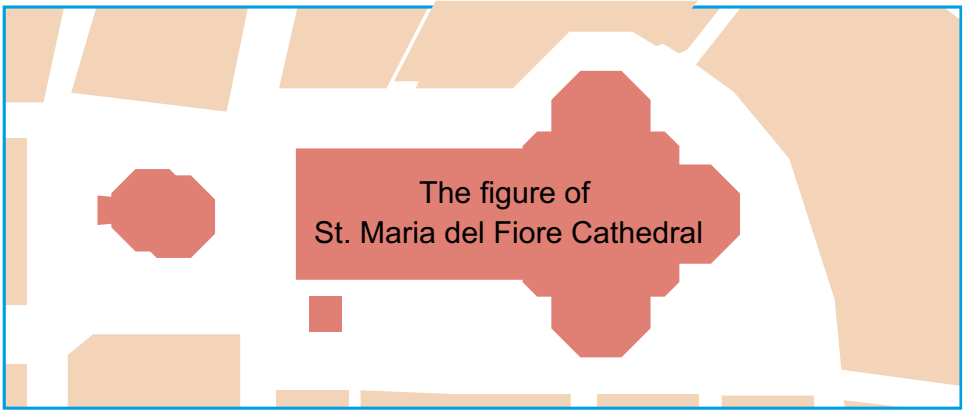


Let's go to the places to find the fragments of the key !

1 Cathedral from Birds' Eyes

Old city area in Florence, Italy, is approved as one of the World Heritage Sites.
The building which can be seen from anywhere in this city is St. Maria del Fiore Cathedral.

This Cathedral's appearance varies differently depending on the position of the viewer. What kind of shape can we see from the top view?
The most Christian church's top view is cross-shaped. Appearances of buildings is dependent upon the viewer's positions.



Yes, there is a story that the number of chimneys is viewed as one, but actually there are two.

A cylinder also has a circle shape from the top view, but a rectangle from the side view.

I will give you a problem now. If we create a solid which consists of the front view "凵", the side view "田" and the top view "+" using cubic blocks, you can access the fragment key.
The design of solid is on the next page.

Design

A. Front view

		5		
		3		
1		5		1
1		3		1
1	1	5	1	1

B. Side view

1	1	1	1	1
1		1		1
1	1	3	1	1
1		3		1
1	1	5	1	1

C. Top view

		5		
		3		
3	1	5	1	3
		3		
		5		

The numbers in the design indicate the number of blocks used for the corresponding slots.

We can imagine the shape, can't we?
Let's make those shapes.



We did it!

I got the answer without calculation!

Well done. So, divide the numbers of all blocks by the number of slots with numbers in each A, B, and C to get the average for one slots of each.

Why did she get the answer without calculation? Write your reasoning in your exercise book.

Ⓐ 

Ⓑ 

Ⓒ 

• Let's cut out fragments on page 246 and paste on the last page.

Let's go to the next place to find the fragments of the key!

2 World Heritage Sites – Comparing Height

Ⓐ Eiffel Tower

The Eiffel Tower in Paris, France, was built in 1889, when the Paris International exhibition was held. Its roof top height is about 300 metres.

I want to go up there one day.

But, Tokyo Tower is a little bit taller.

Let's find out the heights of the following buildings in World Heritage sites. In this activity, there is a hint to get to another key fragment.

Ⓑ The Leaning Tower of Pisa in Italy:
It has a lean of 5° towards the south.

Ⓒ Big Ben in the England

Ⓓ King Khufu's Pyramid in Egypt

Ⓔ The Statue of Liberty in the United States of America
(the height included a part of plinth)

There are 4 sentences below. If the heights of B to E is represented by □, write expressions for calculating their heights.

The height of the 'Eiffel Tower is known.

① The height which is 1 metre less than the Leaning Tower of Pisa is 0.18 times of the Eiffel Tower.

② The height which is 4 times the Statue of Liberty is 72 metres higher than the Eiffel Tower.

③ The height of Big Ben is 0.72 metre less than the height which is 1.04 times the Statue of Liberty.

④ If we add the heights of King Khufu's Pyramid and the Leaning Tower of Pisa, it is twice the height of Big Ben.

If the height of the Leaning Tower of Pisa is □ m, the height which is 1 metre less than □ m is (□ − 1) m.

The height which is 0.18 times as high as the Eiffel Tower is expressed as 300×0.18, therefore, we can make the expression,

$\square - 1 = 300 \times 0.18$

Using this expression, we can get □.

If the height of The Statue of Liberty is □ m, the height which is 4 times □ is the same as the answer of the addition between 72 and the height of the Eiffel Tower.

Therefore, we can represent it as follows □ × 4 = (The height of Eiffel Tower) + 72

Likewise, calculate the heights of the 4 buildings and in the order of their heights from tallest, draw lines.

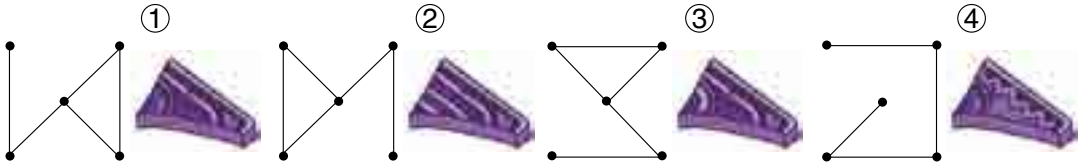
What kind of shapes can we make?

B • • C

• A

E • • D

① ② ③ ④



• Let's cut out fragments on page 246 and paste on the last page.

Let's go to the next place to find the fragments of the key!

3 Sinking Islands

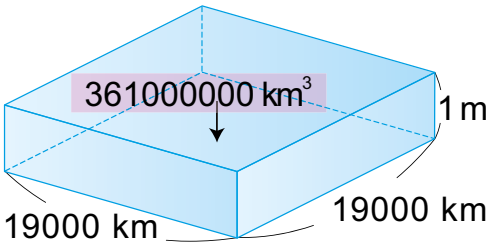
It is said that Global warming leads to the rise in sea level. It is also predicted by some researchers that the sea level will rise to a maximum of 59 cm in the 21st century. In Maldives, in the Indian Ocean, $\frac{4}{5}$ of their land has only less than 1m altitude from the sea level.

It might sink forever if the sea level continuously rises.

The area of the sea on earth is about 361000000 km².

If we think of the area as a square, the length of one side is about 19000 km.

If we think of the following rectangular prism using this square, what km³ of water is necessary for the sea level to rise by one metre? Let's calculate it.



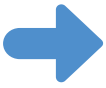
A large amount of water is necessary. If the sea level rises by one metre, most lands of Maldives will sink.

I wonder where this large amount of water comes from. Is it because of Global Warming? It might be as a result of ice melting in the Arctic Ocean.

So, let's experiment! Let's add water and ice in a glass and check the surface of the water.

Check on the surface of water.

Ice floats on water in a glass.

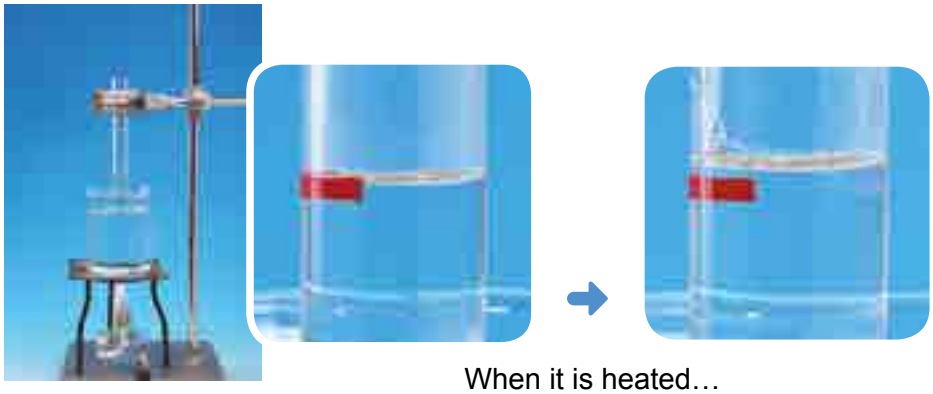


Leave the glass until the ice melts.

Ah, the surface of water has not risen.

In fact, it is said that one of the causes of the rise in the sea level is “Expansion of the seawater because of Global Warming”.

Right. Water expands when it is heated.



When it is heated…

Another cause of rise in the sea level is “Decrease of glacier”.
It means that ice on land melts and it flows into the sea.
Let’s search how much glacier actually melts.
The glacier on Padagonia icy field in Chile and Argentina melts at a faster speed than any other glacier on the earth.
It is said that in the past 7 years,
42 km² of ice is lost every year.
How many 1 m³ ice cubes have melted over the past 7 years?
This is a hint to find a fragment.

Padagonia icy field

A : 200 billion or less than 200 billion

B : more than 200 billion and less than 250 billion or equal to 250 billion

C : more than 250 billion and less than 300 billion or equal to 300 billion

the size of 1 m³

• Let’s cut out fragments on page 246 and paste on the last page.

Let’s go to the next place to find the fragments of the key!

4 Roman Empire Cities with Water Supply

There was a country named the Roman Empire in the Mediterranean area more than 2000 years ago. This country constructed water bridges combining roads connecting to various places with water pipes to send water. One water bridge of these constructions still exists in France and is approved as a part of World Heritage.

Roman aqueduct (France)

I am surprised that there were water pipes in such far past!

It is amazing that it was constructed by piling stones which enabled water to flow!

