Mathematics

Teacher Guide

Grade 6

Standards Based

Papua New Guinea
Department of Education

'FREE ISSUE
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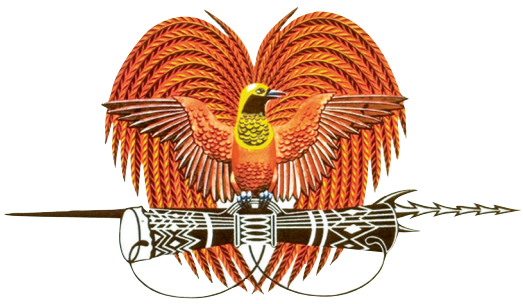

Papua New Guinea
Department of Education

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Secretary's Message

This Mathematics Teacher Guide for Grade 6 was developed as a support document for the implementation of Mathematics Syllabus for grades 6, 7 and 8. It contains sample guided lessons and assessment tasks and rubrics with suggested teaching and learning strategies that teachers can use to work towards the achievement of content standards and benchmarks in the syllabus.

The importance of mathematics curriculum is to ensure that all students will achieve mathematical skills and competencies of the 21st century that will serve them well in their lives and help them to compete locally and globally. The curriculum will engage learners, who are mathematically literate and can think differently and creatively. Mathematics curriculum is vital to support every learner to reach their full potential.

The Teacher Guide reflects the essential knowledge; skills and values that students are expected to know and be able to do at the end of Grade 6. It is designed to promote a firm understanding of practical everyday mathematical concepts, thus raising the standards in mathematics. It also provides an excellent vehicle to train the mind, and to develop its capacity to think logically, abstractly, critically and creatively.

This Teacher Guide is to be used with the grades 6,7 and 8 syllabus for the teaching of mathematics in Grade 6. It is a guide for teachers to deliver the Mathematics content outlined in the syllabus. There are lessons for each day and teachers are expected to follow these throughout the year to ensure students meet the required standards

I encourage teachers to read each section of the guide carefully and become familiar with the content of the subject specified in the teaching and learning and other sections of the guide. I also encourage teachers to try out your own ideas and strategies that you believe will effectively work in your schools for your students.

Teachers are encouraged to make reference to the National Mathematics Text books to effectively plan and teach their lessons.

I commend and approve this Grade 6 Mathematics Teacher Guide to be used in all schools throughout Papua New Guinea.

.....

DR. UKE W. KOMBRA, PhD
Secretary for Education

Introduction

Purpose

This Teacher Guide must be used in conjunction with the Grades 6, 7 & 8 Syllabus. The main purpose is to implement the syllabus in the classroom.

The Teacher Guide provides you with guidelines and directions to help you plan and develop teaching and learning activities for the achievement of Content Standards and Benchmarks. It provides you with information and processes to:

- understand and expand on the relevant knowledge, skills, attitudes and values (KSAVs) provided in this guide
- develop teaching programs based on your school contexts
- plan and develop daily lesson activities
- plan and conduct assessments to monitor students' achievements.

Teachers are required to read carefully and use the guidelines in the Teacher Guide to plan and develop teaching and learning programs. The guide contains the following main components:

- yearly and termly overview which consists of all strands, units, topics and lesson titles
- sample weekly program or timetable
- suggested daily plans which consists of guided lessons and KSAVs
- assessment tasks and rubrics, and
- support resources for use when planning and programming.

How to use this Teacher's Guide

Use this Teacher Guide to help you design your teaching programs, lesson and assessment plans. Therefore, you need to:

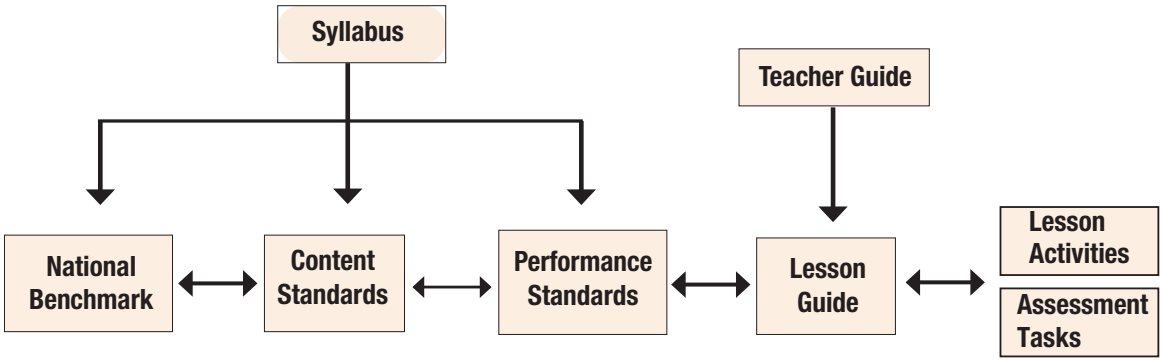
- read this Teacher Guide and the syllabus carefully
- understand the content and what you will require for your classroom teaching
- become familiar with the syllabus strands, units, topics and lesson topics
- read and understand the content standards and benchmarks
- read and understand how the assessment plans and tasks are structured so that you can design appropriate assessment plans
- read and understand the structure and content of sample guided lessons and background information to support you in modification of your lesson.

Link to the syllabus

The Teacher Guide illustrates key parts of the mathematics syllabus. It provides practical ideas about how to use the syllabus and why the teacher guide and syllabus should be used together.
The teacher guide explains ways you can plan and develop teaching, learning

and assessment programs. It includes recommended knowledge, processes, skills and attitudes for each of the content standards in the syllabus and examples of assessment tasks and how to record and report students' achievements.

You are encouraged to select and adapt the strategies and processes illustrated in the guide to meet the needs of your students and their communities.



Time Allocation

Mathematics week for grade 6 is to be timetabled for 240 minutes per. Teachers can use the time allocation to do their timetable or programme according to their school program. Topics and activities may vary in length however; you can plan for double periods of more than 40 minutes
(Refer to Appendix for Sample Timetable)

Key features

The key features found in this Mathematics teacher guide are unique and important in planning, development and implementation of this subject.

Mathematical Process Skills

The five Mathematical process skills that can help the students improve their mathematical thinking.

1. Mathematical Problem Solving

- Understand the meaning of the problem and look for entry points to its solution
- Analyse information (givens, constrains, relationships, goals)
- Make conjectures and plan a solution pathway
- Monitor and evaluate the progress and change course as necessary
- Check answers to problems and ask, “Does this make sense?

2. Mathematical Communication

- Use definitions and previously established causes/effects (results) in constructing arguments
- Make conjectures and use counter examples to build a logical progression of statements to explore and support their ideas
- Communicate and defend mathematical reasoning using objects, drawings, diagrams, actions
- Listen to or read the arguments of others
- Decide if the arguments of others make sense and ask probing questions to clarify or improve the arguments.

3. Mathematical Reasoning

- Make sense of quantities and relationships in problem situations
- Represent abstract situations symbolically and understand the meaning of quantities
- Create a coherent representation of the problem at hand
- Consider the units involved
- Flexibly use properties of operations.

4. Mathematical Connections

- Look for patterns or structure, recognizing that quantities can be represented in different ways
- Recognize the significance in concepts and models and use the patterns or structure for solving related problems
- View complicated quantities both as single objects or compositions of several objects and use operations to make sense of problems

- Notice repeated calculations and look for general methods and short cuts
- Continually evaluate the reasonableness of intermediate results (comparing estimates) while attending to details and make generalizations based on finding.

5. Mathematical Representation

- Apply prior knowledge to solve real world problems
- Identify important quantities and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas
- Make assumptions and approximations to make a problem simpler
- Check to see if an answer makes sense within the context of a situation and change a model when necessary.

Mathematical Activities

Mathematical activities are various activities related to mathematics where students are actively engage in by and for themselves to discover the properties of Number and geometrical figures based on what they have learned and apply them in their life and further studies.

Mathematical activities are usually done through problem solving with rich mathematical thinking which includes various questioning on problem situations such as for finding methods and better ideas in solutions. it also includes explanations for sharing ideas with various representations such as changing / translating representations to find the beautiful and reasonable pattern.

Mathematical activities are easily done if students acquire the fluency for operations and reasoning. They are necessary for developing mathematical thinking and proficiency, providing opportunities for students to feel the joy of thinking and learning, utilizing and appreciating mathematics in their lives.

Through the reflection of mathematical activities student are possible to appreciate the value of mathematics such as simple, easier, reasonable, general, and beautiful and harmony.

You can incorporate these activities into your lessons to have the mathematics lessons become;

- More students centered activities and more proactive with rich content.
- More fun to students.
- Easier to understand by students.
- More compelling and elaborative.
- More innovative with various discussions
- Creative and exploratory.
- Connected to daily life and natural phenomena.
- Easier to think about activities that relate to other subjects and Integrated Study.

Grade 6 Mathematical Activities

Activities / Experience	In learning each content of Numbers, Operation and Computation, Geometrical, Measurement and Transformation, Patterns and Algebra and Statistics and Probability", and in learning the connections of these contents, students should be provided the opportunities doing mathematical activities to;
Performance Activities	a. Explore and explain the meaning of calculation of fractions and ways of the calculation by using words, numbers, algebraic expressions, figures, diagrams and number lines. b. Find units of quantities used in everyday life and investigate how they are related to the units that pupils have learned before. c. Find reduced figures, enlarged figures and symmetric figures in everyday life. d. Find two numbers/quantities that are in proportional relationships in everyday life and solve problems by using the proportional relationships.

Teaching and Learning Strategies

Teaching Strategies

Teaching strategies guide the teacher to teach the lesson content with appropriate learning strategies. Effective learning and acquisition of knowledge, skills, attitudes and values by students in a lesson is achieved through demonstrating appropriate teaching strategies.

It is therefore required that teachers identify and apply the best teaching strategies to deliver the content in the classrooms.

KWL Chart

To help students to build on what they already know, ask them to use a KWL (Know, Want, Learned) strategy when they work on a topic or theme. An example is given below for the theme Traditions, Customs and Festivals.

K (what I already know)	W (what I want to know)	L (what I have learned)
What I know about Relative Amounts	What I want to know about Base Amounts	What I have learned about Comparative Amount

Apply the following steps when using the KWL strategy:

1. Organize the students into small groups.
2. Tell the students the lesson topic.
3. In small groups ask the students to list what they already know about the topic.
4. Get the groups to share their ideas with the class as a whole.
5. Ask the students to list what they want to know about the topic.
6. Students complete the first two columns before they start the topic and the third column is completed at the closure of the unit, topic or lesson.

Way of teaching and delivery of Mathematics lessons

The new curriculum promotes the competencies in Interest/Motivation/Attitude, Knowledge and Understanding, Skills and Mathematical Thinking that is specified clearly each guided lessons.

The method of delivery of Mathematics is student oriented through the process of problem-based approach. In this SBC teaching method of mathematics the students are given the opportunity to think and derive ideas by themselves about the task (problem) and be able to improve their way of thinking mathematically.

Delivery methods of mathematics lessons

1. Situation oriented lesson conceptualizing is situation oriented or problem based

2. Encourage to deriving operations/ideas Opportunity is given for students to derive ideas or operations by themselves

3. Allow for thinking of ways to calculate
   Students to think of ways to calculate by themselves

4. Conclusion using students' ideas
   Lesson conclusion should come from student's viewpoints, and use these ideas for understanding new concepts

5. Practice for consolidation
   Practice similar exercises for affirmation of their understanding of the concept learned in the lesson.

Learning strategies

The students should develop the ability to recognize and categorize situations critically, provide rationale reasoning, constructively solve problems, apply knowledge intelligently, and communicate effectively. Special consideration and more emphasizes must be given to identifying suitable learning strategies which encourage high student participatory learning.

Students' way of learning Mathematics

Steps of conceptual understanding through problem solving approach.

i. Emphasis on understanding meanings
   Students should look at task (problem) given, understand the task, and try to express what the task is.

ii. Thinking how to calculate
   Students think how to solve the tasks, and share ideas of how to solve the problem, and obtain the answer of the problem.

iii. Emphasis on expression and explanation (Reasoning)
   Students conclude and understand new concept from the way they solved the problem.

Planning and Programming

Yearly and termly overview

Teachers are encouraged to use this yearly and termly overview and yearly lesson overview to develop the weekly plans.

Term	Strand	Units	Topics
1	Number and Operation	Review of relationship	Fraction, decimal and percentage
	Geometrical Figures	Symmetry	Figures with line symmetry
			Figures with point symmetry
			Polygons and symmetry
		Unit checkpoint	Review on symmetry
	Data & Mathematical Relations	Mathematical symbols & expressions	Expression with symbols
			Reading expressions
		Unit checkpoint	Review on mathematical symbols & expressions
	Number and Operation	Multiplication of Fractions	Calculation of fraction x fractions
			Inverse numbers
		Unit checkpoint	Review on multiplication of fractions
2		Division of fractions	Calculation of fractions ÷ fractions
			What kind of expression will it become?
		Unit checkpoint	Review on division of fractions
	Data & Mathematical Relations	Multiples and ratios	Multiples and ratios
	Number and Operation	Calculation of decimal and fraction number	Calculation of decimals
			Calculation of fractions
			Mixed decimal and fraction calculation
		Unit checkpoint	Review on calculation of decimal and fraction number
	Quantities & Measurement	Calculating the area of various shapes	Area of circle
			Approximate area
		Unit checkpoint	Review on calculating the area of various shapes
	Data & Mathematical Relations	Order and combination	Ordering
			Combination
		Unit checkpoint	Review on order and combination

Term	Strand	Units	Topics
3	Quantities & Measurement	Speed	Speed
			Speed and graph
		Unit checkpoint	Review on speed
		Volume of prisms and cylinders	Volume of prism
			Volume of cylinder
		Unit checkpoint	Review on volume of prisms and cylinders
	Data & Mathematical Relations	Ratio and the application	Ratio
			Equal ratio
			Application of ratio
		Unit checkpoint	Review on ratio the application
	Geometrical Figures	Enlarge and reduced figures	Enlarging and reducing figures
			How to draw enlarged and Reduced drawings
			Uses of reduced drawing
		Unit checkpoint	Review on enlarge and reduced figures
4	Data & Mathematical Relations	Proportion and inverse	Proportion
			Graph of proportion
			Using the properties of proportion
			Inverse proportion
		Unit checkpoint	Review on proportion and inverse
		How to explore data	Mean
			How to explore distribution
		Unit checkpoint	Review on how to explore data
	Quantities & Measurement	Quantity and unit	How to represent quantity
			Units of length
			Units of area
			Units of volume
			Units of weights

Yearly Lesson Overview

Yearly and termly overview

Teachers are encouraged to use this yearly and termly overview and yearly lesson overview to develop the weekly plans.

Strand	Units	Topics	Lesson No.	Lesson titles
Number and Operation	Review of Relationship	Fraction, Decimal & Percentages	1	Fraction, decimal, percentage
			2	Solve simple word problems
Geometrical Figures	Symmetry	Figures with Line Symmetry	3	Figures with line symmetry
			4	Properties of figures with line symmetry
			5	How to draw figures with line symmetry
		Figures with point Symmetry	6	Figures with point symmetry
			7	Properties of figures with point Symmetry
			8	How to draw figures with point Symmetry
			9	Symmetric figures around me
		Polygons and Symmetry	10	Polygons with line and point symmetry
			11	Regular polygon and Symmetry.
		Unit Checkpoint		Review on symmetry
Data & Mathematical Relations	Mathematical Symbols & Expressions	Expressions with Symbols	12	Expressions with symbols
			13	Let's calculate total
		Let's Put Numbers into Expressions	14	Finding the value of x (1)
			15	Finding the value of x (2)
			16	Finding the value of x (3)
			17	The sum of angles in polygons
		Reading Expressions	18	Reading mathematical expressions
		Unit Checkpoint		Review on mathematical symbols & expressions
Number and Operation	Multiplication and Division of fraction	Calculation of Fraction x Fractions	19	Meaning of multiplication of fractions
			20	Ways in how to calculate fraction x Fraction
			21	Multiplication of whole number by fraction
			22	Multiplication of mixed fraction
			23	Rules of calculation with fractions
		Inverse Numbers	24	Meaning of inverse numbers
		Calculation of Fractions ÷ Fractions	25	Meaning of division of fraction
			26	Ways in how to calculate Fraction ÷ fraction
			27	Division of mixed numbers
			28	Solve problems of divisions of fractions

Strand	Units	Topics	Lesson No:	Lesson titles
		What kind of Expression will it Become	29	What kind of expression to use
		Unit Checkpoint		Review on multiplication & division of Fraction
Data & Mathematical Relations	Multiples and Ratios	Multiples and ratios	30	Comparing two quantities
			31	Ratios represented by a fraction (1)
			32	Ratios represented by a fraction (2)
Number and Operation	Calculation of Decimals and Fractions	Calculation of Decimals	33	Solving decimal number problems (1)
			34	Solving decimal number problems (2)
			35	Solving decimal number problems (3)
		Calculation of Fractions	36	Solving fraction problems (1)
			37	Solving fraction problems (2)
			38	Calculation of time with fraction
			39	Calculation mixed decimal and fraction
Quantities and Measurement	Calculating the area of various shapes	The area of a circle	40	Finding area of circle
			41	Finding formula for area of circle
			42	Calculate area of circle (1)
			43	Calculate area of circle (2)
		Approximate area	44	Calculate approximate area of figure
		Unit checkpoint		Review on calculating area of various shapes
Data & Mathematical Relations	Order and combination	Ordering	45	Ordering (1)
			46	Ordering (2)
		Combinations	47	Combinations (1)
			48	Combinations (2)
		Unit checkpoint		Review on order and combination
Quantities and Measurement	Speed	Speed	49	How to express speed
			50	Correlation among speed and time
			51	Finding distance and time
		Speed and graph	52	Speed and graph
		Unit checkpoint		Review on speed
	Volume of prisms and cylinders	Volume of prism	53	Finding formula for volume of prism
			54	Finding volume of prisms
		Volume of cylinder	55	Finding formula for volume of cylinder
			56	Compare volume of cylinder and Pyramid
		Unit checkpoint		Review on volume of prisms and Cylinders