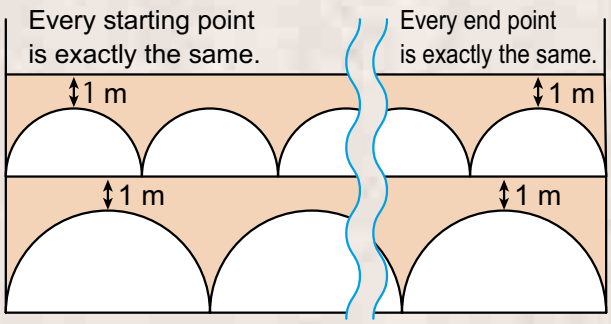
The length of this Water Bridge is 275 m, the height is 49 m and it has 3 levels. The 1st level is supported by 6 arches, the 2nd by 11 and the 3rd by 35.

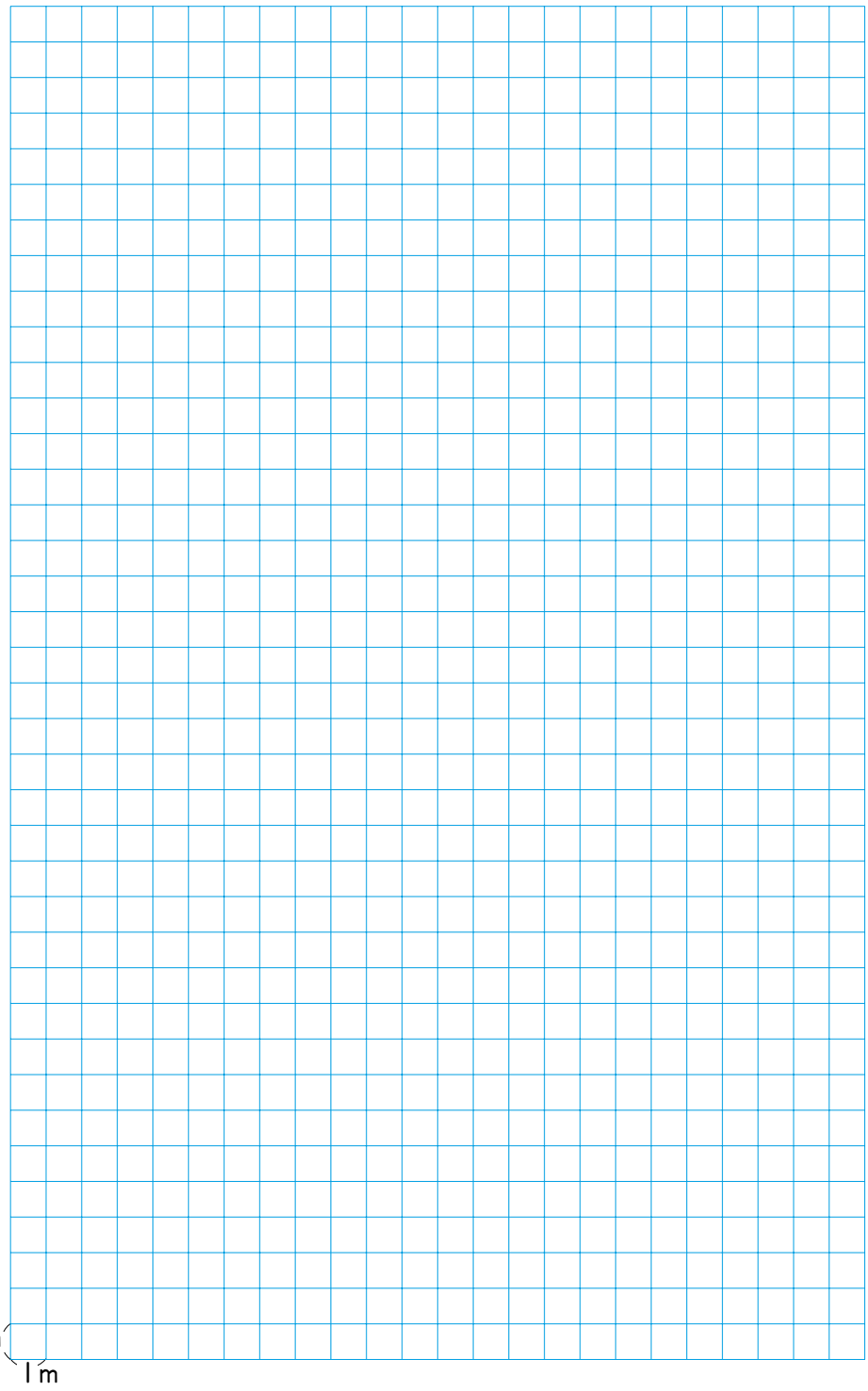
I will tell you a hint to find the key fragment. If you design a water bridge with a length of 24 m, you will find the place of the fragment.

How to design

- The number of arches begins from one in the 1st level and then it increases gradually as the level goes up.
- The width of the arches in each level is the same size and so the total length of every level should be the same.
- The width of the arches should be expressed by a whole number with a unit of "metre".
- The width of the arches in each level is a divisor of 24.
- The shapes of the arches are semicircles and the difference between the highest point of the semicircles in each level and the bridge of the next level is 1 m.

Draw the design using a compass.





You can find a fragment at the number which is an answer of multiplication between the number of arches in 3rd level and the number of arches in 6th levels.

① 22 

② 23 

③ 24 

④ 25 

• Let's cut out fragments on page 246 and paste on the last page.

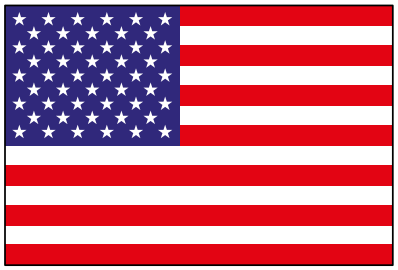
Let's go to the next place to find the fragments of the key!

5 Pentagon by Fractions

The shape of stars is frequently used in the national flags in the world.
The United States, which has “The Statue of Liberty” as a part of World Heritage also use stars indicating each state in their national flag.
In Japan, Nagasaki city also has stars in their flag.

The Statue of Liberty

Peace Statue (Nagasaki city, Japan)



The national flag of the USA

Nagasaki city’s flag

There is an interesting way to draw a star. It is $\frac{5}{2}$.

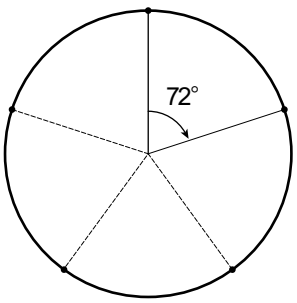
What? How can we draw stars by fractions?

The denominator and the numerator indicate the way to draw it, right?

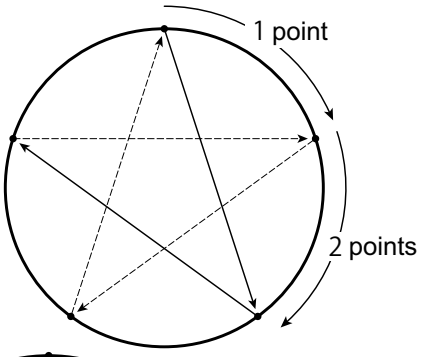
You have an eye on good points. I will show you the way now, so let’s do it together.

At first, the numerator (5) indicates that drawing 5 points divides a circle equally into 5 sectors.

A circle has 360 degrees, so $360 \div 5 = 72$, we can divide by 72 degrees for each.

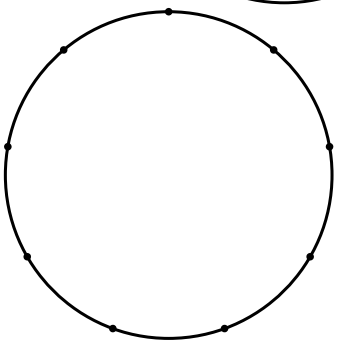


Next, I will explain the meaning of the denominator (2). Decide a starting point and then draw a line connecting the starting point and a point (end point) locating 2 points after the starting point and line connecting the end point with a point locating 2 points after the point again, and continue until it reaches the starting point!



Oh, Yes! We can draw a star.

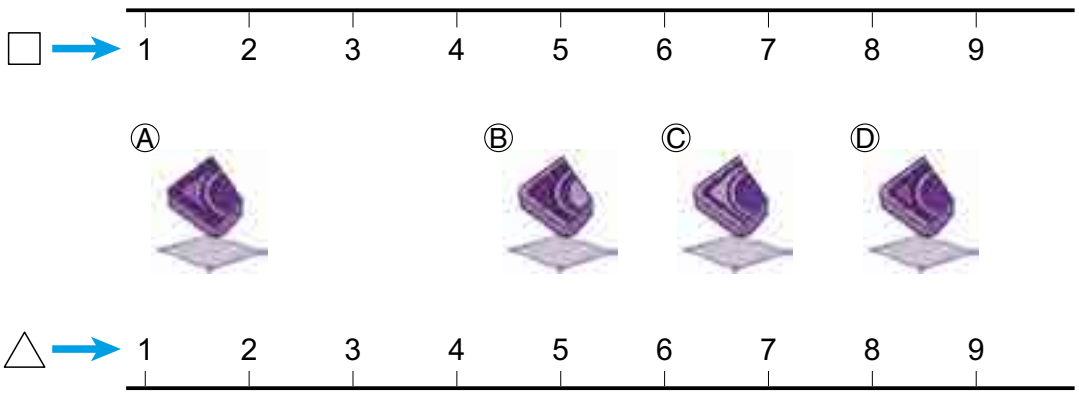
I want to try it by another fraction. How about the case of $\frac{9}{2}$?



Awesome! If we use $\frac{9}{3}$, we can draw a triangle!

$\frac{9}{3}$ reduces to $\frac{3}{1}$. We divide a circle to 3 sectors and draw a line one by one, so it will surely be a triangle.

So, to find the fragment of the key, we should find it by $\frac{\square}{\triangle}$ which enable us to draw a "square". The line between the denominator and the numerator is found in the following diagram. The fragment can be found on the line you drew.



- Let's cut out fragments on page 246 and paste on the last page and make the key completed.

Let's go to the next place to find the fragments of the key!

Value of Toral Shell Money (Tabu)

Papua New Guinea had the practice of buying and selling using their own traditional money before the introduction of Kina and Toea in 1975. Different province and regions in Papua New Guinea have their own way of paying for goods, we call Barter system. When there is need for payments such as bride price ceremony or compensation, the people pay using the goods they produce or raised or pay with the traditional money they have. The Rabaul people use Tabu or shell money as shown in the picture. During a ceremony, rings of Tabu are displayed. The value of Tabu is 10 toea for 12 tabu beads per stick. One arm span is 5 kina. In a bundled ring Tabushell, there are 40 rings with a diameter of 80 cm. If 70 cm of tabu (one arm length) is 5 kina, what is the total value of this bundle ring?

Math Adventure

Part 2

There are phenomena (things) which make us wonder why they happen on earth. We sometimes think 'why did they make this kind of things. What did the ancient people see and think about while they were making these things?

The places of the fragments

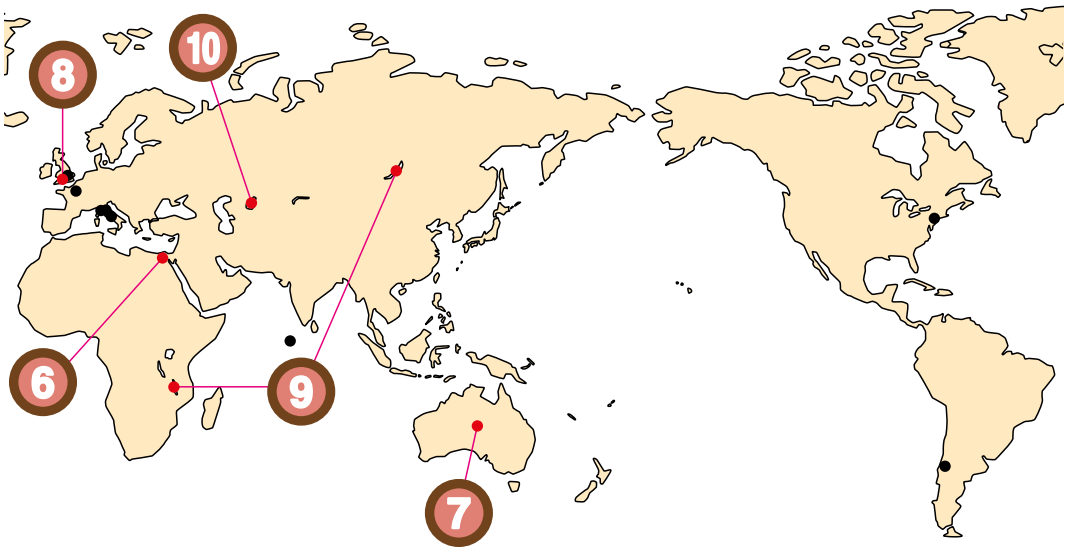
6 The Oldest Scroll of Mathematics

7 Ayers Rock the Center of the Earth

8 A Mysterious Circle of Stones

9 World Heritage – Comparing Areas of the Lakes

10 Disappearing Lake from Map



Let's go to the places to find the fragments of the key !

6 The Oldest Scroll of Mathematics

There are many sites of the ancient Egyptian Royal Dynasty in Egypt. These huge pyramids are all royal sites.

Pyramids (Egypt)

About 3700 years ago, the scribe Ahmose, who worked under a pharaoh, recorded the mathematics knowledge of that period on a papyrus paper scroll. In 1858, an English explorer Alexander Henry Rhind found the scroll and it was deciphered 20 years later.
The scroll shows questions about various fractions which are written as the sum of different unit fractions.

For example, you express $\frac{2}{3}$ as addition of unit fractions as;

$$\frac{2}{3} = \frac{1}{\square} + \frac{1}{\triangle}$$

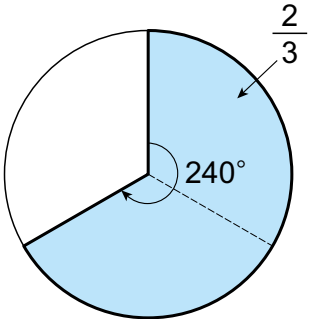
Put different numbers in $\square$ and $\triangle$.

So, we need to express $\frac{2}{3}$ as a sum of different unit fractions.

How about putting any number in the blanks.
See if it's right or not.

A unit fraction is a fraction where the numerator is 1.

Imagine a circle. How many degrees is $\frac{2}{3}$?



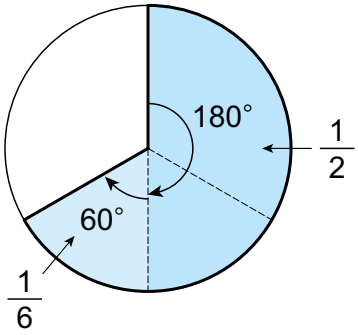
One circle means 360° so dividing it by 3 and two pieces of that are $\frac{2}{3}$.

Then, $360 \div 3 \times 2 = 240$ so, it is 240°.

240° is 180° + 60°, right?

Oh, 180° is, $\frac{180}{360}=\frac{1}{2}$. 60° is $\frac{60}{360}=\frac{1}{6}$.

I see! The answer is $\frac{2}{3}=\frac{1}{2}+\frac{1}{6}$.



This is a quiz to find the key fragment. You can find the hint to the hiding place by expressing $\frac{2}{5}$ as unit fractions.

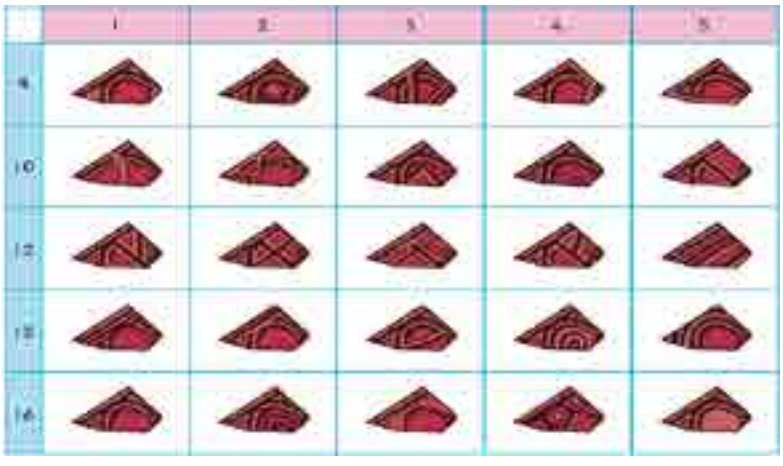
$\frac{2}{5}=\frac{1}{\bigcirc}+\frac{1}{\pentagon}$

Let's study the relationship between fractions and angles. You can calculate the addition of fractions by the addition of angles after we study fractions by dividing a circle and the angle.

Fraction	1	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{9}$	$\frac{1}{10}$	$\frac{1}{12}$
Angle	360°	180°	120°	90°	72°					
	$\frac{1}{15}$	$\frac{1}{16}$	$\frac{1}{18}$	$\frac{1}{20}$	$\frac{1}{24}$					
						14.4°	12°	10°	9°	8°
	6°	5°	4°	3°	2°	1°				

$\frac{2}{5}$ is 114° so, I see!

The column represents the denominator of the bigger angle and the row represents the denominator of the smaller angle.



- Let's cut out a fragment on page 247 and paste on the last page.

Let's go to the next place to find the fragments of the key!

7 Ayers Rock the Center of the Earth

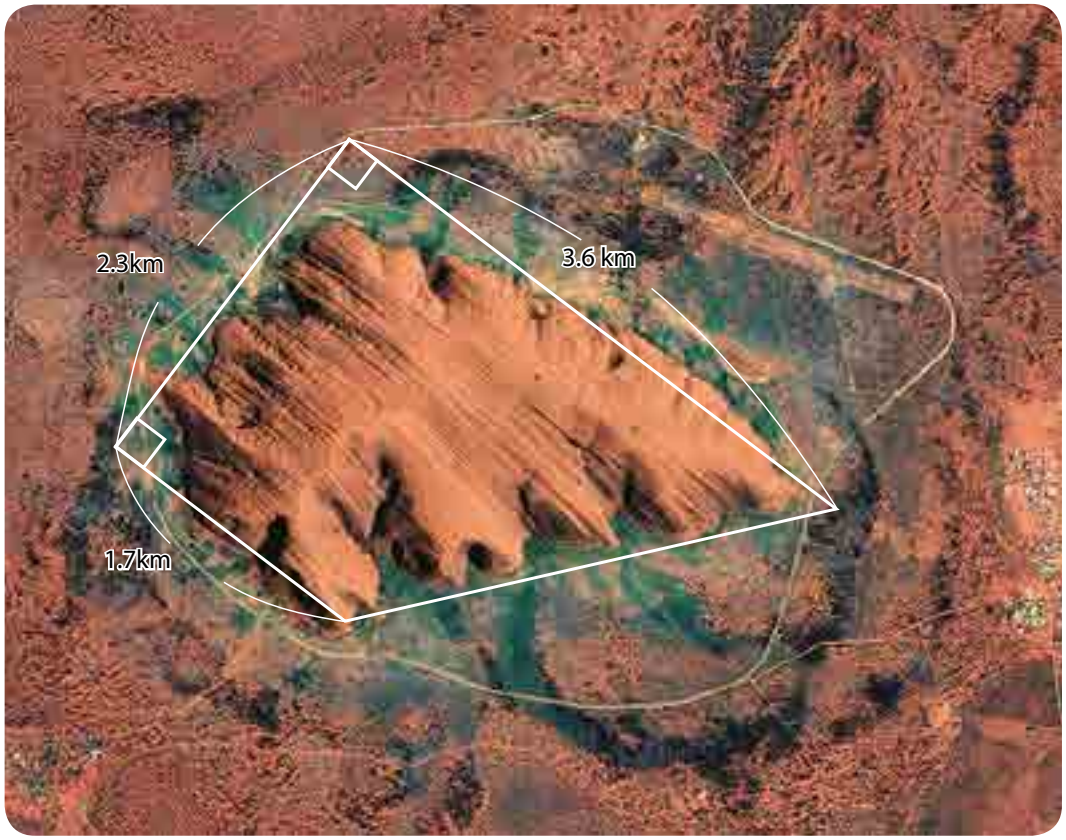
There is a famous rocky mountain called Ayers Rock in Australia.