Strand	Topics	Sub-topic	Lsn #	Lesson Titles
Data & Mathematical Relations	Ratio and the Application	Ratio	57	How to express ratio
			58	How to find value of ratio
			59	Properties of ratio
			60	Finding equal ratio
			61	How to simplify ratio
		Application of Ratio	62	Solving ratio problems
			63	Dividing by ratio
		Unit Checkpoint		Review on ratio and the application
Geometrical Figures	Enlarged and Reduced Drawings	Enlarged and Reduced Figures	64	Understanding similar figures
			65	Features enlarged and reduced figures
			66	Ratio of enlarged and reduced drawings
		How to draw enlarged and reduced drawings	67	Drawing enlarged and reduced figures
			68	Drawing enlarged figure
			69	Drawing reduced figure
			70	How to draw using centre point (1)
			71	How to draw using centre point (2)
		Uses of Reduced Drawings	72	Application of reduced drawings
		Unit Checkpoint		Review on enlarged and reduced Drawings
Data & Mathematical Relations	Proportion and Inverse Proportion	Proportion	73	How two numbers of object change in a related manner
			74	Direct proportion (1)
			75	Direct proportion (2)
			76	Direct proportion (3)
			77	Mathematical sentence of proportion (1)
			78	Mathematical sentence of proportion (2)
			79	Mathematical sentence of proportion (3)
		Graphs of Proportion	80	Making graphs of proportion
			81	Relationships of proportional graph
		Using the Properties of Proportion	82	Use proportion to solve problems (1)
			83	Use proportion to solve problems (2)
			84	Application of proportion
		Inverse Proportion	85	Understanding inverse proportion
			86	Mathematical sentence of inverse proportion
			87	Graph of inverse proportion
		Unit Checkpoint		Review on proportion and inverse proportion

Strand	Topics	Sub-topic	Lsn #	Lesson Titles
	How to Explore Data	Mean	88	Comparing data
			89	Finding the mean
		Distribution	90	Comparing distribution of 2 sets of data
			91	Organising data on frequency table
			92	Organising data on histogram
			93	Data on frequency table and histogram
		Unit Checkpoint		Review on how to explore data
Quantities and Measurement	Quantity and Unit	Represent Quantity and units	94	Representing quantity
			95	Units of length
			96	Units of area
			97	Units of volume
			98	Units of weight
		Unit Checkpoint		Review on quantity and unit

Content Background

Strand: Number, Operation and Transformation

1. Relationship of Fraction, Decimal & Percentages, and ratio

Percentage, decimals, and fractions are 3 different ways to describe the same amount. For example, one half can be described as 50% (a percent), 1/2 (a fraction), or 0.5 (a decimal). This lesson will show you how to convert back and forth between the different forms.

Changing Percentage to Decimals

The word percent means "per 100." 20% means 20 out of 100, or 20/100. 67% means 67 out of 100, or 67/100. So to change a percent to a decimal, you simply divide the percentage number by 100. When you divide by 100, the decimal just moves over 2 places to the left.

Changing Percentage to Fractions

Remember, the word percent means "per 100." This means you can change a percent to a fraction by dividing by 100. Look to see if the numerator and denominator can be divided by the same number. If the percent is a decimal, it takes an extra step to simplify the fraction. To get rid of the decimal, you will need to multiply the numerator and denominator by a power of 10 to move the decimal over first. Once you do this, you can simplify the fraction like normal.

Changing Decimals to Fractions

First, figure out the place value of the last digit on the right. Is it in the tenths place? Hundredths? Thousandths? Use the place value to write the decimal as a fraction over 10, 100, 1000, etc. Then simplify the fraction if possible. Remember, the first place to the right of the decimal is the tenths place. The second place is the hundredths, then thousandths, ten thousandths, and so on.

Changing Decimals to Percentage

Remember, a percent means "per 100." For example, 35% means 35 out of 100. This can be written as the fraction 35/100. We can go the other way around and rewrite the fraction as a percent. If we have 28/100, that means 28 out of 100, which is the same as 28%. If we can get the decimal written as a fraction with 100 as the denominator, the top number will be the percent. Decimal as a fraction first if you want to change it to a percent. You might have to multiply or divide the numerator by a power of 10 if your decimal doesn't end at the hundredths place.

Changing Fractions to Decimals

The easiest way to change a fraction to a decimal is to use a calculator. You simply divide the numerator by the denominator.

Changing Fractions to Percentage

There's more than one way to change a fraction to a percent. You could try to rewrite the fraction with 100 as the denominator, but this might be difficult if your denominator isn't a factor of 100. The fastest and easiest way is probably to use a calculator to change it to a decimal first and then move the decimal over 2 places to the right to change it to a percent.

2. Calculations of Fraction and Decimal Number

The main objective of grade 6 is for students to think about how to multiply and divide in cases where the multiplier or divisor is a fraction and actually be able to perform the calculations.
As for calculating fractions, teach by starting with proper fractions, and also include improper fractions and mixed fractions. Avoid teaching unnecessarily complicated calculations. It is important to teach in a way that students can value and utilize the calculations of fractions in their everyday life and future studies. Help students become aware of the fact that multiplication and division of fractions are much easier to carry out if you use improper fractions and not mixed fractions.

a. The meaning of multiplication and division when the multiplier or divisor is a fraction.

In grade 6, based on the idea of calculation of whole numbers and decimal numbers taught so far, students are expected to understand multiplication and division when the multiplier or divisor is a fraction. The meaning of multiplication can be expressed as such: If B is the base quantity, P is the relative value, and A is the corresponding quantity that has the specified relative size with respect to B, their relationship can be represented by $B \times P = A$. The meaning of division can be thought of as the inverse of multiplication: finding the relative value or finding the base quantity.

b. Multiplication and division of fractions

Students are expected to think about and be able to carry out multiplication and division with fractions based on the multiplication and division of whole numbers or decimal numbers, or multiplication and division of fractions where the multiplier or divisor is a whole number.

A multiplication or division of fractions can be carried out by changing it to a multiplication or division that was discussed previously by applying the properties discussed in the next section

(c). Students can use the number line or diagrams to think about how to perform those calculations. This is discussed in Mathematics Activities (1) - a.
For reciprocal discussed in note (1) of "Handling the Content," the fact that division can be converted to multiplication by the reciprocal of the divisor is taught.

For *example,* since the reciprocal of the divisor in $\frac{2}{5} \div \frac{3}{4}$ is $\frac{4}{3}$, this division can be rewritten as $\frac{2}{5} \times \frac{3}{4}$. Representing multiplication and division of whole numbers and decimal numbers using fractions is also taught.

For *example,* $5 \div 2 \times 0.3 = \frac{5}{1} \times \frac{3}{4} \times \frac{3}{10} = \frac{5 \times 1 \times 3}{1 \times 2 \times 10}$

c. Properties of multiplication and division with fractions

Students will examine properties of multiplication and division that hold for whole numbers and decimal numbers also hold for fractions. The properties to be investigated are not limited to commutative, associative and distributive properties. In addition, students will examine the property of multiplication that when the multiplier becomes 2, 3, 4 times as much, the product also becomes 2, 3, 4, times as much and the property of division, that when the dividend and the divisor and the divisor are multiplied or divided by the same number, the quotient does not change. For example, when dividing fraction, we can utilize the properties of division and O

$\frac{2}{5} \div \frac{3}{4}$ as $\frac{2}{5} \div \frac{3}{4} = \left(\frac{2}{5} \times 4\right) \div 3 = \frac{2 \times 4}{5 \times 3} = \frac{8}{15}$

We can also think of it as

$\frac{2}{5} \div \frac{3}{4} = \left(\frac{2}{5} \times \frac{4}{3}\right) \div \left(\frac{3}{4} \times \frac{4}{3}\right) = \left(\frac{2}{5} \times \frac{4}{3}\right) = \frac{2 \times 4}{5 \times 3} = \frac{8}{15}$

It is important to cultivate the mathematical thinking such as logical thinking through these teachings.

Strand: Geometrical, Measurements and Transformation

1. Calculating the Area of Various Shapes

Approximate shapes and estimated area

The objective of grade 6 is to help students master measurements and be able to measure efficiently according to a purpose, using estimation and other techniques, by actually measuring a variety of objects.

When measuring the area or volume of an object around them, students may notice that the object does not necessarily have a basic shape. In such a case, they may approximate it as a triangle or a rectangle, or divide it into several basic shapes. If the object they want to measure is a solid shape, they may approximate it as a cube or a rectangular parallelepiped, or divide it into those shapes. Approximation plays an important role here.

Students need to enrich their experiences with these processes by thinking about not only regular shapes but also about objects around them.
When calculating with measured values, make sure students understand that using too many digits is meaningless and help students calculate appropriately according to the objectives

Area of a circle

In the previous grade, students learned how to determine the area of shapes such as triangles and quadrilaterals that are surrounded by straight lines. Students also learned that the circumference of a circle is represented by (diameter) × π. In grade 6, students are taught how to think about determining the area of a circle - a geometrical figure surrounded by a curve.

(a) Ways to determine the area of a circle

When thinking about how to determine the area of a circle, it is important to first estimate the area. Looking at the diagram at right, it is clear that the area of a circle is somewhere between 2 and 4 times as large as the area of a square whose side is the length of the radius of the circle. There are several ways of thinking about how to determine area. For *example:*

Draw a circle on a grid paper, and determine the area by counting the squares in the circle.
The diagram at right shows a circle with a radius of 10 centimetres drawn on 1 centimetre grid paper. (The diagram shows only 1/4 of the actual circle.)

As shown at right, equally divide a circle and rearrange the resulting shapes to make a parallelogram-like shape, and determine the area of a circle.
In this case, the more finely you divide a circle, the closer the shape will be to a parallelogram with the

base that is half of the circumference and the height that will be the radius of the original circle. Hence, the area of a circle can be represented by the following expressions:
(area of circle) = (area of parallelogram) = (circumference) ÷ 2 × (radius)
If you use *(circumference) = (diameter)* × π, then :
(area of circle) = (diameter) × π ÷ 2 × *(radius)= (radius)*× *(radius)* × π

Note (2) pi "3.14 should be used for."
This is because if one uses 3.14, it is sufficient for general use in daily life and studies.

Volume of prisms and cylinders

Students were previously taught about the volume of cubes and rectangular parallelepipeds. They also learned prisms and cylinders as basic solid shapes in grade 5. The base of prisms and cylinders are triangles, quadrilaterals, circles, etc. They learned how to determine area of triangles and quadrilateral in grade 5, and how to determine area of circles in grade 6. The objective of grade 6 is for students to be able to determine the volume of prisms and cylinders. It is also necessary to consider deepening students' understanding of prisms and cylinders as geometrical figures.

(a) Determining volume of prisms and cylinders
The main objective here is for the students to understand that the volume of prisms and cylinders can be determined by calculation based on the ways of determining the volume of cubes and rectangular parallelepipeds taught in grade 5.
When determining the volume of cubes and rectangular parallelepipeds, first we thought about the volume of solid shapes whose height is 1 centimetre, then we multiplied that volume by the number corresponding to the height, and thereby derived the formula for volume. We can use this method to determine the volume of prisms and cylinders. By analogy from the formula for determining volume of rectangular parallelepipeds, we can derive the formula for determining the volume of prisms and cylinders. First, we note that (*length*) × *(width)* in the formula for rectangular parallelepipeds corresponds to (area of the base):

(volume of rectangular parallelepiped) = (length) × (width) × (height) = (area of the base) × (height)

Based on this, students are expected to understand that the formulas for determining the volume of prisms and cylinders can be generalized as:
Volume of Prisms and Cylinders = (area of the base) × (height)

2. Speed

In grade 5, the ratio of two quantities of different types, such as crowdedness and population density, was taught.
In grade 6, speed, which is the ratio of two different quantities, is taught. For speed, students have heard people say fast or slow referring to the speed of someone running or a moving vehicle.

Two quantities - the distance travelled and the time needed - are necessary to express speed as a quantity.

If we consider speed as an amount of distance travelled during a unit time, it can be expressed as (speed) = (distance) ÷ (time). For *example,* 60 kilometres per hour means the speed for traveling 60 kilometres in one hour. In our daily life, speed is sometimes thought of as the time required to travel a particular distance.

For *example,* in a 100-meter sprint, speed is indicated by the time required to run 100meters. The shorter the time, the faster the speed. If we think of speed as a distance travelled in a unit time, the faster the speed, the larger the value. If we think of speed as time needed to travel a unit distance, the faster the speed, the smaller the value.

Since speed can be expressed by the algebraic expression
(speed) = (distance) ÷ (time), speed can be determined by distance and time. Also, distance can be determined by speed and time, and time can be determined by speed and distance. It is important to connect speed with actual situations so that students can utilize it in their daily life and study.

3. System of metric units

By the end of grade 5, students understood the meaning of quantities such as length, weight, area, volume, time, and angle, and became able to measure them. The objectives of grade 6 are to summarize the metric system and its units, for students to deepen their understanding of it, and for them to be able to use metric units effectively in measuring.

The characteristics of the metric system are that the units follow the structure of the base -10 numeration system, and that derived units are formed based on the basic units. In the metric system, units are made by adding prefixes to the basic units, as shown in the following table:

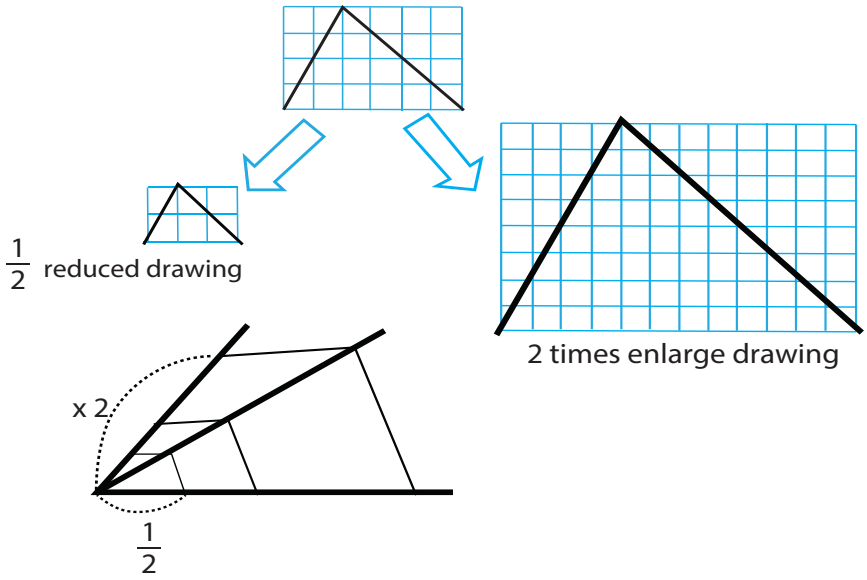
Milli - (m)	Centi - (c)	Deci - (d)		Deca - (da)	Hecto - (h)	Kilo -(k)
$\frac{1}{1000}$	$\frac{1}{100}$	$\frac{1}{10}$		10 times	100 times	1000 times

Though there are units in this chart that are seldom used in our country [Japan], the metric system can be summarized based on these prefixes.
For units of area and volume, derived units are based on the unit of length and they are summarized in the table below:

Unit of length	1 cm	(10 cm)	1 m	(10 m)	(100 m)	1km
Unit of Area	1 cm^2	(100 cm)	1 m^2	(100m^2)	(100a)	1km^2
Unit of volume	1 cm^3 1 ml	(100 cm^3) 1l	1 m^3 1 kl			

4. Reduced and enlarged figures and symmetric figures

In grade 5, students learned about congruency and considered geometrical figures from this viewpoint. In grade 6, reduced and enlarged figures are taught. The objectives of this grade are to enrich students' experience so it will provide the foundation for understanding similarity, and to help them become able to draw and interpret scaled drawings appropriately, according to a purpose. When the shape and the size of two figures are the same, these two figures are said to be congruent. Reduced or enlarged figures have the same shape regardless of their size. The measures of corresponding angles of scaled figures are equal, and the ratio of the lengths of the corresponding sides of scaled figures is constant. When actually drawing scaled figures, sometimes we scale vertically and horizontally using grid paper, and sometimes we scale the lengths of the sides or diagonals from one vertex, as shown in the figure below. Students are expected to understand the meaning and characteristics of scaled figures by actually drawing these kinds of figures.



5. Symmetric figures

Students are expected to consider geometrical figures they previously learned from a new perspective of symmetry, and to deepen their understanding of geometric shapes. For symmetry, we examine a shape from the viewpoints of line symmetry and point symmetry.

Line-symmetric figures are shapes that overlap exactly when folded along a certain line. The folding line perpendicularly bisects all segments that connect corresponding points of the figure.

Point-symmetric figures are figures that exactly overlap when rotated 180 degrees around a point. All segments that connect the corresponding points of a figure run through the centre of symmetry and are bisected by this point.