How big is it?

I can see how big it is as I'm getting closer.

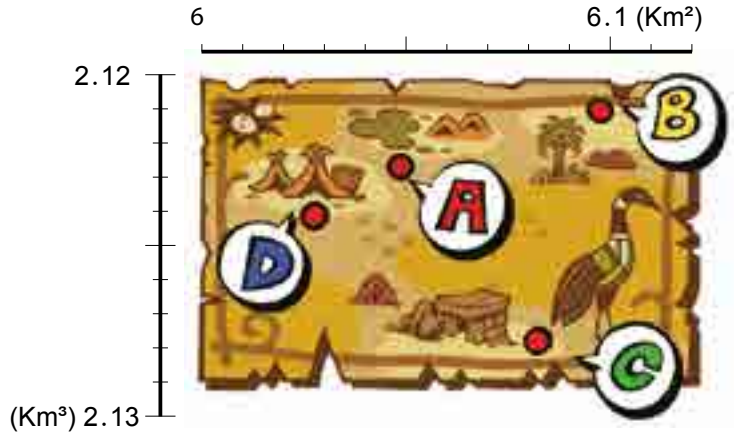
It is a huge monolith. It is said that the monolith is 9 km around, 348 m in height, 3.6 km in length and 2.4 m wide.

Let's consider Ayers Rock to be a trapezoid looked from straight above. The upper base is 3.6 m and the lower base is 1.7 m as shown below.



The location of the key fragment is shown on the following map. The area of Ayers Rock seen from straight above defines a number of the horizontal line and the volume defines a number of the straight lines. (The number of horizontal lines shows an approximate area of Ayers Rock seen from straight above and the number of vertical lines shows the approximate volume.) Round off the value of the volume to three decimal places.

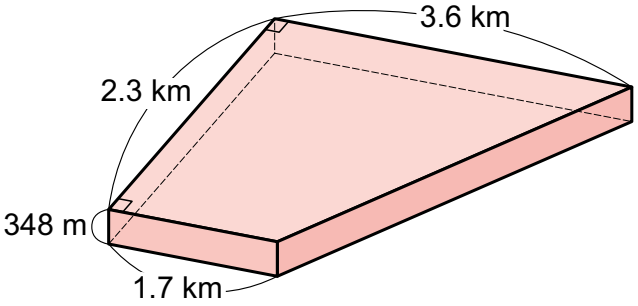
You can find out the location with these two answers.



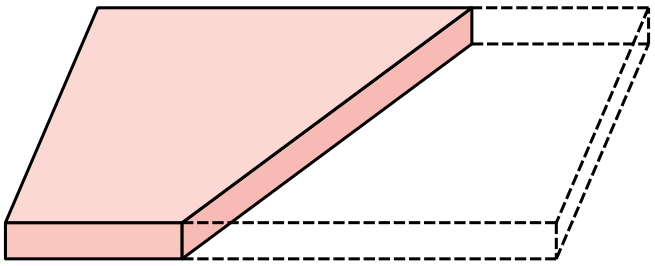
I see, the point where two lines intersect is the place of the fragment!

But, how can we find the approximate area and volume?

Imagine a figure as shown below.



Oh yeah, joining two of these shapes together it becomes a rectangular prism!



• Let's cut out a fragment on page 245 and paste on the last page.

Let's go to the next place to find the fragments of the key!

8 A Mysterious Circle of Stones

At the Stonehenge in the southern part of the England, there are ruins composed of a circle of large stones.
This was built about 3600 to 5000 years ago.
The weight of a stone pillar is about 25 tonnes and there is another stone which weighs 7 tonnes on the top of this.
It seems that these stones were carried from a place about 38 km away from this place. It is said that it took 600 people and 1 year to carry 1 stone.
If there were 1800 people to carry stones, how many years did it take to carry 120 stones?

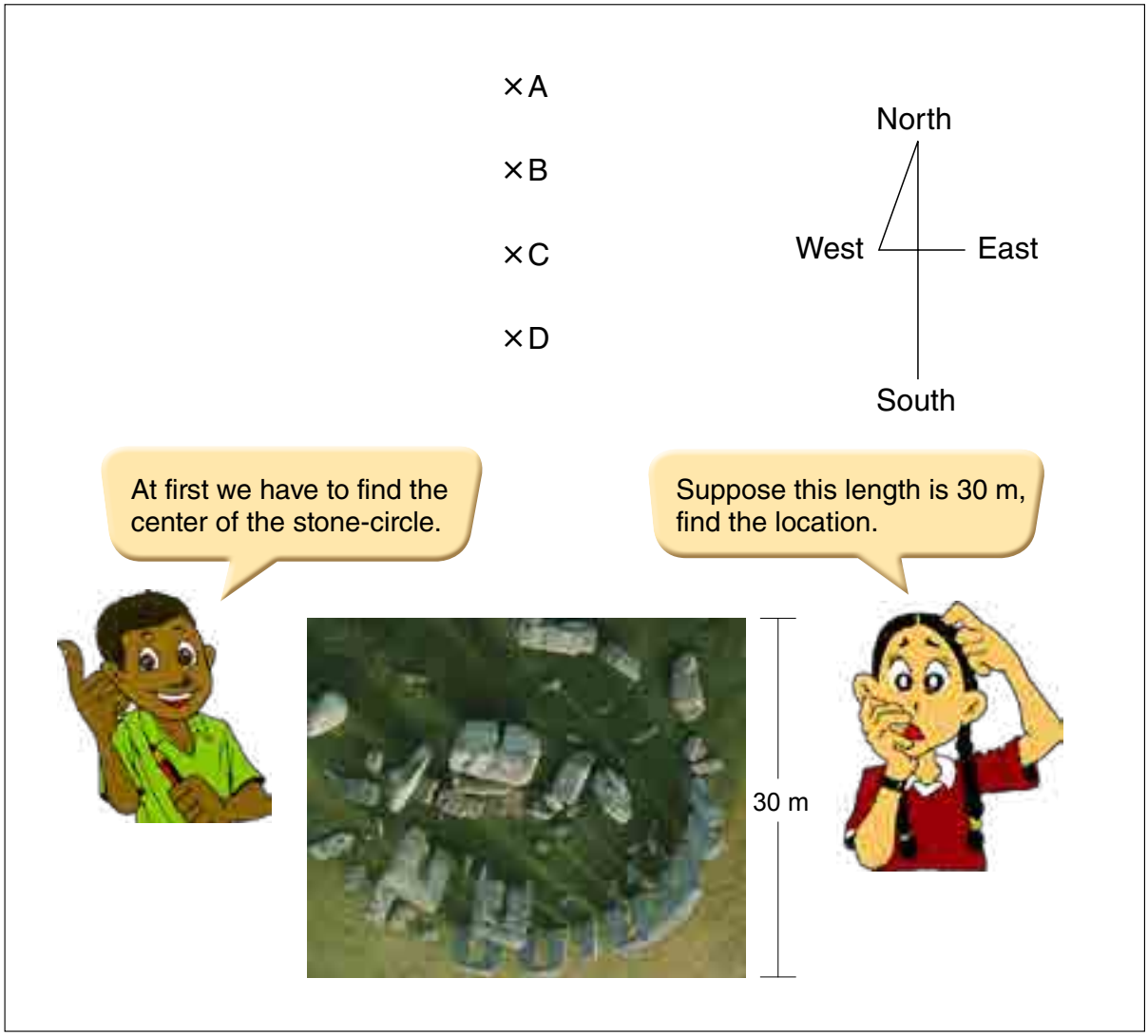
1800 people could carry 3 stones in 1 year.

Then, $120 \div 3 = 40$ so, it takes 40 years.

But how did they carry these stones?

Even in modern science it cannot be explained.

The key fragment is hidden near this stone circle. You will find the location when you go half way round the circumference from the centre of the stone-circle facing North. The stone-circle is 30 m in diameter but in this quiz let the diameter be 5 cm. Draw a figure then find the answer.



Ⓐ Ⓑ Ⓒ Ⓓ

• Let's cut out a fragment on page 245 and paste on the last page.

Let's go to the next place to find the fragments of the key!

9 World Heritage – Comparing the Areas of the Lakes

Lake Baikal, Russia

Lake Malawi, Malawi

Lake Baikal in Russia and Lake Malawi in Africa are both far away from each other but their shape is similar. This is because the two lakes were made in the same way.

There are many other lakes in the World Heritage list. Lake Ohrid in Macedonia and Yellowstone Lake in the United States are famous. Let's compare the areas of these lakes.

While Lake Ohrid is 350 km² big, Lake Baikal is 90 times bigger. The area of Yellowstone Lake is 1.2 % of Lake Malawi, 360 km².

Lake Ohrid and Yellowstone Lake are approximately the same in area.

The areas of Lake Baikal and Lake Malawi are almost the same.

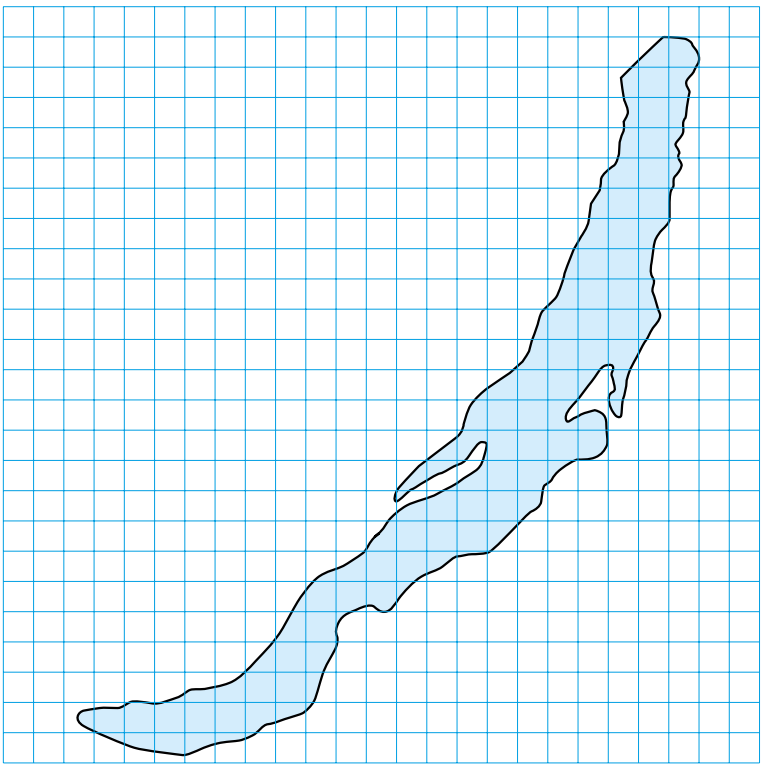
Let's calculate their areas.

You can calculate the area of Lake Baikal by using the area of Lake Ohrid.

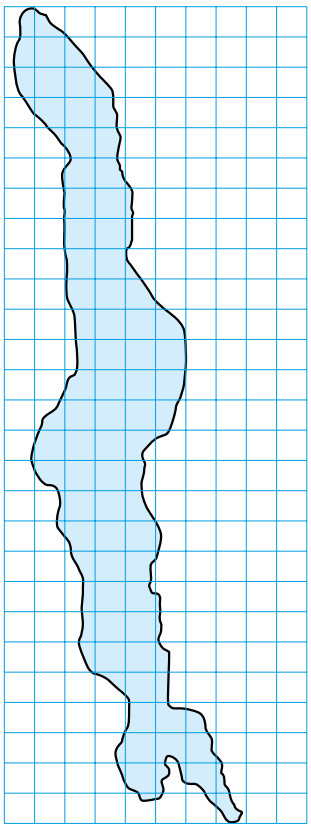
You can divide the area of Yellowstone Lake by 0.012 to find the area of Lake Malawi.

Count the squares on the next page to find the approximate areas of Lake Baikal and Lake Malawi. Compare the calculated value and the counted value of each lake. Which pair has less difference?

Choose the right pair to get a broken piece of the key (The key fragment is hidden in the one with the closer area.).



A：Lake Baikal



B：Lake Malawi

The side of each square is 20 km for each figure.

Both lakes look equal.

The incomplete squares are counted as half an area.

To begin with, put x on incomplete squares and o on complete squares. Then calculate.

We can calculate area of 1 square as $20 \times 20 = 400$ (km^2).

Ⓐ 

Ⓑ 

• Let's cut out a fragment on page 245 and paste on the last page.

Let's go to the next place to find the fragments of the key!

10 Disappearing Lake from Map

The Aral Sea is a salt lake that lies between Kazakhstan and Uzbekistan.

An abandoned ship that was once at the bottom of the lake.

This lake used to have a water volume of 1090 km^3 containing 10 g salt per litre in 1960. However, the water volume has been reducing because of the constructions of canals for agricultural water supply.
Consequently, the amount of salt per litre has been increasing. In short, the salt water is more concentrated. In 1989, the lake separated into the South Aral Sea and the North Aral Sea and in 2003, the total volume of water in the two lakes decreased to 109 km^3. Even at the locations of low salt concentration in the South Aral Sea it contains 80 g of salt per litre.

1960

1996

What is the percentage of the volume of water in 2003 compared to the volume of water in 1960?

You can apply the knowledge of proportion to find the answer.

The chart below shows how the salt concentration has increased since 1987. Study when (from what year to what year) the salt concentration became equal to that of the sea and you can find the key fragment.

How many grams of salt does the sea water contain?

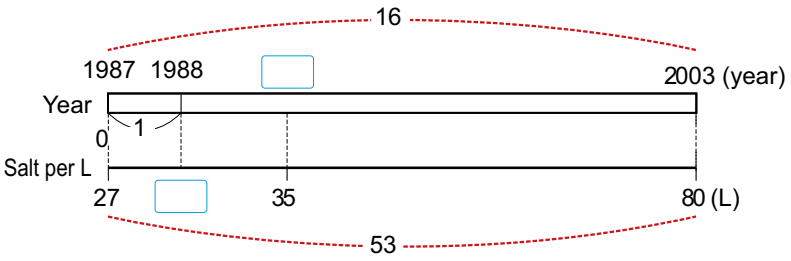
It is 35 g per litre in average.

The Change in the Concentration of Salt in Aral Sea

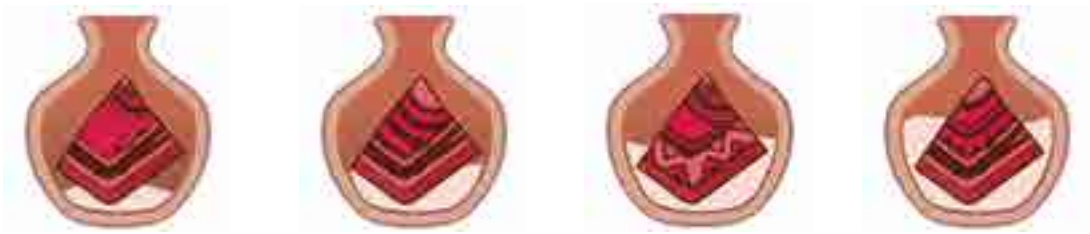
Year	1987	1988	1989		2003
The salt per litre (g)	27	?	?		80

Suppose that the concentration of salt increases at the constant rate every year from 1987 to 2003…

The amount of salt per litre in 1987 is 27 g per 1 L and the salt per 1 L in 2003 is 80 g per 1 L. So, there is an increase of 53 g in 16 years.



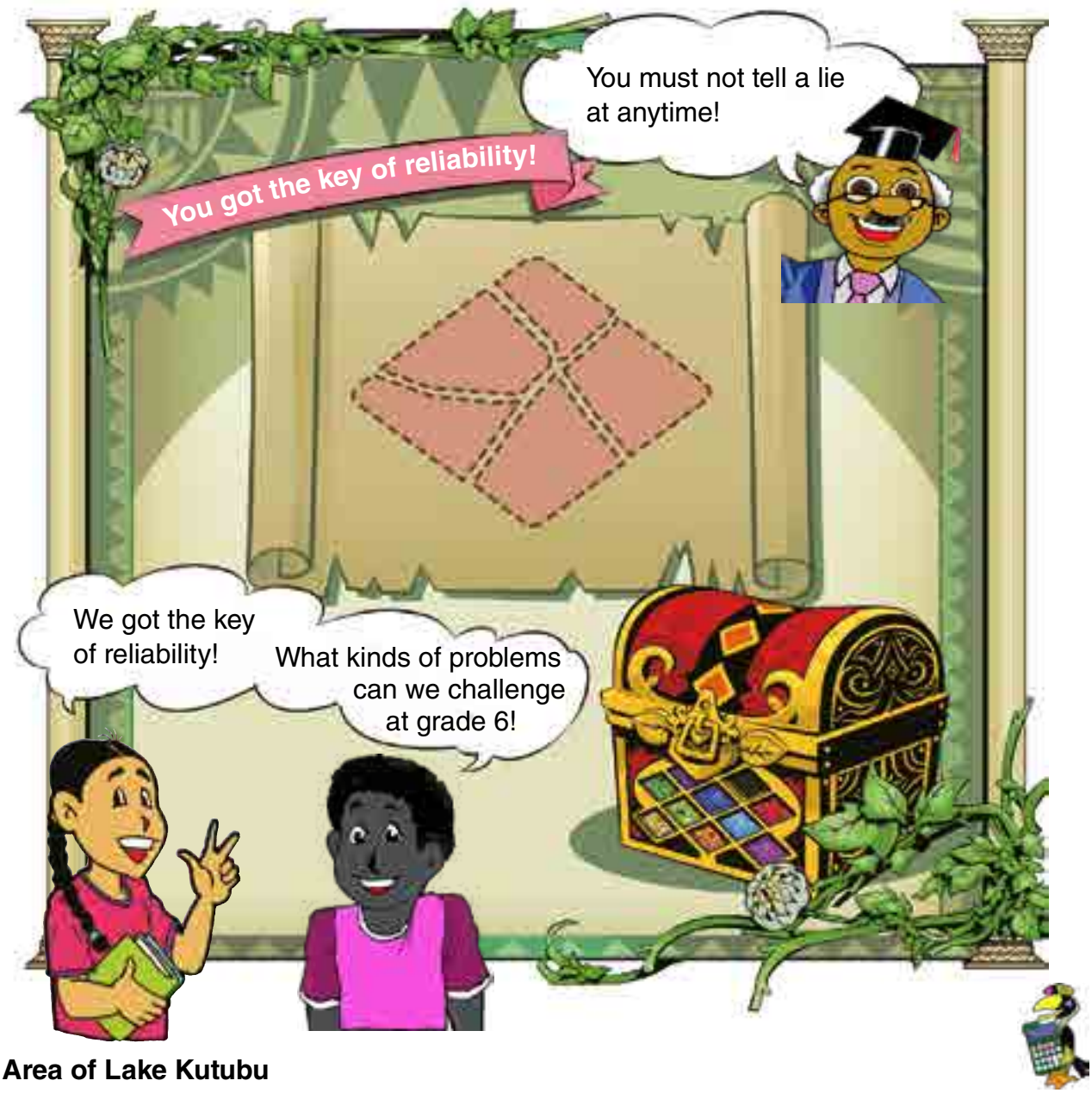
There are four jars with the key fragment inside. The final key fragment is in the jar made in the same year as the salt concentration was 35 g per litre.