It is important to understand the meaning of line symmetry and point symmetry through such activities as observation and drawing, and to deepen the ways of viewing geometrical figures by distinguishing line-symmetric figures, point-symmetric figures, and figures that have both line and point symmetry. When looking at triangles from the viewpoint of line symmetry, one can grasp that isosceles triangles and equilateral triangles are line-symmetric figures. When quadrilaterals are examined from the viewpoint of point symmetry, parallelograms, rhombuses, rectangles, and squares are point-symmetric figures.

Students began to learn about symmetry in lower grades when they studied geometrical figures. For example, when they learned about isosceles triangles in grade 3, they learned that an isosceles triangle exactly overlaps when folded by the perpendicular bisector of the base. In this way, students focused on symmetry through concrete manipulation. In grade 6, students are taught to focus on the beauty of balance, stability, and general beauty of geometrical figures through activities such as observation and drawing.

To experience and understand that symmetric figures are used in their daily life by finding them in their surroundings. Symmetric figures like the ones in tiled figures and tiled patterns can be found in the beauty of balanced figures in everyday life. Symmetric figures can be found anywhere, such as in plants and animals, accessories, patterns, map symbols or prefecture marks. It is important to utilize activities involving finding symmetric figures.

Strand: Patterns and Algebra

1. Ratios

When comparing the size of two quantities and representing their proportions, we sometimes use a pair of simple whole numbers to represent this without using a unit quantity. This is called ratio. Students learned the foundation of ratio when they learned multiplication, fractions, and proportional relationships. In grade 6, the representation of ratio in the form of a : b is introduced, and students will understand ratio. When teaching, consideration should be taken so that students understand when ratios are equal and what the equality of ratios means by examining concrete situations. For *example,* suppose you mixed two different kinds of liquid, three cups for one and five cups for the other. If you want to mix these two kinds of liquid to get a liquid of the same concentration, the ratio of the two kinds of liquid should stay the same — such as 6 cups for one and 10 cups for the other or 9 cups for one and 15 cups for the other. From this fact, help students to understand that 3:5 is equal to 6 : 10, 9 : 15 or 1.5 : 2.5..

Ratio is used in various aspects of our daily life. When teaching, use ingenuity and incorporate activities such as finding places where ratio is used in daily life or utilizing ratio to handle things. Also, since ratio is related to proportional relationships, inverse proportional relationships, and scaled drawing, it is necessary to endeavour that the study of each of these topics deepens students' understanding of the others.

2. Proportional Relationships

The objective of grade 6 is to enhance students' ability to think about and reason with functions as a way to summarize the viewpoints of quantitative relations taught so far, through examinations of co-varying quantities with a focus on proportional relationships.

a. Proportional relationships in algebraic expressions, tables, and graphs

Proportional relationships have the following characteristics:

(a) Suppose there are two quantities, A and B; if one of them becomes 2, 3, 4, … times as much, or 1/2,1/3,1/4, times as much, the other changes in the same way and becomes 2, 3, 4, …. times as much, or 1/2,1/3,1/4, times as much.

(b) Generalizing (a), when one of two quantities becomes m times as much, the corresponding quantity of the other also becomes m times as much.

(c) The quotient of two corresponding quantities remains constant.

Through grade 5, in regard to the relationship between two quantities that vary simultaneously, teaching focused on examining how quantities corresponded and changed by using tools such as tables. Particularly, in grade 5, proportional relationships in simple cases were taught.

In grade 6, in order to summarize the relationship between two quantities, a relationship with the characteristic described in (a) is defined as a proportional relationship. It is important to incorporate activities such as representing two quantities that vary simultaneously in everyday life using tables, etc. and identify proportional relationships by examining the characteristics of change.

For students, it is not necessarily easy to generalize (a) in the form of (b). Therefore, it is important to incorporate activities such as actually examining various numerical values from tables so that students can become aware of the viewpoint in (b).

The characteristic described in (c), focusing on the quotient of two corresponding values, is effective when examining whether two quantities are in a proportional relationship from the viewpoint of functional relationships.
It is necessary to teach students so that they understand this way of examining correspondence.

An algebraic expression that represents the proportional relationship, if the quotient in (c) is k,is $y = k \times x$.

Generally speaking, a graph that represents a proportional relationship is a straight line passing through the origin. This is an important characteristic used to distinguish proportional relationships. Here, it is important to teach students using concrete numbers, and through the activities such as representing on a graph two quantities that vary simultaneously so that they understand that if two quantities are in a proportional relationship, the graph representing this relationship is a straight line.

b. Solving problems using proportional relationships

In grade 6, multiplication, fractions, ratio, and proportional relationships are summarized from the perspective of proportional relationships, and students will deepen their ability to think about and reason with functions by using proportional relationships to solve problems.

Provide situations where proportional relationships are used effectively, and help students appreciate the value of using proportional relationships to solve problems efficiently, and foster their attitude to willingly use proportional relationships when solving everyday problems.

c. Inverse proportional relationships

The objectives are to know about inverse proportional relationships and to deepen one's understanding of proportional relationships. Inverse proportional relationships have the following characteristics:

a. Suppose there are two quantities A and B; if one of them becomes 2, 3, 4, … times as much, or 1/2,1/3,1/4,E times as much, the other changes in the same way and becomes 2, 3, 4, …. times as much, or 1/2,1/3,1/4,E times as much.

b. Generalizing the characteristic in (a), when one of the two quantities becomes m times as much, the corresponding quantity of the other becomes 1/m times as much.

c. The product of the two corresponding quantities remains constant.

When teaching, it is important to compare and contrast proportional relationships and inverse proportional relationships. For inverse proportional relationship graphs, have students plot several points that satisfy the inverse proportion relationships or show teacher-made graphs so that students can examine the change.

3. Algebraic expressions with letters

This topic is the study of Algebraic expressions with letters and focused on helping students deepen their understanding of algebraic expressions that represent the relationships of two numbers/quantities, and to use the algebraic expressions.

In this study the students are able to represent relationships in algebraic expressions by using letters such as "a" and "x" instead of symbols such as Δ, □ and so on, and to explore the relationships by substituting numbers for the letters.

The objectives of grade 6 are to deepen the understanding of algebraic expressions that represent quantitative relations, and to be able to use algebraic expressions to represent such relationships, and to interpret them in Algebraic expressions with letters such as a and x

In grade 4, students learned to use symbols such as Δ, □ in algebraic expressions to represent relationships among numbers and quantities, and to investigate their relationships by substituting numbers for the symbols.
In grade 6, based on what was taught in grade 4, letters such as x and a are used instead of words or symbols like Δ, □,etc., and students are expected to gradually become accustomed to using letters.

In the lower secondary school, letters are used extensively. For a smooth transition to lower secondary school mathematics, it is important to cultivate a foundation for appreciating the merits of using literal symbols like a and x, such as conciseness. When teaching, first make sure that students understand the use of Δ and □, and then help students use a or x in place of Δ, or □. Consideration should be taken so that students understand, through activities such as substituting numbers in letters, that not only whole numbers but also decimal numbers and fractions can be substituted, and that they can think in terms of an expanded range of numbers.

Strand: Statistics and Probability

1. Analysing Data

a. Mean

Students learned about the mean of measured values in “B. Quantities and Measurement”-(3) in grade 5. Based on this, in grade 6 students are expected to understand the mean as a representative value of data, and deepen their understanding of mean. When data are scattered over a range, the mean is often used to represent the entire data in order to grasp the tendency of the data. In grade 6, based on the idea of evening out data when there are several values, the mean is taught as a representative value of a group when there are several values.
Also, teach that distribution is another characteristic of data sets. It is necessary for students to understand that, even if the mean is the same, the characteristics of data differ if the data are concentrated or dispersed.
To help students understand this, it is important to incorporate activities where students devise different ways to represent data such as by recording values on a number line.
It is important to consider enhancing students’ ability to examine and represent things around them statistically using the mean.

b. Tables and graphs representing frequency distribution

Teach students that frequency tables and histograms are good methods for representing the overall distribution and characteristics of the data when they are scattered over a range, and help them to draw and interpret them. A frequency table is a table in which the range of a variable is divided into several intervals (called categories), and each interval and its frequency is displayed, so that investigation of how the data are distributed becomes easy.

For the histogram, it is enough to understand it as comprising rectangles for each category with the horizontal dimension as the interval and the vertical dimension as the frequency. An important idea of statistical manipulation is the organization of data according to a purpose. How well data are sorted and organized - for *example,* how wide an interval is - greatly influences how easily the tendencies and characteristics of the data can be grasped; therefore, consideration should be taken in these areas as well.

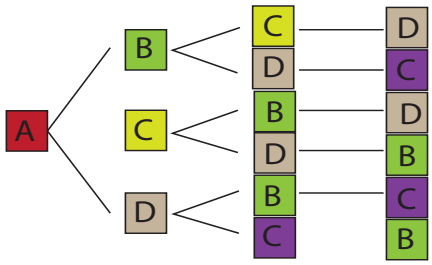
2. Possible Outcomes

Ordering and Combination

The objectives of grade 6 are to observe all possible cases from appropriate points of view, to sort and organize them, and to list them in order, based on grade 5 activities of classification and organization. "Analyse all the possible outcomes systematically" means to organize them in order - rather than randomly,which may easily cause omissions or duplications - so that all possible outcomes are clearly and correctly shown. When teaching, an emphasis should be on systematic analysis rather than obtaining the total number of outcomes. It is necessary to take consideration to foster the attitude to systematically examine the events, avoiding omissions or duplications, by representing them using diagrams and tables.

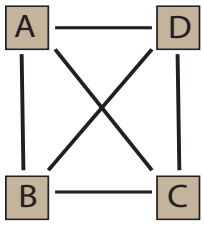
For *example,* think about arranging 4 people in a line. First, think about a case where A is at the head of the line. If B lines up second, then the third is either C or D. Then think about a case where C comes second, and then think about a case where D comes second. It becomes clear from the following diagram that there are 6 cases in which A comes first. Since there are also cases where B, C, and D come first, one can conclude from the diagram that there are 24 possible arrangements.

A - B - C - D
A - B - D - C
A - C - B - D
A - C - D - B
A - D - B - C



When thinking about all possible matches among four teams, a diagram or a table such as the ones below permits one to investigate all the possible combinations without omissions or duplications.

A - B
A - C
A - D
B - C
B - D
C - D



	A	B	C	D
A				
B				
C				
D				

In this way, it is important for students to become able to use tables and diagrams appropriately and to think logically according to the conditions. It is also important to experience and understand that representing names concisely by using symbols is effective for systematic sorting and organizing.

Mathematics Grade 6

Guided Lessons

Lesson No: 1 to 98

LO1: Converting Fractions, decimals and percentage

Fraction, Decimal & Percentages

Lesson Objective: To use different ways of convert between fractions, decimals and percentages **(6.1.1.1)**
Materials: A4 grid paper, pencils, rules (30cm),blackboard

ASK-MT and Assessment	
Attitudes/Values	Appreciate the use the fractions, decimals and percentage in everyday life Situations.
Skills	Convert between fractions, decimals and percentage and vice versa.
Knowledge	Use of fractions, decimals and percentage in everyday life situations.
Mathematical Thinking	Think about ways to convert fractions, decimals and percentage to Understand their relations.
Assessment	Use the key concepts below to assess the students learning progress during the lesson

Teaching and Learning Activities

1 Lets write these fractions as decimals and as percentages

(a) $\frac{1}{5}$ (b) $\frac{3}{8}$

Expected Ideas

1. Find an equivalent fraction by multiplying the numerator and denominator by same number

$$\frac{1}{5} \overset{\times 20}{=} \frac{20}{100} = 20\%$$

$$\frac{3}{5} \overset{\times 20}{=} \frac{37.5}{100} = 60\%$$

2. Divide numerator by the denominator of a fraction

$$\frac{3}{8} = 3 \div 8 = 0.375 \qquad \frac{3}{5} = 3 \div 5 = 0.60$$

The process can be reserved using opposite operation for converting

Exercises

Convert the fractions, percentages and decimals.

(1) $\frac{3}{11}$ to percentage and decimal (2) 12.5 % to fraction and decimal

(3) 0.87 to fraction and percentage

LO2 : Solve simple word problems

Lesson Objective: Solve simple problems involving fractions, decimals and percentage **(6.1.1.2)**
Materials: Blackboard

ASK-MT and Assessment	
Attitudes/Values	Be able to appreciate the use the fractions, decimals and percentage in everyday life situations.
Skills	Be able to convert between fractions, decimals and percentage and vice versa.
Knowledge	Be able to understand use the fractions, decimals and percentage in everyday life situations.
Mathematical Thinking	Be able to think about ways to convert fractions, decimals and percentage to understand their relations.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let's calculate the amount of quantity

(a) A rectangular piece of paper measures 42 cm by 61mm. $\frac{1}{7}$ of the paper is painted red, what is the area of the paper that is not painted red.

(b) The table shows the number of certificate won by different tutor groups in

Tutor group	Tutor group	Tutor group	Maths Certificate	Science Certificate
7 Up	27	15	23	7
7 Tyrone	29	16	25	8
7 Magnificent	32	17	27	8
7 Secret	30	16	24	7

(i) What percentage of 7UP won the English certificates?
(ii) What percentage of 7Magnificient won Science certificate?
(iii) Which tutor group had the highest proportion of Maths certificates?

LO3 : Understanding Line Symmetry

Figures with Line Symmetry

Lesson Objective: Realize that there is a balance shape through the activities of folding and understand the meaning and definition of line symmetry **(6.3.1.1)**

Materials: A4 grid paper, pencils, rules (30cm),blackboard

ASK-MT and Assessment

Attitudes/Values	Enjoy and share ideas on how to draw line of symmetry.
Skills	Identify balance and beautiful shapes and draw the line of symmetry.
Knowledge	Understand meaning and definition of line symmetry.
Mathematical Thinking	Think of ways to identify line symmetry based on the idea of folding paper.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

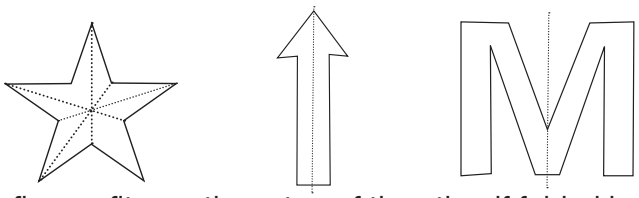
Teaching and Learning Activities

1 Let's group the figures into the following;

(a) One side of this shape fits exactly on top of the other if folded in half.

(b) The shape looks exactly as the original shape when it is rotated.

(c) None of the above.

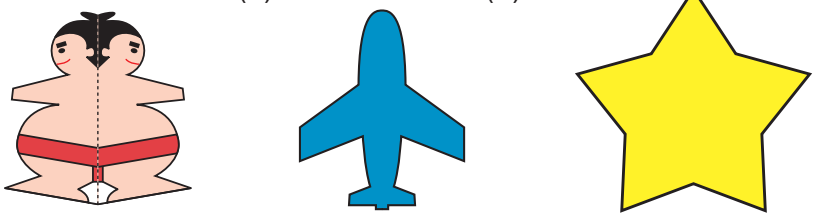


One side of these figures fit exactly on top of the other if folded in half.

2 (a) How do you fold these figures exactly in half?

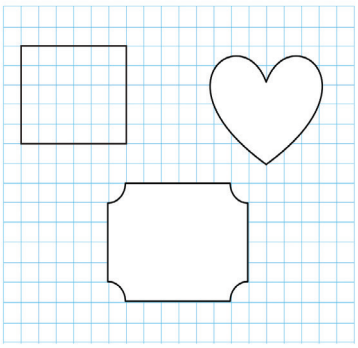
Draw a folding line on each diagram below.

(A) (B) (C)



(b) Let's use the grid below and draw other shapes that can fit by folding into half.

(Provide grid papers for students to draw shapes that can fit by folding into half)



Key Ideas

A figure is line symmetrical when it can be folded along a straight line and two halves of the shape fit exactly on top of each other. The folding line is called *line of symmetry or axis of symmetry*.

LO4 : Properties of line symmetry

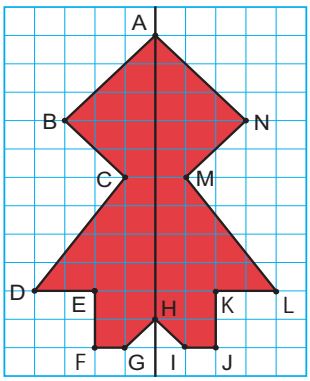
Lesson Objective: Investigate the characteristic of corresponding points, sides and angles in the line of symmetry. **(6.3.1.2)**

Materials: A4 grid paper, pencils, rules (30cm),blackboard

ASK-MT and Assessment	
Attitudes/Values	share their ideas on how to fold paper to identify the properties of line symmetry.
Skills	explore and identify corresponding points, sides and angles in the line of symmetry
Knowledge	understand the properties of line symmetry
Mathematical Thinking	think of how to identify properties of line symmetry based on the idea of folding paper
Assessment	Use the key concepts below to assess the students learning progress during the lesson

Teaching and Learning Activities

1 Let's explore the points, sides and angles when it is folded along its line of symmetry. (Use the figure on the right)



axis of symmetry

(a) Which points lie on the point B and point K respectively when the figure is folded along its symmetric axis?

(b) Which sides lie on top of side AB and DE respectively?