A 1989 B 1992 C 1995 D 1997

- Let's cut out a fragment on page 245 and paste on the last page and make the key completed.

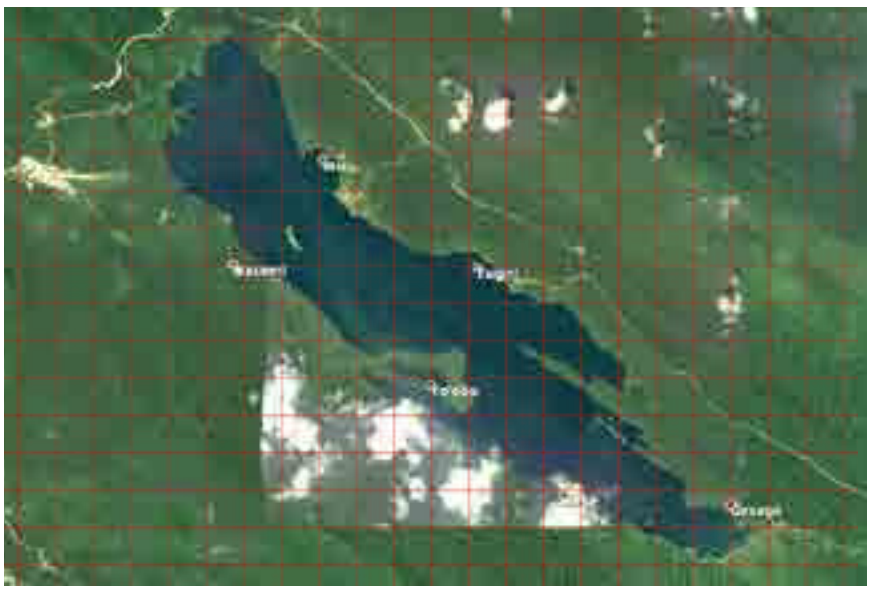
Let's go to the next place to find the fragments of the key!



Area of Lake Kutubu

Papua New Guinea has many lakes. The two largest lakes are Lake Murray and Lake Kutubu. Lake Kutubu is famous because of its location which is near to the Kutubu Oil Project, in the Southern Highlands Province. The water is clear and the lake reaches a depth of 70 m (230 feet) and is about 800 m above sea level.

The picture shows the map of Lake Kutubu. For each square grid, the area is 10 km^2. Find the total area of the Lake using the method of calculating the approximate area learned in this grade.



Answers

Chapter 1 Excercise: Page 8

1 ① 10, 1, 0.1 ② 0.001, 0.0001

2 ① 10, 10 ② ten

3 10 times of 36.05 is 360.5

100 time of 35.05 is 3605

$\frac{1}{10}$ of 36.05 is 3.605

$\frac{1}{100}$ of 36.05 is 0.3605

Chapter 1 Problems: Page 9

1 ① 8.695 kg ② 0.32 L ③ 3670 m ④ 6720 cm

2 ① 8.25 ② 567 ③ 7.23 ④ 0.452

3 ① 0.3074 ② 2.05 ③ 175

1 ① 132 ② See teacher ③ See teacher

Chapter 2 Excercise: Page 22

1 ① 6.8 cans per day

2 Ⓑ is more crowded.

3 White paint 4 2.4 kg

Do you remember?: Page 22

① 1404 ② 5762 ③ 2730 ④ 7392 ⑤ 36160

⑥ 29664 ⑦ 21.6 ⑧ 55.8 ⑨ 20

Chapter 2 Problems: Page 23

1 780 people

2 ① 120 kina ② 600 kina ③ 12 m

3 ① 70 sheets of papers

② 560 sheets of papers ③ 30 min

4 37 pages 5 5.6 second

Chapter 3 Excercise: Page 35

1 ① 215 ② 10.8 ③ 83.2 ④ 4.2

⑤ 161.2 ⑥ 43.4 ⑦ 0.48 ⑧ 3.15

⑨ 5.1 ⑩ 0.075 ⑪ 2.898 ⑫ 6.54

2 1.02 m² 3 38.7g, 3.6g

4 ① > ② < ③ < ④ =

5 See teacher

Do you remember?: Page 35

Ⓐ 120° Ⓑ 60° Ⓒ 40° Ⓓ 140°

Chapter 3 Problems: Page 36

1 10, 10, 23, 16, $\frac{1}{100}$

2 ① 36.4 ② 22.8 ③ 5.76 ④ 0.24 ⑤ 2.45

⑥ 3.8 ⑦ 12.341 ⑧ 2.268 ⑨ 0.056

3 ① 288 kina ② 54 kina

4 ① 20.8 ② 42 5 ① 0.42 ② 15.432

Chapter 4 Excercise: Page 47

1 ①, ②, ③ and ④ See teacher

2 See teacher

Do you remember?: Page 47

① 180 ② 272 ③ 739 ④ 777 ⑤ 842 ⑥ 1221

⑦ 110 ⑧ 336 ⑨ 674 ⑩ 131 ⑪ 438 ⑫ 188

Chapter 4 Excercise: Page 56

1 ① 70 ② 25 ③ 110 ④ 95 ⑤ 120

Do you remember?: Page 56

① 12 ② 23 ③ 24 ④ 4 ⑤ 6 ⑥ 4

⑦ 56 ⑧ 75 ⑨ 58 ⑩ 6 ⑪ 9 ⑫ 57

Chapter 4 Problems: Page 57

1 See teacher

2 ① 80 ② 65 ③ 130 ④ 80 ⑤ 125

Chapter 5 Excercise: Page 70

1 ① 8 ② 20 ③ 25 ④ 3 ⑤ 7

⑥ 3 ⑦ 8 ⑧ 14 ⑨ 0.375 ⑩ 2.6

⑪ 4.5 ⑫ 0.4 ⑬ 1.45 ⑭ 9.25 ⑮ 0.25

2 ① 16 remainder 0.2 ② 27 remainder 0.02

③ 6 remainder 0.12

3 4 cups of 0.8L and 0.2 L is left

4 ① 0.47, 0.467 ② 2.16, 2.158 ③ 8.41, 8.406

5 8.3g

Do you remember?: Page 70

① 144 cm² ② 351 cm² ③ 24 m²

Chapter 5 Problems: Page 71

1 ① 23 ② 2.5 ③ 98 ④ 2.35 ⑤ 0.825 ⑥ 1.875

2 4.5m 3 16 cups and 0.12L left

4 ① Amount of paint per 1 kg

② Weight of red paint per 1 L

5 ① > ② <

6 See teacher

Chapter 6 Excercise: Page 86

1 ① 504 cm³ ② 729 cm³

2 10800000 cm³, 10.8 m³

3 400000 cm³, 0.4 m³ 4 216 cm³

Do you remember?: Page 86

① 36 ② 6.48 ③ 11.502 ④ 0.06

⑤ 6 ⑥ 1.8 ⑦ 0.85 ⑧ 2.3

Chapter 6 Problems: Page 87

1 ① 540 cm³ ② 125 m³

2 ① 225 cm³ ② 48 m³

3 68.448 cm³ 4 4 times

Chapter 7 Excercise: Page 103

1 ① 3, 6, 9, 12, 15, 18, 21, 24, 27,

30, 33, 36, 39, 42, 45, 48

② 7, 14, 21, 28, 35, 42, 49

③ 21, 42 ④ 1, 2, 4, 7, 14, 28

⑤ 1, 2, 4, 8, 16, 32 ⑥ 1, 2, 4

2 ① 6, 12, 18 LCM: 6 ② 40, 80 120 LCM: 40

③ 15, 30, 45 LCM: 15

3 ① 1, 2, 3, 6 GCD: 6 ② 1, 2 GCD: 2
③ 1, 2 GCD: 2

Do you remember?: Page 103

① $2\frac{2}{3}$, $\frac{8}{3}$ ② $1\frac{2}{5}$, $\frac{7}{5}$

Chapter 7 Problems: Page 104

1 ① 16, 32, 48 Divisors: 1, 2, 4, 8, 16
② 13, 26, 39 Divisors: 1, 13
③ 24, 48, 72 Divisors: 1, 2, 3, 4, 6, 8, 12, 24

2 ① 21, 42, 63 LCM: 21 ② 36, 72, 108 LCM: 36
③ 20, 40, 60 LCM: 20

3 ① 1, 3 GCD: 3 ② 1 GCD: 1
③ 1, 2, 3, 4, 6, 12 GCD: 12

4 9 : 24 am **5** 10 sets of 6 cm squares **6** 53

Chapter 8 Excercise: Page 121

1 ① > ② > ③ < ④ >

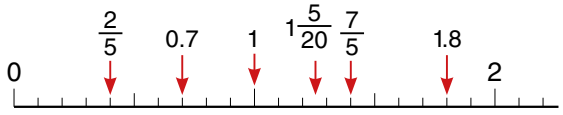
2 ① $\frac{1}{2}$ ② $\frac{2}{3}$ ③ $\frac{3}{4}$ ④ $\frac{2}{3}$ ⑤ $\frac{3}{4}$

3 ① $\frac{1}{7}$ ② $\frac{5}{9}$ ③ $\frac{11}{3}$ $(3\frac{2}{3})$

4 ① 0.5 ② 0.31 ③ 3 ④ 1.25

5 ① $\frac{3}{10}$ ② $\frac{19}{10}$ $(1\frac{9}{10})$ ③ $\frac{61}{100}$ ④ $\frac{111}{100}$ $(1\frac{11}{100})$

6



Do you remember?: Page 121

① $\frac{2}{5}$ ② 1 ③ $\frac{9}{4}$ $(2\frac{1}{4})$ ④ $\frac{6}{7}$ ⑤ $\frac{4}{5}$ ⑥ $\frac{11}{8}$ $(1\frac{3}{8})$

Chapter 9 Excercise: Page 129

1 ① $\frac{15}{28}$ ② $1\frac{6}{35}$ ③ $1\frac{1}{12}$ ④ $1\frac{1}{2}$ ⑤ $2\frac{7}{8}$ ⑥ $7\frac{10}{21}$
⑦ $\frac{11}{18}$ ⑧ $\frac{1}{24}$ ⑨ $\frac{11}{28}$ ⑩ $1\frac{1}{12}$ ⑪ $4\frac{11}{35}$ ⑫ $1\frac{11}{12}$

2 ① $\frac{4}{5}$ m rope with $\frac{1}{20}$ m longer ② $1\frac{11}{20}$ m

3 ① Wrong, not calculated making same dinominator.

Do you remember?: Page 129

① 6.37 ② 2.38 ③ 0.28 ④ 12.642
⑤ 20 ⑥ 0.6 ⑦ 3.5 ⑧ 2.5

Chapter 10 Excercise: Page 147

1 ① 32 cm² ② 10 cm² **2** ① 6 cm² ② 40.5 cm²

3 ① 16 cm² ② 20 cm²

Do you remember?: Page 147

① 16 ② 12 ③ 4 ④ 4
⑤ 86 ⑥ 156 ⑦ 18 ⑧ 27

Chapter 10 Problems: Page 148

1 ① 18 cm² ② 20 cm² ③ 12 cm² ④ 18 cm²

2 See teacher **3** 18 cm

4 ① 40 cm² ② 14 cm² ③ 20 cm²

Chapter 11 Excercise: Page 159

1 ① $\frac{2\times3}{7}$, $\frac{6}{7}$ ② $\frac{5}{7\times3}$, $\frac{5}{21}$

2 ① 2 ② $4\frac{2}{3}$ ③ $9\frac{1}{3}$ ④ 33 ⑤ $1\frac{1}{4}$ ⑥ 12
⑦ $4\frac{1}{2}$ ⑧ 99

3 $2\frac{1}{2}$ L

4 ① $\frac{5}{24}$ ② $\frac{2}{7}$ ③ $\frac{1}{20}$ ④ $\frac{2}{35}$
⑤ $\frac{3}{4}$ ⑥ $\frac{1}{7}$ ⑦ $\frac{11}{24}$ ⑧ $\frac{7}{8}$

5 $\frac{7}{18}$ L

Do you remember?: Page 159

① 48 cm³ ② 15.625 cm³ ③ 150 m³

Chapter 11 Problems: Page 160

1 ① 4 ② $\frac{7}{32}$

2 ① $\frac{5}{6}$ ② $3\frac{3}{4}$ ③ 14 ④ $\frac{4}{27}$ ⑤ $\frac{3}{13}$ ⑥ $\frac{5}{27}$

3 $\frac{7}{50}$ m **4** $5\frac{1}{2}$ cm²

1 ① $\frac{1}{3}$ hours ② $\frac{1}{3}$ days ③ $\frac{1}{16}$ minutes

Chapter 12 Problems: Page 169

1 ① Not proportional ② Not proportional
③ Proportional ◯=30×□

2 ① 20, 40, 60, 80, 100, 120
② Length is directly proportional to weight.
③ 20 ④ ◯=20×□ ⑤ 48 g

Chapter 13 Excercise: Page 181

1 See teacher

2 ① 18.84 cm ② 31.4 cm

3 ① 2 cm ② 4 cm

4 6.28 cm

Do you remember?: Page 181

① 8 ② 98 ③ 13.26 ④ 2.76 ⑤ 32.68 ⑥ 19.716

Chapter 14 Excercise: Page 190

1 ① Triangular Prism ② 5 faces and 6 edges
③ Parallel to face DEF, Perpendicular to faces ACFD, BCFE and ABED
④ AD, BE and CF

2 Number of vertices 14, 16, 18, 20
Number of edges 21, 24, 27, 30
Number of faces 9, 10, 11, 12

3 ① Cylinder ② 12.6 cm ③ See teacher

Do you remember?: Page 190

① 16 ② 4 ③ 35 ④ 8 ⑤ 2.6 ⑥ 9

Chapter 14 Problems: Page 191

1 ① Pentagonal prism ② Cylinder

2 See teacher **3** 10.2 cm

Chapter 15 Excercise: Page 207

1 ① 0.7 ② 1

2 ① 0.8 ② 1.25

3 105% **4** 12 eggs

Do you remember?: Page 207

① $\frac{9}{10}$ ② $1\frac{1}{18}$ ③ $3\frac{3}{4}$ ④ $3\frac{19}{24}$
⑤ $\frac{1}{4}$ ⑥ $\frac{3}{20}$ ⑦ $\frac{1}{2}$ ⑧ $2\frac{12}{35}$

Glossary

Addition is the process of calculating the total of two or more numbers or amounts. ..... 5 & 32

Approximately is when a number or measure obtained from given numbers which is closer to the actual number or measure 25

Averaging is the process of making different sized measurements to the new measure evenly or equally. 13

Band Graph is a graph that expresses the total as a rectangle-like band. 203

Circumference is the surrounding length of a circle. 175

Congruent is a figure which is identical in shape, size and angles. .. 38 & 42

Corresponding is the side, vertex or angle of a figure which is simmilar or identical to another congruent figure. 42

Denominator is the number below the line in a fraction. ..... 109 & 110

Diameter is a straight line that passes through the centre of a circle that halves the circle into two equal parts. 175

Division is the process of sharing or dividing a number or a quantity by another. 58

Divisors are whole numbers by which a number can be divided with no remainder. ..... 59 & 61

Estimate is a measure or number obtained by guessing from given numbers which is almost the same as the actual answer. 11

Even numbers are whole numbers divided by 2 without a remainder. .. 102

Improper fraction is a fraction expressed that has a numerator larger than its denominator. 103

Mean is the same number or measure which is averaged from some numbers or measures. 13

Mixed fraction is a fraction that includes both a whole number part and a fractional part. 103

Multiples are whole numbers multiplied by a certain number. ..... 7 & 29

Multiplication is the process of combining a number or quantity by another to obtain its product. 24

Net is the plane shape that is developed that when folded, it gives an enclosed solid. · · · · · · · · · 187 & 188

Numerator is the number above the line in a fraction. · · · · · · · · · · · · · 109

Odd numbers are whole numbers divided by 2 that leaves a remainder of 1. · · · · · · · · · · · · · 102

Percentage is the quantity obtained in expressing a ratio by making the basic quantity 100. · · · · · · · · · · · · · 197

Polygon is a plane figure with at least three straight sides and angles and are typically five or more. · · · · · · · · · · · · · · 55

Population Density is the population measured in per $1km^2$. · · · · · · · · · 18

Prime is the number of sides of base in polygons. · · · · · · · · · · · · · 100

Prime Number is a number than can be divided only by 1 and itself. · · · 100

Proportion is when a quantity changes and the other quantity also changes at the same amount. · · · · · · · · · 165 & 166

Quadrilateral is a shape with four sides, vertex and angles. · · · · · · 43 & 44

Quotient is the result or measure obtained by dividing one quantity by another. · · · · · · · · · · · 64 & 66

Ratio is the result or measure obtained when compared quantity is divided by a basic quantity. · · · · · · · · · · · · · 178

Regular Polygons are polygons that have all sides and angles equal. · · 172

Solids are the shapes that are covered by planes or curved surfaces. · · 182

Subtraction is the process of taking away one number or amount from the other. · · · · · · · · · · · · · 122

Volume is the size of a solid represented by a number of units. · · · · · · · 76

Attachments

Let's paste the fragments on the last page

Cathedral from Birds' Eyes (Page 219)

A 

B 

C 

World Heritage Site - Comparing Height (Page 221)

A 

B 

C 

D 

Sinking Islands (Page 223)

A 

B 

C 

Roman Empire Cities with Water Supply (Page 225)

A 

B 

C 

D 

Pentagon by Fractions (Page 227)

A 

B 

C 

D 

Let’s paste the fragments on the last page

Ayers Rock the Centre of the Earth (Page 233)

A 

B 

C 

D 

A Mysterious Circle of Stones (Page 235)

A 

B 

C 

D 

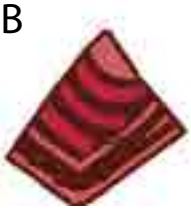
World Heritage - Comparing the Areas of the Lakes (Page 237)