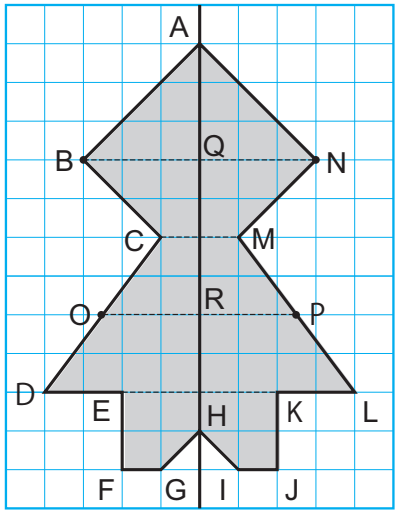
(c) Which angles lie on top of angle D and J respectively?

2 Let's explore the figure with line symmetry below.

(a) The points B and N are corresponding. Consider how the line BN intersects with the line of symmetry.

(b) The points O and P are corresponding. Consider how the line OP intersects with the line of symmetry.

(c) Compare the lengths of lines QB and QN; RP and RO.



Teaching and Learning Activities

Key Ideas

When the figure with line symmetry is folded along its symmetry,

- The matching points are called **corresponding points**
- The matching sides are called **corresponding sides**
- The matching angles are called **corresponding angles**

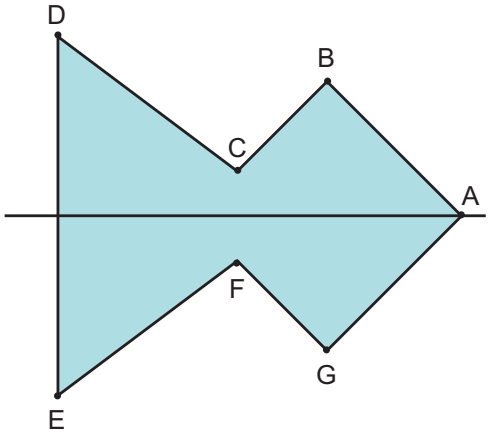
In line symmetric figures, the sizes of the corresponding sides and angles are respectively equal.

For the figure with line symmetry, a line that connects two corresponding points always intersect perpendicularly with the line of symmetry.

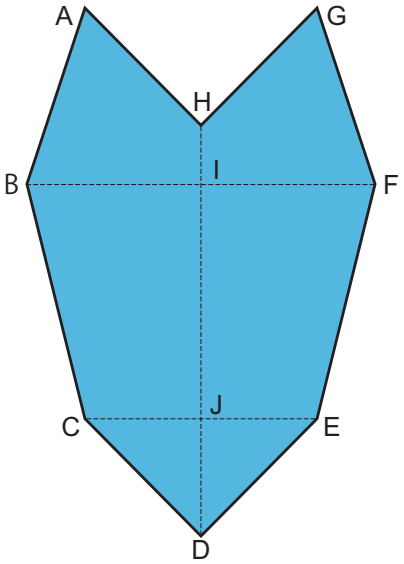
The lengths from the line of symmetry to the corresponding points are equal.

Exercises

(1) The figure below has line symmetry. Let's write the corresponding points, sides and angles



(2) The figure below has line symmetry. How does the line CE intersect with the line of symmetry? If the length of the line BI is **25mm**, what is the length of line FI in **mm**?



LO5 : How to draw figures with lines symmetry

Lesson Objective: Understand how to draw line of symmetry by investigating the characteristic of corresponding points, side and angles **(6.3.1.3)**

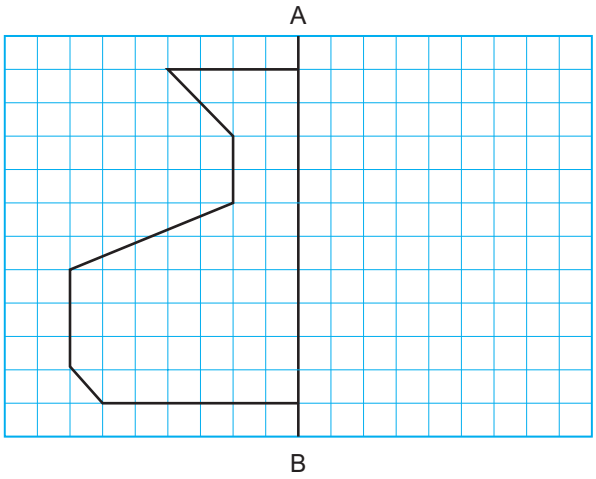
Materials: A4 graph paper, pencils and rules (30cm),blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on how to draw line of symmetry
Skills	Draw line of symmetry by investigating the characteristic of corresponding points, side and angles
Knowledge	Line of symmetry properties
Mathematical Thinking	Think of ways on how to draw line of symmetry by investigating the properties
Assessment	Use the key concepts below to assess the students learning progress during the lesson

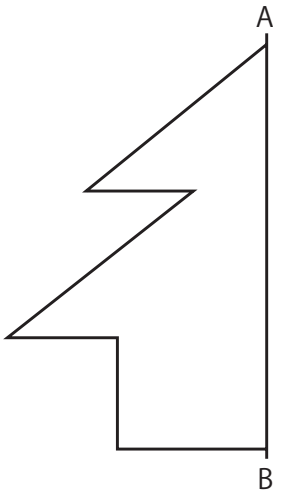
Teaching and Learning Activities

1 The figure below shows half of the figure with line symmetry, with AB as the line of symmetry

(a) Let's draw the other half to complete the full figure. Discuss with your classmates how you drew?



(b) Let's draw the other half to complete the figure.



LO6 : Understanding point symmetry

Figures with Point of Symmetry

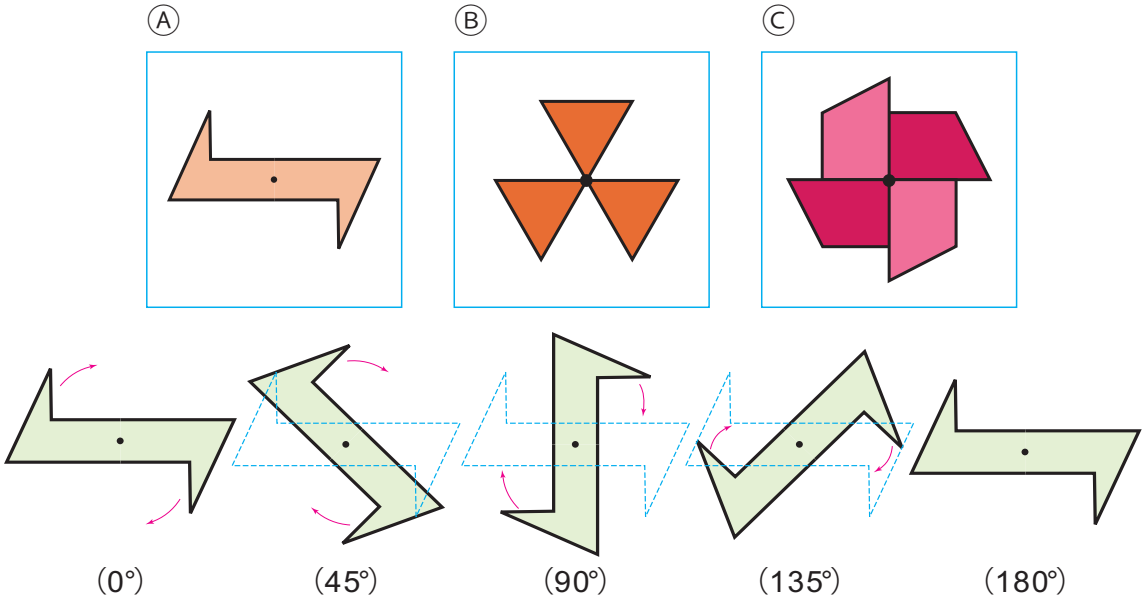
Lesson Objective: Understand the definition and characteristic of figures with point symmetry. **(6.3.1.1)**
Materials: Drawings of Diagrams (a-b),Blackboard

ASK-MT and Assessment

Attitudes/Values	Enjoy and share their ideas on how to identify figures with point symmetry.
Skills	Explore and identify point symmetry by turning the figure 180°.
Knowledge	Understand the definition of point symmetry.
Mathematical Thinking	Think of ways on how to identify point symmetry.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

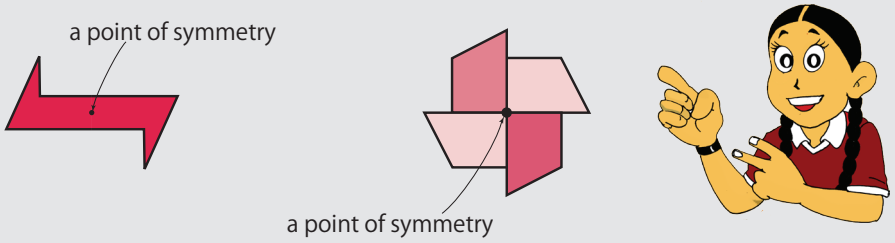
Teaching and Learning Activities

1 Which of the following figures match the original figure when rotated for 180° with the " • "?
Trace each figure and rotate it 180°. Confirm if the figure matches the original figure or not.



Key Ideas

A figure is point symmetrical when it is rotated 180°with respect to a point and the shape exactly matches the original.
The centre point is called **point of symmetry**



LO7: Properties of figures and point symmetry

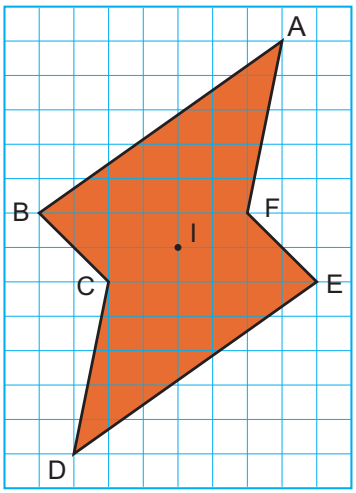
Lesson Objective: Investigate the characteristic of corresponding point. side and angle using point symmetry. **(6.3.1.2)**

Materials: A4 paper graph paper, rules (30cm) and pencils,blackboard

ASK-MT and Assessment	
Attitudes/Values	Enjoy and share their ideas on how to discovering the properties of point symmetry using grid paper.
Skills	Explore and identify characteristic of corresponding point, side and angle using point Symmetry
Knowledge	Properties of point symmetry
Mathematical Thinking	Think of ways on how to identify properties of point symmetry
Assessment	Use the key concepts below to assess the students learning progress during the lesson

Teaching and Learning Activities

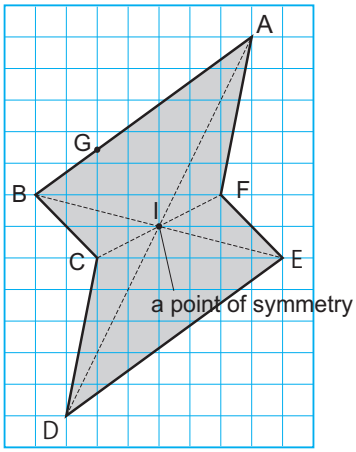
1 The figure below has point symmetry. Trace the figure and rotate it 180° with respect to a point of symmetry. Let's explore its points, sides and angles.



(a) Which points lie on point B and C respectively after rotation?
(b) Which sides lie on side AB and BC respectively after rotation?
(c) Which angles lie on top of angle B and D respectively after rotation?

2 Let's explore the figure with point symmetry on the right.

(a) Where do following lines intersect each other? AD, BE, and CF
(b) Draw point H, corresponding to point G on side AB.
(c) Compare the lengths of lines IG and IH.



Teaching and Learning Activities

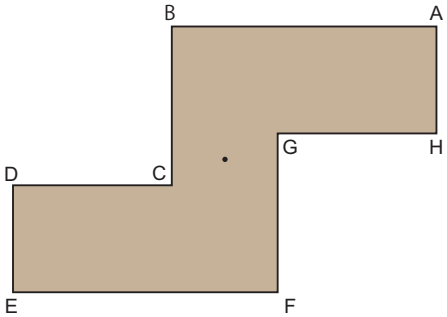
Key Ideas

For the figure with point symmetry, a line that connects two corresponding points always passes through the point of symmetry.

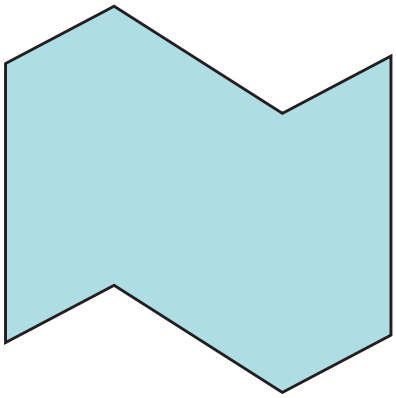
The segments between a point of symmetry and each of the corresponding points are equal.

Exercises

(1) The figure below has point symmetry. Let's find the corresponding points, sides and angles.



(2) The figure below has point symmetry. Let's locate the point of symmetry. Then, explain how you locate it.



LO8 : How to draw figures with lines symmetry

Lesson Objective: Understand how to draw line of symmetry by investigating the characteristic of corresponding points, side and angles **(6.3.1.3)**

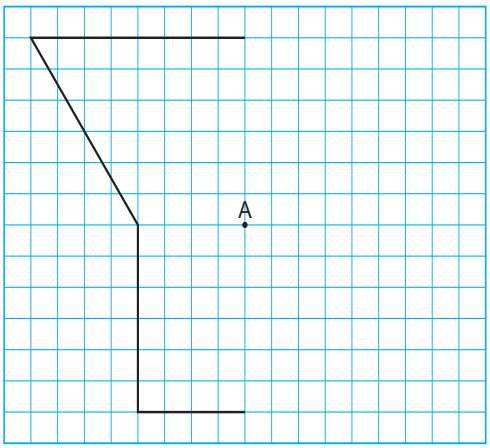
Materials: A4 graph paper, pencils and rules (30cm),blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on how to draw line of symmetry.
Skills	Draw line of symmetry by investigating the characteristic of corresponding points, side and angles.
Knowledge	Line of symmetry properties.
Mathematical Thinking	Think of ways on how to draw line of symmetry by investigating the properties.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

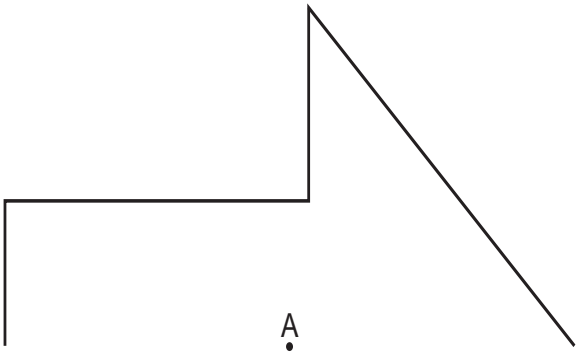
Teaching and Learning Activities

1 The figure below shows half of the figure with A as the point point of symmetry.

(a) Let's draw the other half to complete the full figure. Discuss with your classmates how you drew the figure?



(b) Let's draw the other half to complete the figure.



LO9 : Symmetric figures around me

Lesson Objective: To find the figure with line symmetry or point symmetry in daily lives **(6.3.1.1)**
Materials: News cuttings, pictures from magazines,blackboard

ASK-MT and Assessment	
Attitudes/Values	Enjoy finding interesting figures with line symmetry or point symmetry around them.
Skills	Investigate figures with line symmetry or point symmetry around them.
Knowledge	Understand and appreciate the connection of mathematics in our daily.
Mathematical Thinking	Think about shapes or figures around them that have line symmetry or point symmetry.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let's Find Symmetrical Figures Around You

(a) Let's find out line symmetries in the figures below.

(b) Display pictures or illustrations of shapes or figures that are symmetric that you find around you.

L10: Basic shapes with axis of symmetry or point symmetry

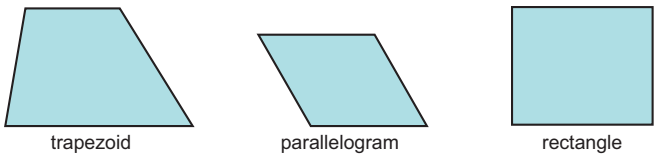
Polygons and Symmetry

Lesson Objective: Find the axis of symmetry or point symmetry by observing the basic shapes. **(6.3.1.2)**
Materials: Diagrams of common polygon shapes,blackboards

ASK-MT and Assessment	
Attitudes/Values	Enjoy identifying symmetry of basic shapes and appreciate their connections in context.
Skills	Investigate line and point of symmetry on the basic shapes.
Knowledge	Drawing symmetry of basic shapes.
Mathematical Thinking	Think about how to draw symmetry of basic shapes.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let's explore the following quadrilaterals.



Let's draw lines and point of symmetry on very figure.

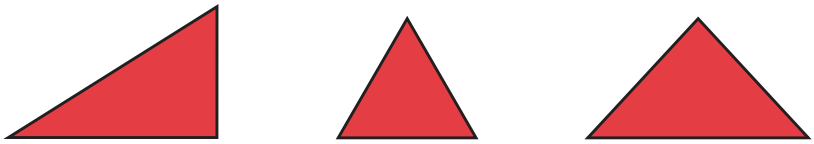
(a) Which quadrilaterals have line symmetry, and how many lines of symmetry does each have?

(b) Which quadrilaterals have point symmetry? Indicate the point of symmetry in each figure.

(c) Which quadrilaterals have line symmetry and point symmetry, respectively?

(d) Which quadrilaterals have two diagonals that are line of symmetry?

2 Let's explore the following triangles.



(a) Which triangles have line symmetry? And how many lines of symmetry can you draw in each figure?

(b) Which triangles have point symmetry?

Key Ideas

Not all quadrilaterals and triangles have line of symmetry nor point of symmetry.

L11: Regular Polygons and Symmetry

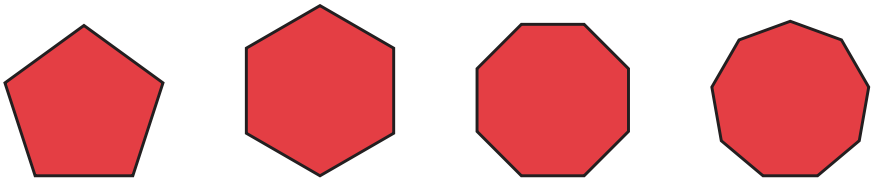
Lesson Objective: Identify axis of symmetry or point of symmetry of polygons. **(6.3.1.1)**
Materials: Diagrams of polygons shapes,blackboards

ASK-MT and Assessment

Attitudes/Values	Enjoy identifying symmetry of regular polygons and appreciate their connections in context.
Skills	Investigate line and point of symmetry of regular polygons.
Knowledge	Understand and the axis of symmetry or point of symmetry of polygons.
Mathematical Thinking	Think about how to draw the axis of symmetry or point of symmetry of polygons.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let's explore regular polygons.



regular pentagon regular hexagon regular octagon regular nonagon

(a) Let's group the figures above into the figures with line symmetry and point symmetry.

Line symmetry	
Point symmetry	

(b) How many lines of symmetry does each figure have? Let's fill in the table below.

Line symmetry	Regular pentagon	Regular hexagon	Regular octagon	Regular nonagon
Point symmetry				

(c) Let's draw a point of symmetry in each figure with point symmetry.

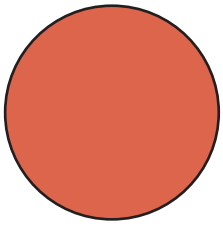
(d) Let's reflect on what you explored. Please write what you noticed in your notebook and discuss with your classmates. Let's classify heptagon and decagon in the above table.

Exercises

Let's explore a circle.

(1) Does a circle have line symmetry? How many lines of symmetry can you find?

(2) Does a circle have point symmetry? Find a point of symmetry.



Unit checkpoint

Review on symmetry

Symmetry	Name:	Score /100

1. The figure below is point-symmetric. [4 × 10 points = 40 points]

(1) For locating the centre of symmetry, which pair of lines are appropriate to be drawn?

a: AC and CG

b: CH and DG

c: CG and DH

Answer:

(2) Write the part corresponding to;

a) Point A

Answer:

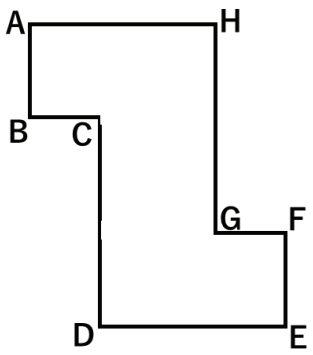
b) Side DE

Answer:

(3) Let the centre of symmetry point I.

Find the side which is the same length as HI.

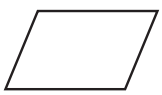
Answer:



2. Find all answers of the following questions about the figures below;

[3 × 20 points = 60 points]

(a) (b) (c)



(1) line symmetry figure. Answer :

(2) point-symmetric figure. Answer :

(3) figures with both features of line-symmetric and point-symmetric. Answer :

L12: Expressions with symbols

Expressions with Symbols

Lesson Objective: To understand how to write mathematical expressions using x or a apart from the symbols of □ or ○ **(6.4.3.1)**

Materials: picture chart of 2 pupils buying phones for their gifts, picture of window frame,blackboard

ASK-MT and Assessment	
Attitudes/Values	Share the ideas on how to write a mathematical expression using the letter "x" or "a".
Skills	Write a mathematical expression using the letter "x" or "a".
Knowledge	Understand mathematical expressions using "x" or "a".
Mathematical Thinking	Think about how to express mathematical expressions using "x" or "a".
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 The pupils are buying phones at 80 kina each.

P1 "How much do 5 phones cost? S "400 kina"
P2 "How much do 2 phones cost? S "160 kina"
S: "One phone costs 80 kina"

Students think about what numbers can be substituted (or put in) by recalling the mathematical expressions with words.

(a) Let's fill in table below with a number and make expressions.

• Bought 1 phone	80 x	1	80
• Bought 2 phones	? x	?	?
• Bought 5 phones	? x	?	?

(b) Represent the number of phones with □ and the price with ○ Make an expression to represent the relationship of □ and ○.

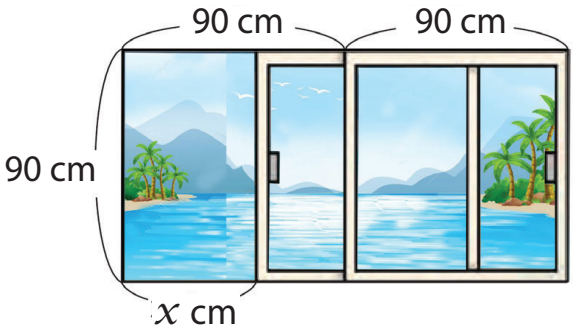
Key Ideas

- In Mathematics, the numbers and quantities can be represented using symbols such as a or x other than □ and ○.
- The price of x phones at cost of 80 kina each can be written as 80 x x as an expression (The cost remains constant while the x value changes.

Teaching and Learning Activities

2 There is a window with the height of 90 cm.

(a) Make an expression to find the perimeter.



Opened 5 cm..... 90 x 5 = 450

Opened 10 cm..... 90 x ☐ = ☐

Opened 12.5 cm..... 90 x ☐ = ☐

Opened 90 cm..... 90 x ☐ = ☐

Height | opened length | Area of opened window

(b) Write an expression to find the area if you opened it x cm.

Exercises

Make different types of regular polygons using 6 cm strings.

(1) Make an expression to find the perimeter

(i) Regular triangle 6 x ☐
(ii) Regular pentagon 6 x ☐
(iii) Regular octagon 6 x ☐
(iv) Regular dodecagon ☐ x ☐

(2) Write an expression to find the perimeter of a regular polygon with a sides

(i) Regular polygon with a side ☐ x ☐ .

L13: Lets calculate Total

Lesson Objective: Find the value of mathematical expressions by substituting a number for x. **(6.4.3.2)**

Materials: Images of apples, (or other substituted fruits or vegetables can be used to demonstrate during the lesson), lollies, Gold sport cordial 750ml, Line segment drawn on a chart,blackboard

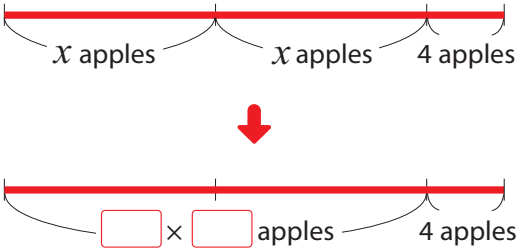
ASK-MT and Assessment	
Attitudes/Values	Share ideas on how to find the value of mathematical expression by substituting a number for x.
Skills	Calculate using x to find the value of mathematical expression.
Knowledge	Identify and understand the value of mathematical expression by substituting a number for x.
Mathematical Thinking	Think about how to find the value of mathematical expression by substituting a number for x.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 There are 2 boxes of apples and 4 apples.

(a) If there are 10 apples in each box, how many apples are there altogether?

(b) Use x to show the number of apples in each box, and make an expression to find the total number of apples.



(c) If the number of apples is 15 in each box, how many apples are there altogether?

Key Ideas

- To find the value of mathematical expression and substitute the number values
- Calculate the solutions of the mathematical expressions

Exercises

(1) Use x to show the number of lollies in each box.

Write an expression to find the total number of lollies using x symbol.

L14: Finding the value of x (1)

Let's put numbers into expressions

Lesson Objective: To explore various ways and identify the appropriate number or value to substitute for x in problems applying addition. **(6.4.3.1/2)**

Materials: Blackboard

ASK-MT and Assessment

Attitudes/Values	Explore various ways to identify the appropriate number or value to substitute for x.
Skills	Explore and identify appropriate number values and substitute for x value problems.
Knowledge	Substituting letters with numbers in algebraic expressions.
Mathematical Thinking	Think about various ways to identify the appropriate number or value to substitute for x and ways to solve the expressions.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Farmers filled the box with oranges. There is one box and 7 oranges.

(a) Use x to show the number of oranges in the box and write the expression to find the total number of oranges.

b) If we have 35 oranges at the beginning, how many oranges are in the box?

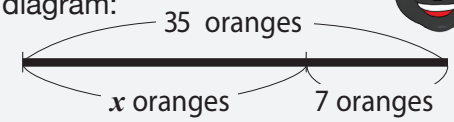
Expected Ideas

Kekeni's Idea

1. if x was 30, total number is 30 + 7 = 37. However, it is 2 greater than 35, so x is 2 less than 30. Therefore x = 28

Sare's idea

2. I used a diagram:



Therefore, x = 35 - 7
= 28

2 Yamo's idea for solving problem is shown below. Explain her idea.

Yamo's Idea

Think of a mathematical sentence as a balance. x + 7 and is ☐ balanced.

if you take ☐ away from both sides, they are still balanced.

Therefore, x = 28

Key Ideas

To find the value of x, if a mathematical sentence is in addition such as $x + 7 = 35$, you may use subtraction to find the answer.

$$x + 7 = 35$$
$$x + 7 - 7 = 35 - 7$$
$$x = 28$$

L15: Finding the value of x (2)

Lesson Objective: To explore various ways to identify the appropriate value for x in problems applying multiplication. **(6.4.3.1/2)**

Materials: Chart on Drawing of a figure like a parallelogram,blackboard

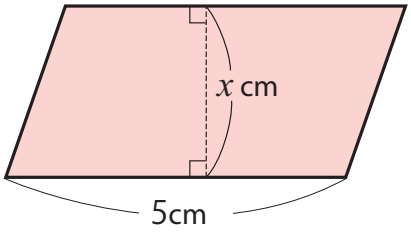
ASK-MT and Assessment	
Attitudes/Values	Share ideas on various ways to identify the appropriate value for x in problems applying multiplication.
Skills	Find the number to substitute for x which substitute (a x x = b).
Knowledge	Understand mathematical expressions using symbols of "a" or "x".
Mathematical Thinking	Think about why mathematical expressions using symbols of "a" or "x" are appreciated.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Below is a parallelogram like a figure on the right.

(a) If the area is 18cm^2 and height is x cm, write the mathematical sentence to find the area.

(b) Based on the above expression, find the height of the parallelogram.



2 Aaron drinks the same amount of milk every day. He drank 2 L in 3 days.

(a) If he drank x L per day, write a mathematical sentence to find the total amount of milk in 3 days.

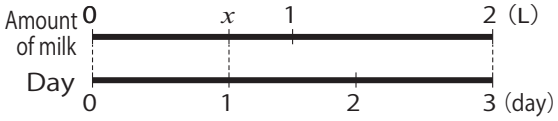
x 3

Milk (L)	x	2
Day (day)	1	3

x 3

(b) Based on the mathematical sentence of the above, solve the amount of milk he drank per day.

3 You used a or x to show various quantities. Write in notebook when symbols are useful, and discuss it with your friends.



Teaching and Learning Activities

Key Ideas

To find x, if a mathematical sentence is in multiplication such as 5 x x = 18, or x x 3 = 2, you may use division to find the answer

$5x\ x = 18$
$x = 18 \div 5$
$x = 3.6$

$x \times 3 = 2$
$x = 2 \div 3$
$x = \frac{2}{3}$

Exercises

Find the number or value for x.

(1) $x + 4 = 22$ (2) $x - 16 = 15$ (3). $7 \times x = 5$ (4) $x \times 4 = 14$

L16: Finding the value of x (3)

Lesson Objective: To find the number to substitute for "x" which satisfies (x x $a + b = c$). and write mathematical expressions with "x". **(6.4.3.2)**

Materials: Blackboard

ASK-MT and Assessment

Attitudes/Values	Share ideas how to identify the number to substitute for "x " which satisfies (x x $a + b = c$).
Skills	Write mathematical sentences and substitute to calculate the values.
Knowledge	Substituting values for pronumerals and finding their solutions.
Mathematical Thinking	Think about how to substitute and satisfy the mathematical sentences.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 There are 2 boxes of chocolates, which contains the same amount and 3 more pieces of chocolates. When you counted the total, it was 23 chocolates. How many chocolates does each box have?

(a) If the number of chocolates per box is x. write a mathematical sentence for the total number.

(b) By using the following table below; let's find the number of chocolates in the case of 7, 8, 9 …etc. to x.

x	7	8	9			
x x 2	14					
x x 2 + 3	17					

Expected Ideas

- First calculate the number of chocolates in 2 boxes and then add 3
- I could find the number for x , if the total number of chocolates is 23

2 There are 8 bundles of coloured papers and 3 sheets.

(a) If showing 1 bundle as x sheets, write mathematical sentences to find the total. ☐

(b) In the total of 107 sheets, how many sheets are in one bundle? Try numbers 10, 11, 12, etc. for x.

Key Ideas

We can put a number into x to reach or come up with the appropriate value for "x". This can be done even with a mathematical sentence that contains multiplication and addition.

Exercises

In the case of 8,9,10.....to x, find what number applies for x.

(a) x x 3 + 4 = 37 (b) x x 8 + 5 = 77

L17: The sum of angles in polygon

Lesson Objective: To interpret various mathematical expressions representing the sum of the angles in a-sided polygons and determine the appropriate value for "a". **(6.4.3.1)**

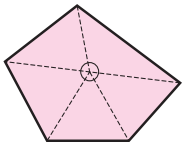
Materials: Drawing of two polygons on a chart, blackboard

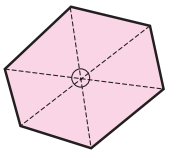
ASK-MT and Assessment

Attitudes/Values	share their ideas on various mathematical expressions representing the sum of the angles.
Skills	make a math sentence based on a figure and calculate the solutions of the expressions.
Knowledge	mathematical expressions representing the sum of the angles.
Mathematical Thinking	think of various mathematical expressions representing the sum of the angles in a-sided polygons and determine the appropriate value for "a".
Assessment	use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let's reflect on the sum of angles in polygons.





(i) The sum of angles in triangle ..... 180°

(ii) The sum of angles in quadrilateral..... 360°

(iii) The sum of angles in pentagon..... ☐

(iv) The sum of angles in hexagon..... ☐

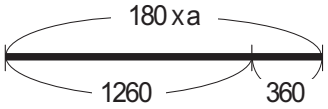
(a) Based on the figures above, Makoto thought of an expression for calculating the sum of the angles of regular polygons. Fill the ☐ below, and explain his thinking.

☐ x a - ☐

(b) Use the expression in (a), to find the sum of angles of decagon.

(c) If the sum angle is 1260°, how many sides does this polygon have?

180 x a- 360 = 1260



180 x a = 1260 + ☐

180 x a = ☐

a = ☐ ÷ 180

a = ☐

(d) Sandra wrote the expression 180 x (a - 2) to find the sum of angles in a-sided polygon.

Explain her idea with figures.

Using the expression, calculate how many sides a polygon has if the sum of it's angles is 1620°.

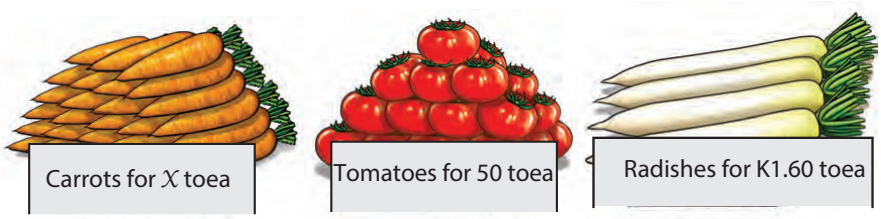
L18: Reading mathematical expression

Lesson Objective: Read mathematical expression and think about what it represents. **(6.4.3.1)**

Materials: Blackboard, Food charts

ASK-MT and Assessment	
Attitudes/Values	Appreciate what mathematical expressions represent.
Skills	Interpret what mathematical expressions represent.
Knowledge	Reading mathematical expressions.
Mathematical Thinking	Think about what mathematical expressions represents.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

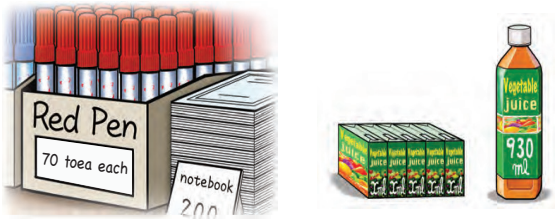


1 Philip went to the market to buy vegetables. Carrots were x kina each, tomatoes were 50 toea each and radishes were K1.60 each. What does each expression a - d below represent?

(a) $x + 50$ (b) $x \times 7$ (c) $x \times 4 + K1.60$ (d) $x \times 4 + 50 \times 4$

2 Look at the pictures below and write what each expressions represent?.

(a) $70 \times x$ (b) $x \times 5 + 930$



Unit checkpoint

Review on mathematical symbols & expressions

Mathematical Symbols and Expressions	Name:	Score /100

1. Find x .

[4 × 10 points = 40 points]

(1) $x + 46 = 91$

Answer: $x =$

(2) $x - 15 = 67$

Answer: $x =$

(3) $x \times 8 = 344$

Answer: $x =$

(4) $x \times 6 + 43 = 181$

Answer: $x =$

2. Write mathematical sentence using x and find the numbers in x.

[Maths sentence is 10 points and answer is 10 points]

(1) After using 3 dL from x dL of cooking oil, I have 15 dL of the oil finally.