A 

B 

Disappearing Lake from Map (Page 239)

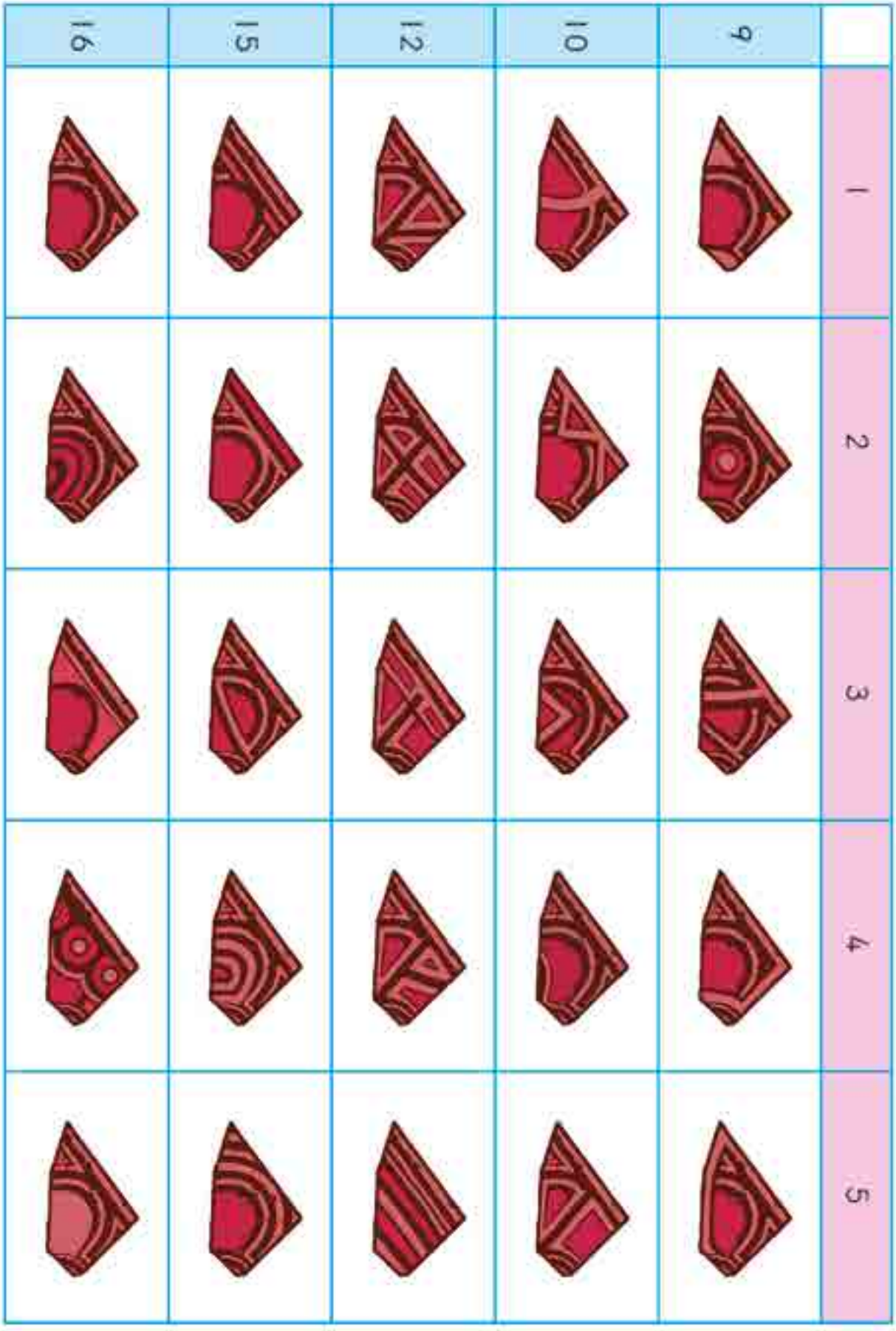
A 

B 

C 

D 

The Oldest Scroll of Mathematics (Page 231)



National Mathematics Grade 5 Textbook Development Committees

The National Mathematics Grade 5 Textbook was developed by Curriculum Development Division (CDD), Department of Education in partnership with Japan International Cooperation Agency (JICA) through the Project for Improving the Quality of Mathematics and Science Education (QUIS-ME Project). The following stakeholders have contributed to manage, write, validate and make quality assurance for developing quality Textbook and Teacher's Manual for students and teachers of Papua New Guinea.

Joint Coordinating Committee members for QUIS-ME Project

Dr. Uke Kombra, Secretary for Education - Chairperson, Mr. Walipe Wingi, Deputy Secretary - Deputy Chairperson, Mr. Baran Sori, Mr. Samson Wangihomie, Mr. Titus Romano Hatagen, Mr. Godfrey Yerua, Mrs. Annemarie Kona, Mr. Camilus Kanau, Mr. Joseph Moide, Mr. Peter Kants, Late Mr. Maxton Essy, Mr. Steven Tandale, Ms. Hatsie Mirou, Mr. Paul Ainui, Mr. Packiam Arulappan, Mr. Allen Jim, Mr. Nopa Raki, Mr. Gandhi Lavaki, Mr. John Kakas, Mrs. Philippa Darius, Mr. Alex Magun, Ms. Mary Norrie, Mr. James Namari, Ms. Kila Tau, Mr. Moses Hatagen Koran, Ms. Colette Modagai, Ms. Dorothy Marang, Mr. Dan Lyanda, Representatives from Embassy of Japan and JICA PNG Office, Mr. Akinori Ito, MPS, Mr. Chiko Yamaoka and other Project Experts

Steering Committee members for QUIS-ME Project

Mrs. Annemarie Kona, First Assistant Secretary - Chairperson, Mr. Steven Tandale - Assistant Secretary, CDD - Deputy, Chairperson, Ms. Hatsie Mirou, Mr. Paul Ainui, Mr. Gandhi Lavaki, Mr. John Kakas, Mrs. Philippa Darius, Mr. Alex Magun, Ms. Mary Norrie, Mr. James Namari, Ms. Kila Tau, Mr. Moses Hatagen Koran, Ms. Mary Phillips, Mr. Nopa Raki, Mr. Geoff Gibaru, Ms. Jean Taviri, Mr. Glen Benny, Mr. Akinori Ito, MPS, Mr. Chiko Yamaoka, Mr. Satoshi Kusaka, Mr. Ryuichi Sugiyama, Mr. Kenichi Jibutsu, Ms. Masako Tsuzuki, Dr. Kotaro Kijima and Representatives from Textbook writers and JICA PNG Office

Curriculum Panel

Mr. Steven Tandale, Assistant Secretary - Chairperson, Mr. Gandhi Lavaki, Mr. John Kakas, Mrs. Philippa Darius, Mr. Anda Apule, Mr. Alex Magun, Ms. Mary Norrie, Mr. Gilbert Ikupu, Mr. John Wek, Ms. Betty Bannah, Ms. Mirou Avosa, Mr. Rupuna Pikita and Ms. Clemencia Dimain

Editorial & Contents Supervisors

Prof / Dr. Masami Isoda, Mr. Satoshi Kusaka, Ms. Kyoko Kobayashi, Mr. Katsuaki Serizawa and Mr. Akinori Ito, MPS, Ms. Mary Norrie, Prof. Hiroki Ishizaka, Prof. Yoichi Maeda and Prof. Takeshi Sakai

Writers & Proofreaders (Curriculum Officers & Textbook writers - Math working group)

Ms. Mary Norrie - Math Working Group Leader, Mr. James Namari, Ms. Kila Tau, Mr. Anda Apule, Ms. Hilda Tapungu, Ms. Ileen Palan, Mr. Armstrong Rupa, Mr. Gibson Jack, Ms. Pisah Thomas and Ms. Michelle Pala

Chief Proofreader, Illustrators, Photos & Desktop Publishing

Ms. Clemencia Dimain (Chief Proofreader), Mr. Micheal John (Illustrator), Mr. David Gerega, Mr. Vitus Witnes (Graphic designers), Mr. Armstrong Rupa, Mr. Gibson Jack, Mr. Satoshi Kusaka, Ms. Yoshiko Osawa and Ms. Michiyo Ueda (Desktop Publishing), Mr. Chiko Yamaoka (Photographer) and Gakko Tosho Co.,Ltd. (Photos and illustrations)

Validation Team (Math working group & Teachers from pilot schools)

Ms. Mary Norrie, Mr. Anda Apule, Ms. Hilda Tapungu, Mr. Gibson Jack Ms. Pisah Thomas, Ms. Aiva Koia, Ms. Lee Kalinoe, Ms. Linda Wami, Mrs. Theresa Paisoi and Ms. Lucy Paul

Cooperation

Japan International Cooperation Agency (JICA), Department of National Planning & Monitoring (DNPM), Bank of PNG, Centre for Research on International Cooperation in Education Development (CRICED) - University of Tsukuba, Naruto University of Education, Gakko Tosho Co.,Ltd. , Gaire Primary School, Iobuna Kouba Primary School, Koki Primary School, Koiari Park Primary School, St. Therese Primary School, Sogeri Primary School and Tubuseria Primary School, South Pacific Post Ltd, QUIS-ME Project Staff; Ms. Rose Leveni, Mr. Samuel Masa, Ms. Angela Koso, Mr. Robert Silovo, Mr. Benstead Talania and Mr. Pascarl Sury

Department of Education

JICA

筑波大学 University of Tsukuba

鳴門教育大学 Naruto University of Education

GAKKO TOSHO CO.,LTD.

IC Net Limited

PADECO


From
the People of Japan