Mathematical sentence:	Answer: dL

(2) 162 pencils are necessary to distribute 3 pencils each for x people.

Mathematical sentence:	Answer: people

(3) There is a triangle whose base is 4 cm and height is x cm. The area is 16cm^2

Mathematical sentence:	Answer: cm

L19: Meaning of multiplication of fractions

Calculation of fraction × fraction

Lesson Objective: Appreciate the meaning of multiplication of fractions by representing the given situation with a math expressions and how to calculate the answers. **(6.1.2.2)**

Materials: Drawing of two polygons on a chart,blackboard

ASK-MT and Assessment

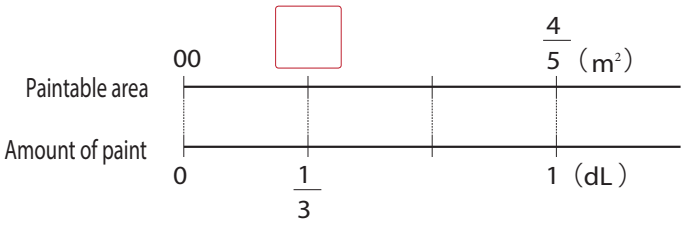
Attitudes/Values	Share their ideas in how to recognize situations where you use multiplication of fraction and make a math expression.
Skills	Recognize situations of multiplication of fraction problems, represent the given situation with a make math expressions and ways in how to calculate the answers.
Knowledge	Meaning of multiplication of a fraction by a fraction by relating to diagram representation.
Mathematical Thinking	Think about situations where you use multiplication of fraction and how to calculate the answers.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let's find how much area in m^2 can you paint using $\frac{1}{3}$ dL of the green

Paintable area (m^2)	$\frac{4}{5}$	?
Quantity of paint (dL)	1	$\frac{1}{3}$

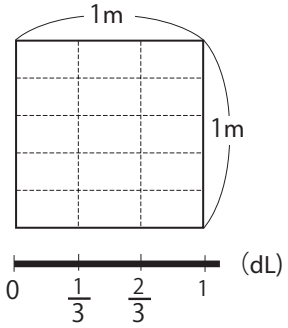
(a) Write a mathematical expression.



(b) Show the area on the picture on the right.

(c) What area in m^2 can you paint using $\frac{2}{3}$ dL of paint cover? Write an expression

(d) Think about how to calculate the expression in 3.



Teaching and Learning Activities

Expected Ideas

Idea. 1

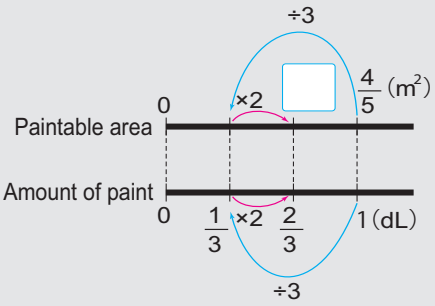
Paint table area with $\frac{1}{3}$ dL is $\frac{4}{5} \div 3$ (m^2)

$\frac{2}{3}$ dL is twice $\frac{1}{3}$ dL.

$\frac{4}{5} \div 3 \times 2 = \frac{4}{5 \times 3} \times 2$

$= \frac{4 \times 2}{5 \times 3}$

$= \square$



Idea. 2

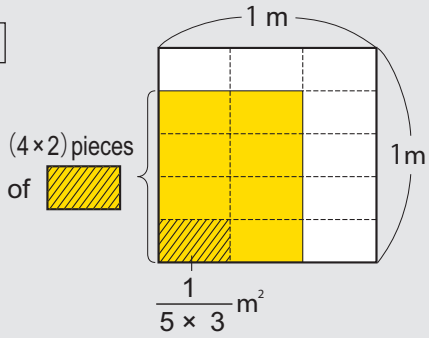
Divide $1m^2$ equally into 5 horizontal and 3 vertical pieces.

Area of is $\frac{1}{5 \times 3} m^2$

Paint table area is (4 x 2) pieces of $\frac{1}{5 \times 3} m^2$, therefore $\frac{4 \times 2}{5 \times 3} m^2$,

$\frac{4 \times 2}{5 \times 3} = \frac{4 \times 2}{5 \times 3}$

$= \square$



Idea. 3

Changing fraction into integer

Calculate by changing fractions into integer, just as we did with decimals

$\frac{4}{5} \times \frac{2}{3} = \square$

×5 ×3 ÷15

$4 \times 2 = 8$

L20: Ways in how to calculate fraction × fraction

Lesson Objective: To identify ways on how to calculate a fraction × a fraction and simplify the answer. **(6.1.2 .2)**

Materials: Blackboard

ASK-MT and Assessment

Attitudes/Values	Enjoy writing a math expression, colour the diagram showing the expected area to be painted and calculate a fraction × fraction
Skills	Make a math expression, colour the diagram showing the expected area to be painted and calculate a fraction × fraction
Knowledge	Ways on how to calculate a fraction in x a fraction and simplify the answer.
Mathematical Thinking	Think about how to compare the paint table area and the amount of paint and the expected area in m^2.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

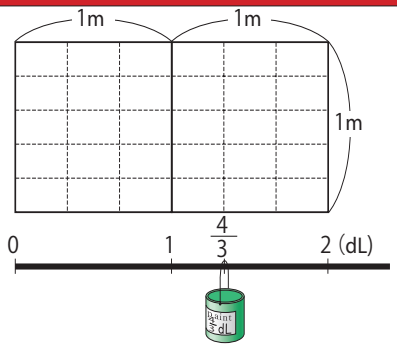
Teaching and Learning Activities

1 Let's think about how to calculate what area in m^2 will $\frac{4}{3}$ dL of paint cover in lesson previous lesson on task 1.

(a) Write an expression.

(b) Colour the diagram.

(c) Calculate the answer



2 There is iron pole which weighs $\frac{4}{15}$ kg per metre. Let's find how much does it weigh if the pole is $\frac{5}{6}$ m in length?

$$\frac{4}{15} \times \frac{5}{6} = \frac{4 \times 5}{15 \times 6}$$

$$= \frac{4 \times 5}{15 \times 6}$$

$$= \square$$

Weight (Kg)	$\frac{4}{15}$	?
Length (m)	1	$\frac{5}{6}$

× 5/6 (top) × 5/6 (bottom)

Key Ideas

When multiplying a fraction by another fraction, multiply the two numerators and two denominators.

For *example;* $\frac{B}{A} \times \frac{D}{C} = \frac{B \times D}{A \times C}$

Exercises

Let's calculate.

(a) $\frac{3}{4} \times \frac{1}{2}$ (b) $\frac{3}{5} \times \frac{3}{8}$ (c) $\frac{5}{4} \times \frac{5}{3}$ (d) $\frac{3}{2} \times \frac{14}{9}$

L21: Changing whole number to fraction for calculation

Lesson Objective: To identify the relationship when multiplying a whole number by a fraction and fraction by fraction. **(6.1.2.1)**

Materials: Black board

ASK-MT and Assessment	
Attitudes/Values	Enjoy and share ideas on multiplying a whole number by a fraction, and fraction by a fraction.
Skills	To multiply a whole number by a fraction, and fraction by a fraction.
Knowledge	Multiplying a whole number by a fraction, and fraction by a fraction.
Mathematical Thinking	Think about how to multiply a whole number by a fraction, and fraction by a fraction.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let's think about how to calculate by changing integers to fractions it becomes multiplication of fractions.

(a) $2 \times \frac{3}{5} = \frac{3}{\square} \times \frac{3}{5}$

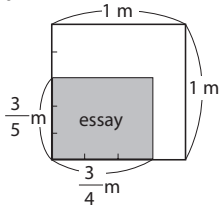
$= \square$

(b) $\frac{4}{5} \times 4 = \frac{4}{5} \times \frac{3}{\square}$

$= \square$

2 The diagram on the right shows the area to place a student's essay on the bulletin board. What area in m^2 is there for the student's essay?

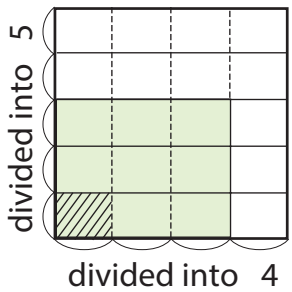
(a) Let's find out about the way it's calculated as shown below and fill in the $\square$.



The area of ▨ is $\frac{1}{5 \times 4}$ of the square, and it is $\square$ m^2.

The area for the essay section is (3 × 3) pieces, which is $\square$ m^2.

(b) Use the are formula for rectangle $\frac{4}{5} \times \frac{3}{4}$.



Key Ideas

Even when the measurements of the sides are given in fractions, we can use area formulas.

Exercises

1. Let's calculate.

(a) $5 \times \frac{3}{7}$ (b) $3 \times \frac{5}{6}$ (c) $4 \times \frac{1}{2}$ (d) $\frac{5}{8} \times 2$

L22: Multiplication of mixed fraction

Lesson Objective: To calculate multiplication of mixed fractions. (6.1.2.2)
Materials: Blackboard

ASK-MT and Assessment	
Attitudes/Values	Enjoy and share ideas on how to calculate multiplication of mixed fraction.
Skills	Calculate multiplication of mixed fraction.
Knowledge	Understand how to calculate multiplication of mixed numbers.
Mathematical Thinking	Think about how to calculate multiplication of mixed numbers.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

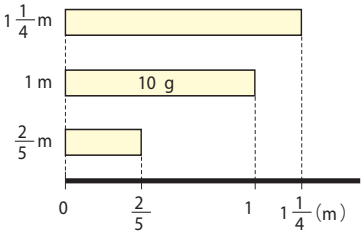
Teaching and Learning Activities

1 Let's think about how to calculate $3\frac{1}{7} \times 2\frac{1}{10}$.

$$3\frac{1}{7} \times 2\frac{1}{10} = \frac{22}{7} \times \frac{21}{10}$$
$$= \frac{22 \times 21}{7 \times 10}$$
$$= \square$$

2 1 m of wire weighs 10g.

(a) How much does each wire weigh, in grams if it is $1\frac{1}{4}$ m and weighs $\frac{2}{5}$ m long?



$10 \times 1\frac{1}{4} = \square$

$10 \times 1 = 10$

$10 \times \frac{2}{5} = \square$

(b) $110 \times 1\frac{1}{4}$ or $10 \times \frac{2}{5}$, which expression has the product that is less than 10?

Key Ideas

- When multiplying fractions, change mixed numbers into improper fractions.
- If you multiply a fraction that is less than 1, the product will be less than the multiplicand.

Exercises

(1) Let's Calculate.

(i) $3\frac{1}{2} \times 1\frac{5}{9}$ (ii) $2\frac{5}{8} \times 2\frac{2}{9}$ (iii) $9\frac{1}{3} \times \frac{3}{8}$ (iv) $\frac{6}{7} \times 4\frac{2}{3}$

(2) 1 L of sand weighs $1\frac{3}{5}$ kg. How much does it weigh in kg, if there is $3\frac{3}{4}$ L of sand?

L23: Rules of the calculation with fraction

Lesson Objective: : To apply that the rules of calculations fraction **(6.1.2.2)**
Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas in how to apply rules of calculations learnt to fractions.
Skills	Apply rules of the calculation to the fraction.
Knowledge	Understand that the rules of calculation can be applied to fractions. Rule Ⓐ Ⓑ Ⓒ Ⓓ are commutative laws.
Mathematical Thinking	Rules of calculation learnt and think about how to apply the rules to fractions.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

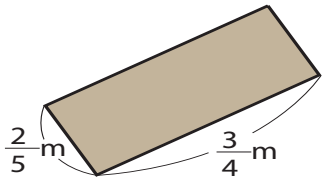
Teaching and Learning Activities

1 Student's learnt the rules of calculation in 5th grade. Confirm that those rules can be used in calculation of fractions.

Ⓐ **A x B = B x A**
Ⓑ **(A X B) X C = A X (B X C)**
Ⓒ **(A + B) X C = A X C + B X C**
Ⓓ **(A-B) X C = A X C - B X C**

(a) Let's calculate the area of a rectangle on the right.

$$\frac{2}{5}\times\frac{3}{4}=\frac{\overset{1}{\cancel{2}}\times 3}{5\times\overset{2}{\cancel{4}}}=\frac{3}{10} \qquad \frac{3}{4}\times\frac{2}{5}=\frac{3\times\overset{1}{\cancel{2}}}{\underset{2}{\cancel{4}}\times 5}=\frac{3}{10}$$

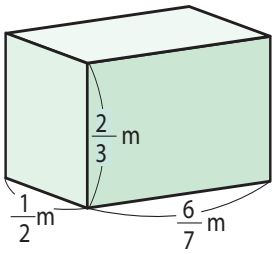


Calculation rule Ⓐ can also be used with fractions

(b) Let's find the volume of a quadrangular prism on the right.

$$\left(\frac{1}{2}\times\frac{6}{7}\right)\times\frac{2}{3}=\frac{1\times\overset{3}{\cancel{6}}}{\underset{1}{\cancel{2}}\times 7}\times\frac{2}{3}=\frac{3}{7}\times\frac{2}{3}=\frac{\overset{1}{\cancel{3}}\times 2}{7\times\underset{1}{\cancel{3}}}=\frac{2}{7}$$

$$\frac{1}{2}\times\left(\frac{6}{7}\times\frac{2}{3}\right)=\frac{1}{2}\times\frac{\overset{2}{\cancel{6}}\times 2}{7\times\underset{1}{\cancel{3}}}=\frac{1}{2}\times\frac{4}{7}=\frac{1\times\overset{2}{\cancel{4}}}{\underset{1}{\cancel{2}}\times 7}=\frac{2}{7}$$



Calculation rule Ⓑ can also be used with fraction.

Key Ideas

- Review the rules of calculation Ⓐ Ⓑ Ⓒ Ⓓcovered 5th grade and observe and confirm that rule Ⓐ Ⓑ can also be used with fractions.
- Rules of rules of calculation can be applied to fractions.

L24: Meaning of inverse numbers

Inverse Numbers

Lesson Objective: To discuss the meaning of inverse numbers and identify inverse numbers of other numbers. **(6.1.2.2)**

Materials: Inform students to prepare 18 cards with numbers 1-9 at home before this lesson. Two cards for each number, blackboard

ASK-MT and Assessment

Attitudes/Values	Appreciate the meaning of inverse numbers.
Skills	Identify inverse numbers of other numbers.
Knowledge	Inverse numbers and it's properties.
Mathematical Thinking	Think about how to identify inverse numbers of other numbers.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

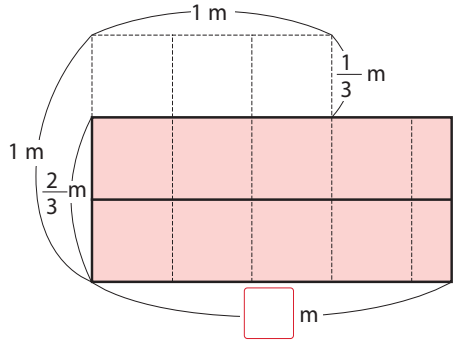
1 Let's find the inverse numbers.

(a) There are 18 cards with numbers 1-9 and there are two cards for each number. Use those cards and complete the expression below.

$$\frac{\square}{\square} \times \frac{\square}{\square} = 1$$

(b) What rule is there between multiplicand and multiplier to make the product 1?

(c) There is a square whose side is 1m each. If you change the shape into a rectangle without changing its area of $1m^2$, and if the width of the rectangle is $\frac{2}{3}$ m, what is the length?



2 Let's find the inverse number of 6 and of 0.4. To find the inverse numbers of an integer or a decimal, change them into a fraction first.

Key Ideas

- When the product of 2 numbers is 1, one number is called the other number's **inverse number.**
- Inverse number of $\frac{2}{3}$ is $\frac{3}{2}$ and inverse number of $\frac{3}{2}$ is $\frac{2}{3}$.

Exercises

Let's find inverse numbers. (1) $\frac{4}{5}$ (2) $\frac{10}{3}$ (3) $\frac{1}{8}$ (4) $1\frac{5}{6}$ (5) 0.6

L25: Meaning of division of fractions

Calculation of fraction ÷ fraction

Lesson Objective: Appreciate the meaning of division of fractions and represent the given situation by making a math expression and solve to find the answers. **(6.1.2.2)**

Materials: blackboard

ASK-MT and Assessment

Attitudes/Values	Share their ideas in how to recognize situations where you use division of fraction and make a math expression.
Skills	Recognize situations of division of fraction problems, represent the given situation with a make math expressions and ways in how to calculate the answers.
Knowledge	Division of fractions.
Mathematical Thinking	Think about situations where you use division of fraction and how to calculate the answers.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

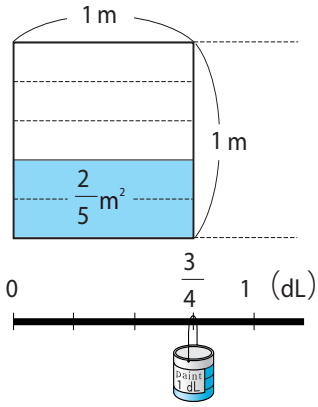
1 We used $\frac{3}{4}$ dL of blue paint for a $\frac{2}{5}$ m^2 fence calculate.

How many m^2 did we cover with a 1dL of paint?

(a) Let's write an expression.

(b) How many m^2 can be covered by 1dL of paint? Check this by colouring the sections of the figure above.

(c) Let's think about how to calculate.



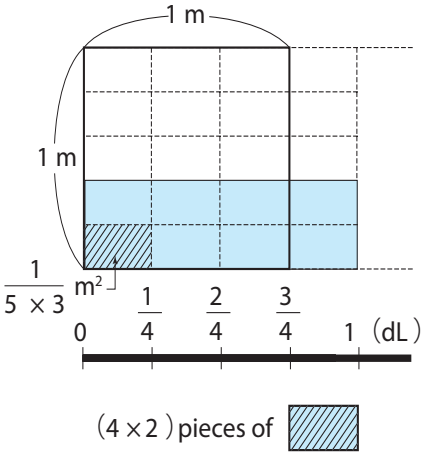
Paintable area (m^2)	?	$\frac{2}{5}$
Quantity of paint (dL)	1	$\frac{3}{4}$

2 I divided 1m^2 horizontally into 5 equal parts and vertically into 3 equal parts.
Then the area of ▨ becomes $\frac{1}{5 \times 3}$ m^2. Since there (2 × 4) sets of $\frac{1}{5 \times 3}$ m^2 the area that can be painted with 1dL is;

$$\frac{2}{5} \div \frac{3}{4} = \frac{1}{5 \times 3} \times (2 \times 4)$$

$$= \frac{2 \times 4}{5 \times 3}$$

$$= \square$$



(4 × 2) pieces of ▨

Teaching and Learning Activities

3 The answer to a division problem is the same even if we multiply the divisor and dividend by the same number. Tura and Becky calculated the answer $\frac{2\times4}{5\times3}$. It is the same as $\frac{2}{5}\times\frac{4}{3}$

$$\frac{2}{5}\div\frac{3}{4}=\left(\frac{2}{5}\times\frac{4}{3}\right)\div\left(\frac{3}{4}\times\frac{4}{3}\right)$$

$$=\frac{2}{5}\times\frac{4}{3}\div1$$

$$=\frac{2}{5}\times\frac{4}{3}=\frac{2\times4}{5\times3}=\square$$

Key Ideas

To divide a fraction by another fraction, you can calculate the answer by multiplying the inverse number of the divisor fraction.

For *example*; $\frac{B}{A}\div\frac{D}{C}=\frac{B}{A}\times\frac{C}{D}$

L26 : Ways on how to calculate fraction ÷ fraction

Lesson Objective: Calculate a fraction ÷ a fraction and simplify the answer. **(6.1.2.3)**
Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share ideas on how to calculate fractions ÷ fractions by reducing and simplify the answer.
Skills	Calculate fractions ÷ fractions by reducing and simplify the answer.
Knowledge	Dividing fractions and whole numbers.
Mathematical Thinking	Think about how to calculate fractions ÷ fractions by reducing and simplify the answer.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let's think about how to calculate.

(a) $\frac{8}{3} \div \frac{12}{5} = \frac{8}{3} \times \frac{\square}{\square}$

$= \square$

(b) $3 \div \frac{2}{5} = \frac{3}{1} \div \frac{2}{5}$

$= \frac{3}{1} \times \frac{\square}{\square}$

$= \square$

(c) $\frac{2}{3} \div 5 = \frac{2}{3} \times \frac{1}{\square}$

$= \square$

Key Ideas

- It's easy to calculate when we reduce the fraction.
- Change an integer (whole number) to a fraction for using the method of fraction ÷ fraction.

Exercises

Let's Calculate.

(1) $\frac{1}{4} \div \frac{1}{3}$ (2) $\frac{2}{7} \div \frac{3}{4}$ (3) $\frac{2}{3} \div \frac{7}{8}$ (4) $\frac{3}{5} \div \frac{7}{4}$

(5) $\frac{16}{7} \div \frac{4}{3}$ (6) $\frac{4}{3} \div \frac{2}{3}$ (7) $4 \div \frac{3}{5}$ (8) $8 \div \frac{2}{3}$

L27: Division of mixed numbers

Lesson Objective: To calculate fractions ÷ mixed numbers by changing mixed number into an improper fraction. **(6.1.2.3)**

Materials: blackboard

ASK-MT and Assessment

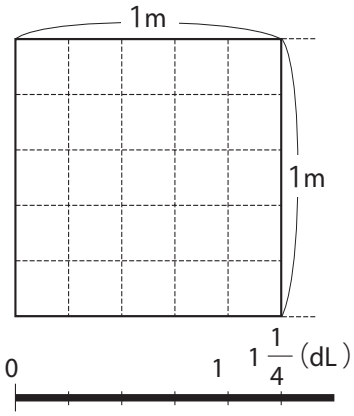
Attitudes/Values	Enjoy dividing fractions with mixed numbers.
Skills	Divide fractions with mixed numbers.
Knowledge	Division of fractions with mixed numbers.
Mathematical Thinking	Think about how to calculate fractions with mixed numbers.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 We use calculate $1\frac{1}{4}$ dL of red paint to paint m^2 of fence. How much can we paint in $\frac{2}{5}$ m^2 using 1dL of paint?

(a) Let's write an expression.

(b) Check this by colouring the sections of the figure on the right.



(c) Let's think about how to calculate.

$$\frac{2}{5} \div 1\frac{1}{4} = \frac{2}{5} \div \frac{\square}{\square}$$

$$= \frac{2}{5} \times \frac{\square}{\square}$$

We can calculate by changing a mixed number into an improper fraction.

(d) Let's compare the dividend. In task 1 the divisor is smaller than 1 however in task 3 the divisor is larger than the dividend.

Key Ideas

- When dividing by a fraction, just like we divided by a decimal, if the divisor is smaller than 1, the quotient becomes larger than the dividend.
- If the divisor is larger than 1, the quotient becomes smaller than the dividend.

Exercises

Calculate.

(1) $7 \div \frac{3}{4}$ (2) $7 \div 1\frac{2}{3}$ (3) $7 \div \frac{3}{2}$ (4) $7 \div 7\frac{7}{8}$

L28 Solving various problems of division.

Lesson Objective: To calculate and solve various problems of division of fractions involving fractions, integers and mixed numbers.

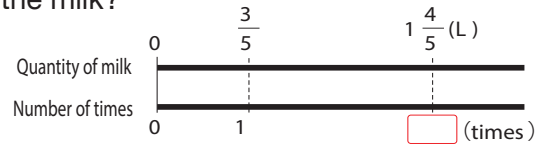
Materials: blackboard

ASK-MT and Assessment

Attitudes/Values	Enjoy how to calculate and solve various problems of division of fractions involving fractions, integers and mixed numbers.
Skills	Calculate and solve various problems of division of fractions involving fractions, integers and mixed numbers.
Knowledge	How to calculate and solve various problems of division of fractions involving fractions, integers and mixed numbers.
Mathematical Thinking	Think about how to calculate and solve various problems of division of fractions involving fractions, integers and mixed numbers.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

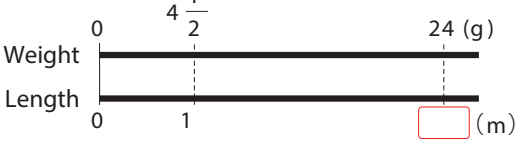
Teaching and Learning Activities

1 There is $1\frac{4}{5}$ L of milk. If you drink $\frac{3}{5}$ L each time with your family meal, how many meals will it take to finish the milk?



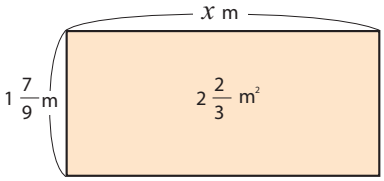
Quantity of milk (L)	$\frac{3}{5}$	$1\frac{4}{5}$
Number of times	1	?

2 There is a wire which weighs $4\frac{1}{2}$ g per metre. If it weighs 24g in total, what is it's length in metres?



Weight (g)	$4\frac{1}{2}$	24
Length (m)	1	?

3 There is a rectangular cloth with the area of $2\frac{2}{3}$ m². If its length is $1\frac{7}{9}$ m, what is it's width in metres.



The area formula of a rectangle is (length) × (width)

Key Ideas

- When dividing by a fraction, just like we divided by a decimal, if the divisor is smaller than 1, the quotient becomes larger than the dividend.
- If the divisor is larger than 1, the quotient becomes smaller than the dividend.

Exercises

Lets calculate.

(1) $\frac{3}{5} \div \frac{9}{10}$ (2) $\frac{5}{8} \div \frac{5}{6}$ (3) $1\frac{3}{5} \div \frac{2}{7}$ (4) $1\frac{1}{4} \div \frac{5}{8}$

L29: What kind of expression to use

What kind of expression will it become?

Lesson Objective: To differentiate between multiplication and division problems in fractions and create and solve problems made by themselves. **(6.1.2.4)**

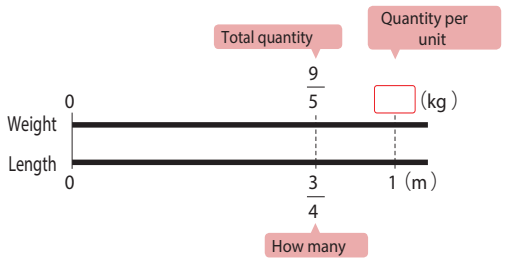
Materials: blackboard

ASK-MT and Assessment

Attitudes/Values	Enjoy how to differentiate between multiplication and division problems in fractions and solve the problems made by themselves.
Skills	Calculate and solve multiplication and division problems in fractions and solve the problems made by themselves.
Knowledge	Difference between multiplication and division problems in fractions.
Mathematical Thinking	Think about which operation is used and solve the problem.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

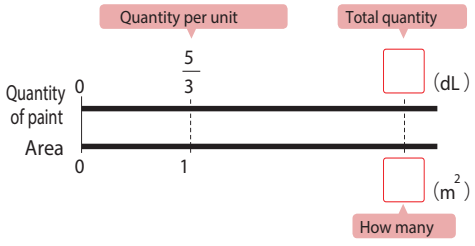
Teaching and Learning Activities

1 We use calculate $\frac{3}{4}$ dL of red paint to paint m^2 of fence. How much can we paint in $\frac{9}{5}$ m^2 using 1dL of paint?



Weight (kg)	?	$\frac{9}{5}$
Length (m)	1	$\frac{3}{4}$

2 We painted the wall of a corridor. We used of $\frac{5}{3}$ dL of paint to cover $1m^2$ of the wall. How many dL of paint do we need for $\frac{5}{2}$ m^2?

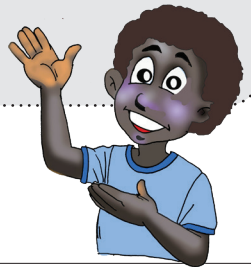


Quantity of paint (dL)	$\frac{5}{3}$	?
Area (m^2)	1	$\frac{5}{2}$

3 If we use $\frac{6}{7}$ L of water for a $1m^2$ field, we need ☐ of water for a $\frac{2}{3}$ m^2 field. Let's fill the ☐.

Key Ideas

Differentiate between multiplication and division problems in fractions and identify the operation used and solve the problems made by themselves.



Unit checkpoint

Review on multiplication & division of fraction

Multiplication of Fractions	Name:	Score /100

1. Calculate. [10 × 10 points = 100 points]

(1) $\frac{3}{4} \times \frac{8}{4}$

(2) $\frac{5}{6} \times \frac{9}{10}$

(3) $1\frac{1}{2} \times 2\frac{2}{3}$

(4) $2\frac{1}{2} \times 1\frac{1}{6}$

2. Find the inverse fractions. [2 × 10 points = 20 points]

(1) $\frac{7}{3}$ Answer:

(2) $3\frac{1}{6}$ Answer:

3. Write an appropriate sign from $<$, $>$ or $=$. [

(1) $\frac{2}{3} \times \frac{4}{7}$ ☐ $\frac{2}{3}$

(2) $\frac{5}{9} \times 1\frac{1}{2}$ ☐ $\frac{5}{9}$

4. A car drives $5\frac{1}{5}$ km with 1 L of fuel. How many kilometres does the car drives with $1\frac{1}{3}$L of fuel? [10 points in total; 5 points for expression and 5 points for the answer]

Mathematical Expression :	Answer :

L30: Comparing two quantities

Multiples and Ratio

Lesson Objective: Explain the ratio of two quantities that is in a proportional relationship. **(6.4.1.1)**
Materials: blackboard

ASK-MT and Assessment

Attitudes/Values	Be confident to explain the ratio of two quantities that is in a proportional relationship
Skills	Read the problem, understand the context and solve it
Knowledge	Cases arising when a ratio is described as a ratio of two numbers.
Mathematical Thinking	Think about how to show a relationship using ratio from given situation.
Assessment	Use the key concepts below to assess the students learning progress during the lesson

Teaching and Learning Activities

1 In a mini basketball team at a school, Jean is able to score shots. When she was in grade 5 she scored 20 shots in 3 games. Now when she is in grade 6 she scored 50 shots in 3 games.
How many more times could she score shots in 6th grade compared to 5th grade?

$$\underset{\text{Compared quantity}}{50} \div \underset{\text{Basic quantity}}{20} = \underset{\text{Multiple}}{\square}$$

2 Suppose the number of shots she made in grade 6 is x times more than 5th grade,

$$\underset{\text{Basic quantity}}{20} \times \underset{\text{Multiple}}{x} = \underset{\text{Compared quantity}}{50}$$

Shot (shots)	20	50
Ratio (multiple)	1	x

$\times x$ above the table, $\times x$ below the table

$$x = 50 \div 20$$

$$x = \frac{5}{2}$$

Key Ideas

When comparing two quantities while considering one of the quantities as 1, the relationship with the two quantities is called ratio. Shown in the example above a ratio is sometimes called a multiplier of the base quantity of the base quantity (to show another quantity)

Exercises

Give one or two exercises to help students understand more about the ratio concept.

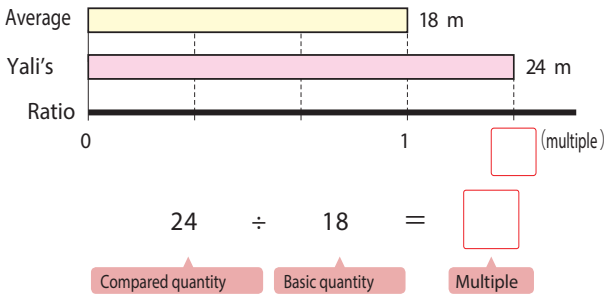
L31 : Ratios represent by a fraction (1)

Lesson Objective: To express ratios with fractions. **(6.4.1.1)**
Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share ideas on how to express ratios with fractions.
Skills	Express ratios with fractions.
Knowledge	Expressing ratio as fractions.
Mathematical Thinking	Think about how to express ratio as fraction.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Yali and her friends played a game by comparing how far they could throw a softball, the average was 18m. Yali's record is 24m. How many times is her record to the average? Show it by a fraction. (study the figure and table below)



Suppose her record is x times the average,

Distance (m)	18	24
Ratio (multiple)	1	x

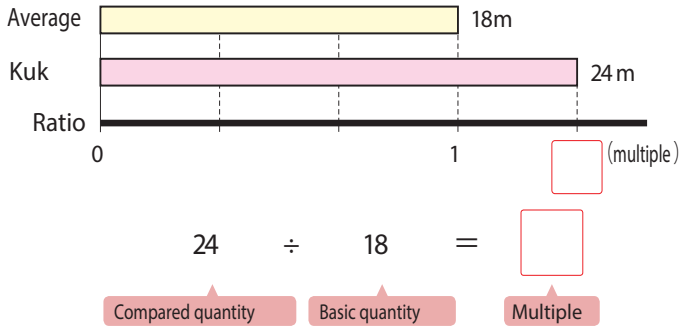
(× x above the 24 column; × x below the 24 column)

Then $18 \times x = 24$

$x = 24 \div 18$

2 Kuk and his friends played a game by comparing how far they could throw a softball. The average is 18m.

(a) Kuk record is 24m. How many times is his record to the average? show it by a fraction.



Suppose his record is x times the average,

Distance (m)	18	24
Ratio (multiple)	1	x

(× x above the 24 column; × x below the 24 column)

$18 \times x = 24$

$x = 24 \div 18$

Note: Ratio is sometimes expressed as fractions.

Teaching and Learning Activities

Key Ideas

- Read the problem and understand the context
- Study the average quantities that give the basic quantity
- Study the compared quantity and solve the problem for the context
- The multiple or ratio can be expressed in fractions

Exercises

Let's fill in the box with fractions.

(1) 15cm is ☐ times of 9m

(2) 35*kg* is ☐ times of 42*kg*

L32: Ratio represented by a fraction (2)

Lesson Objective: To identify the basic quantity and compared quantity based on the given ratio in which two quantities are expressed with fractions. **(6.4.1.4)**

Materials: blackboard

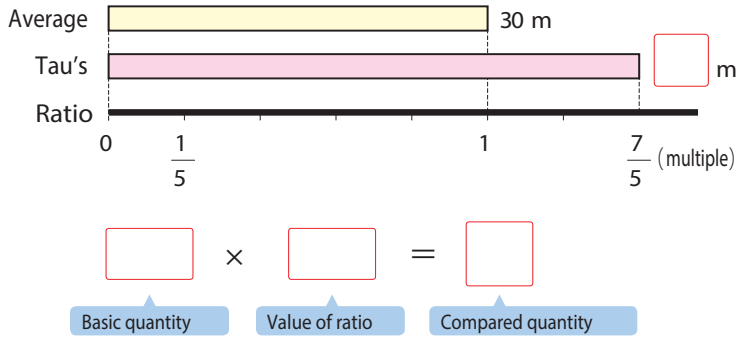
ASK-MT and Assessment

Attitudes/Values	Enjoy solving problem involving ratio and fraction
Skills	Solve the tasks identifying the basic quantity and compared quantity based on the given ratio
Knowledge	Ratio of the average quantity and compared quantity
Mathematical Thinking	Thinking of how to compare quantity expressed in fraction and calculate its solution
Assessment	Use the key concepts below to assess the students learning progress during the lesson

Teaching and Learning Activities

1 This lesson is based on how to identify the compared quantity.

Tau and his friends played a game by comparing how far they could throw a softball, and the average was 30 m. Tau's score was $\frac{7}{5}$ times the average. How far did he throw in metre ? Suppose his record is x m.



□ × □ = □

Basic quantity | Value of ratio | Compared quantity

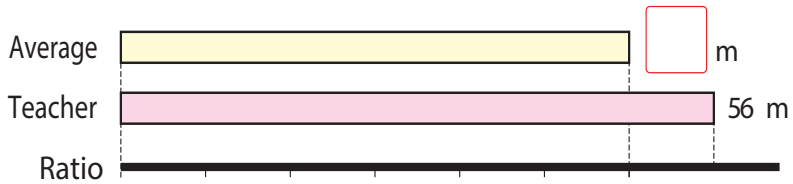
Suppose his record is x m,

Distance (m)	30	
Ratio (multiple)	1	$\frac{7}{5}$

(×$\frac{7}{5}$)

$30 \times \frac{7}{5} = x$

2 A teacher threw a softball for 56m. The record was $\frac{7}{6}$ times the teacher's average. What was the teacher's average in metre?



Suppose the average is x m and write a mathematical sentence .

$x \times$ □ $= 56$

$x = 56 \div$ □

Distance (m)	x	56
Ratio (multiple)	1	$\frac{7}{6}$

(×$\frac{7}{6}$)

Teaching and Learning Activities

Key Ideas

- Identify the average quantity which is the basic quantity in the problem
- Multiply by the value of ratio fraction to give the product of compared quantity

Exercises

Let's fill the box $\square$.

(1) $\frac{6}{5}$ times of 5 kg is $\square$ kg.

(2) $\frac{6}{5}$ times of $\square$ kg is 50kg.

L33: Solving decimals numbers (1)

Calculation of decimals

Lesson Objective: To solve decimal problems using the four arithmetic operations. **(6.1.3.1)**
Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Appreciate using the four operations to solve decimal problems.
Skills	Calculate decimals number using 4 arithmetic operations.
Knowledge	How to calculate decimal number.
Mathematical Thinking	Think about the processes used in calculating decimal numbers.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

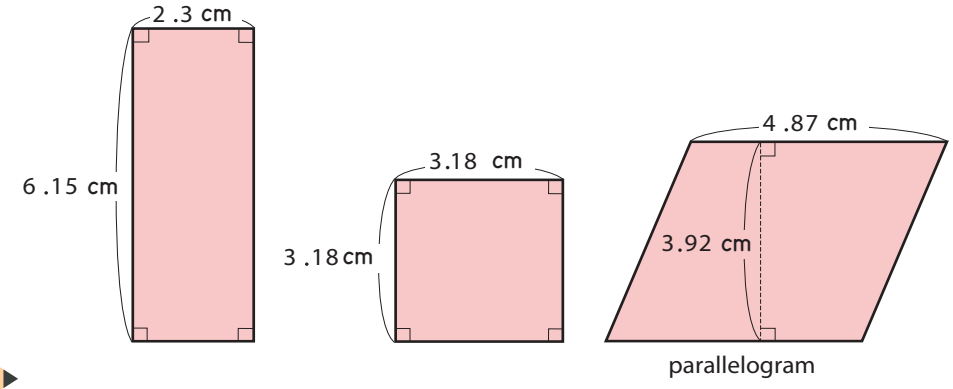
1 Calculate the decimals.

(a) There are two water melons, one weights 2.3 kg and an other 1.63kg.
What is their total weight in kg?

(b) Vagi ran 850m in the 2km marathon course.
How much more in km does he have to run to finish?

(d) Kua drew a circle with 7m of the radius in a ground.
What is the circumference of this circle? The ratio of the circumference is 3.14.

2 Find the area of the following shapes.



Exercises

Calculate these problems.

(1) 1.24 + 2.45 (2) 5.57 + 3.61 (3) 2.66 + 4.54 (4) 6.8 + 2.36 (5) 8.75 - 3.52

(6) 9.36 - 6.54 (7) 7.24 - 4.35 (8) 8.5 - 1.72 (9) 2.3 x 1.2 (10) 7.43 x 8.2

L34 : Solving decimal number (2)

Lesson Objective: To solve decimal problems using the four arithmetic operations. **(6.1.3.1/3)**
Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share ideas on how to solve decimal problems using the four operation.
Skills	Calculate decimal number using the four arithmetic operations.
Knowledge	How to calculate decimal numbers in different situations in daily life .
Mathematical Thinking	Think about how to perform calculations of decimal different situation in daily life.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Kua and his 3 of his friends did long jumps for 3 times as shown on the table below.

(m)

Name \ Try	1st Try	2nd Try	3rd Try
Kua	2.56	2.43	2.54
Yaki	2.53	2.51	2.61
Agua	2.62	2.52	2.51
Sanae	2.51	2.49	2.53

(a) What is length Kua jumped in 3 tries?

(b) On the first tries how much farther Agua jumped than Yaki?

(c) What is the difference between the best and worst record of Yaki after 3 tries?

(d) Look at the table and discuss who jumped the farthest. Explain your reasons.

L35: Solving decimal number (3)

Lesson Objective: Solve various decimal problems applying the four arithmetic operations. **(6.1.3.1/3)**
Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share ideas on how to identify the right calculation process to solve decimal numbers.
Skills	Read problems and identify the right calculation process to solve decimal numbers.
Knowledge	Various decimal problem.
Mathematical Thinking	Think about ways to solve various decimal problems and what operation to use.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

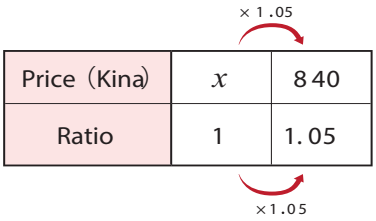
Teaching and Learning Activities

1 There are three digit cards for each of the numbers 1 to 9. Let us Develop division problems, and calculate. If the number is not divisible, round off the quotient to one decimal place.

□ □ . □ ÷ □ . □

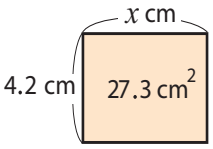
1 2 3 4 5 6 7 8 9

(a) You bought a TV screen, which cost K840 and 20% of sales tax is included in to the price. How much is the price without tax?

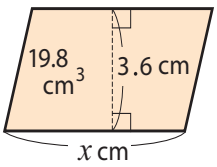


2 Answer the questions.

(a) Suppose the with of a rectangle is x cm and its length is 4.2 cm and the area is 27.3 cm^2. Find the width.



(b) Suppose the width of a parallelogram is x cm and its height is 3.6cm and area is 19.8 cm^2. Find the base.



Key Ideas

Read and understand the problems set and think of ways to solve them applying the four arithmetic operations

Exercises

Calculate the following.

(1) 9 ÷ 0.6 (2) 8.4 ÷ 0.7 (3) 1.2 ÷ 0.4 (4) 22.8 ÷ 0.4 (5) 7.14 ÷ 3.4

(6) 6.45 ÷ 1.5 (7) 6.45 ÷ 1.5 (8) 6.66 ÷ 3.7 (9) 9.24 ÷ 4.2

L36 : Solving fraction problems (1)

Calculation of fraction

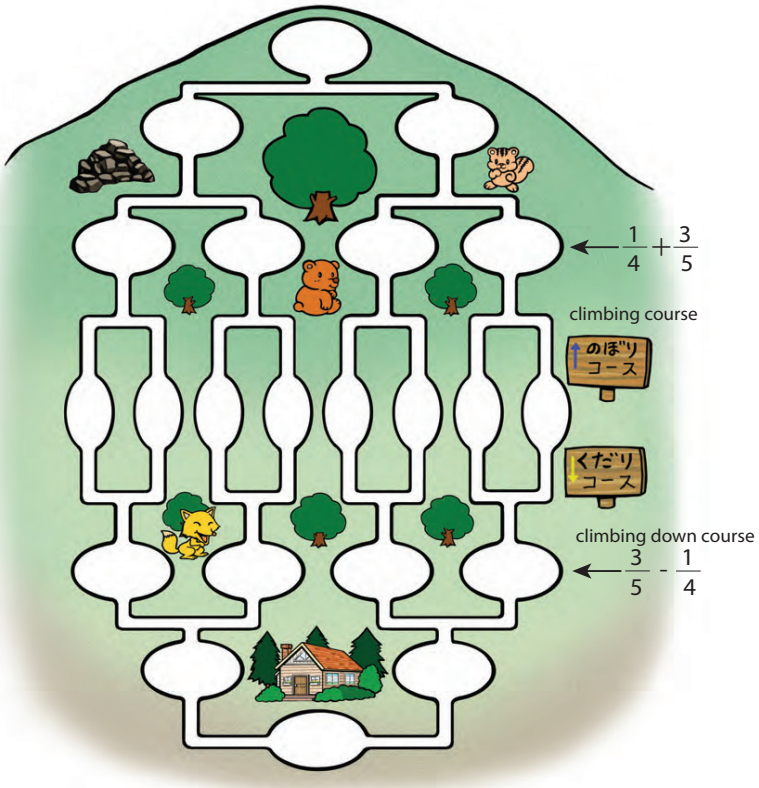
Lesson Objective: Solve various fraction problems applying the four arithmetic operations.**(6.1.3.2/3)**
Materials: blackboard

ASK-MT and Assessment

Attitudes/Values	Share their ideas on how to calculate fraction.
Skills	Read and solve problems in relation to fractions using the four arithmetic operations.
Knowledge	Understand the fraction problems given.
Mathematical Thinking	Think about ways to solve fraction problems.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Starting from a fraction in the middle of the picture, as you go up the course, add the fractions. As you go down the course, subtract the smaller from the larger fractions. What are the final numbers?



Exercises

Solve the following problem.

(1) $\frac{1}{2}+\frac{1}{3}$ (2) $\frac{7}{9}+\frac{2}{3}$ (3) $\frac{7}{9}+\frac{2}{3}$ (4) $1\frac{3}{4}+\frac{5}{6}$ (5) $1\frac{1}{7}+2\frac{2}{5}$

(6) $\frac{7}{8}-\frac{1}{4}$ (7) $\frac{5}{6}-\frac{3}{5}$ (8) $\frac{5}{6}-\frac{3}{5}$ (9) $1\frac{7}{8}-\frac{1}{6}$ (10) $1\frac{2}{9}-\frac{4}{5}$

L37: Solving Fraction Problems (2)

Lesson Objective: To read and understand various problems on fractions, make mathematical expressions and solve. **(6.1.3.3)**

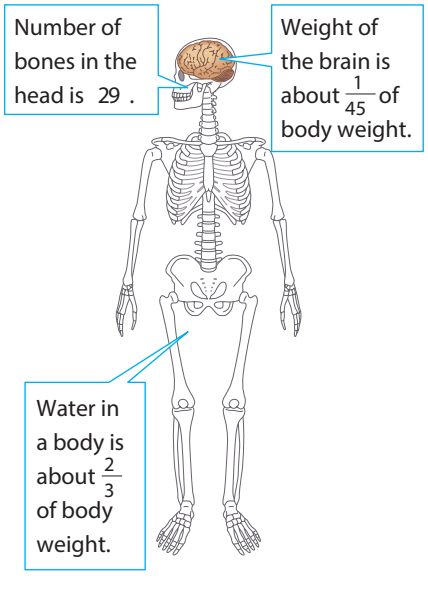
Materials: blackboard

ASK-MT and Assessment

Attitudes/Values	Appreciate reading and identifying various fraction problems, forming expressions and solve them.
Skills	Write a mathematical expression and solve fraction problems.
Knowledge	Understand a given fraction problems, form expressions and solve.
Mathematical Thinking	Think about ways to write a mathematical expression for a fraction problem and the process to solve.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Look at the picture on the right and think about our body.



(a) How much is the weight of a brain if the person weighs 36kg?

(b) About $\frac{1}{7}$ of the bones are in the head.

How many bones are therein a human body?

(c) How much water is in the body if the person weighs 45kg?

2 For the body to grow and to exercise, we need various nutrition Carbohydrates and energy for exercise. Protein provides a base of body like muscles.

(a) Rice contains about $\frac{2}{5}$ of carbohydrates in the total weight.

How much carbohydrates in the 200g of rice?

(b) A fish contains about $\frac{1}{4}$ of protein in total weight.

If you want to take 30g from fish. How much do you have to eat in grams?

(c) Sausages contain about $\frac{3}{20}$ of protein in total weight. Let's develop problems with this information.

Rice

Fish

Sausages

Key Ideas

Understanding a mathematical problems and thinking about ways to solve it.

L38 : Calculation of time with fraction

Lesson Objective: To calculate time and duration using fraction. **(6.1.3.2/3)**
Materials: blackboard

ASK-MT and Assessment

Attitudes/Values	Enjoy and share ideas on time and duration and calculate using fractions.
Skills	Calculate time and duration using fraction.
Knowledge	Calculating time using fraction.
Mathematical Thinking	Think about how to calculate time and duration using fraction.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 The relationships among different units of time are shown in the table on the right. Time units are not organised by multiple of tens. For calculating time, it is useful to use a fraction.

Time	Minutes	Second
$\frac{1}{3600}$	$\frac{1}{60}$	1
$\frac{1}{60}$	1	60
1	60	3600
24	1440	86400

(a) What is 4 minutes in terms of hours?

$\frac{1}{\square} \times 4 = \square$

(b) Let's change the given time by the unit ( ) below

(A) 35 minutes (hour) (B) 20 seconds (minutes)

(C) $\frac{2}{3}$ hour (minutes) (D) $\frac{1}{4}$ minute (seconds)

(c) How long is $7\frac{1}{3}$ minutes in minutes and seconds

$7\frac{1}{3}$ (minutes) = 7 (minutes) + $\frac{1}{3}$ (minutes)

= 7 (minutes) + $\square$ x $\frac{1}{3}$ (seconds)

= 7 (minutes) + $\square$ (seconds)

2 When we use the method in the previous lesson, we can represent calculation of time using fractions. Answer the following by using fractions.

(a) The music performed by the sixth graders is 1hour and 40 minutes long. If they perform it for 3 times, how long will it take in terms of hours?

(b) Tavi ran 1.5 km in 6 minutes and 15 second. How much time did he use to run for 1km?

(c) Yaki studied 2 hours and 40 minute every day. Yesterday she spent 40 minute to each subject. How many subjects did she study?

Key Ideas

Conversion of units of time and understanding how long or length of time spend.

L39: Calculation of mixed fractions and decimals

Lesson Objective: To calculate addition and subtraction of mixed decimal numbers and fraction.**(6.1.3.3)**
Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Work corporately ideas and show interest in solving given problems.
Skills	Calculate mixed decimal numbers and fraction problem.
Knowledge	Calculating mixed fraction and decimal.
Mathematical Thinking	Think about how to calculate mixed fraction and decimal.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let's calculate $\frac{2}{5}+0.5$.

(a) Let's convert decimals to fractions.

$0.5=\frac{1}{2}$ $\quad\quad$ $\frac{2}{5}+\frac{1}{2}=$ ☐

(b) Let's convert fractions to decimals and calculate.

$\frac{2}{5}=0.4$ $\quad\quad$ $0.4+0.5=$ ☐

2 Let's calculate $0.2-\frac{1}{6}$.

(a) Let's convert decimals to fractions and calculate.

$0.2=\frac{1}{5}$ $\quad\quad$ $\frac{1}{5}-\frac{1}{6}=$ ☐

(b) Let's convert fractions to decimals and calculate.

$\frac{1}{6}=0.1666\ \ldots$
$\downarrow$
0.167

$0.2-0.167=$ ☐

Key Ideas

If addition and subtraction include both decimal and fraction, convert and align the units to either decimal or fraction. If you cannot convert a number to an accurate decimal, convert unit to a fraction.

Exercises

Calculate the following.

(1) $0.6+\frac{4}{9}$ $\quad$ (2) $0.7+\frac{4}{5}$ $\quad$ (3) $\frac{3}{7}+0.4$ $\quad$ (4) $\frac{2}{3}+0.45$

(5) $\frac{7}{8}-0.3$ $\quad$ (6) $1\frac{4}{7}-0.4$ $\quad$ (7) $\frac{7}{8}-0.25$ $\quad$ (8) $\frac{1}{5}-0.12$

L40: Finding area of circle using square

Area of a circle

Lesson Objective: Discover ways to determine the area of a circle using grid squares then devise ways to identify the area of incomplete cells in a grid. **(6.2.1.1.1)**

Materials: graph papers, 30cm ruler,blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on how to determine the area of a circle on a grid square.
Skills	Find the area of circle by inventing ways to identify the area of incomplete cells and complete cells in a grid.
Knowledge	Finding area of circle using square.
Mathematical Thinking	Think about how to determine the area of circles.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let's find the area of the circle with radius of 10 cm, by using the squares.
The (Use the figure on the right)

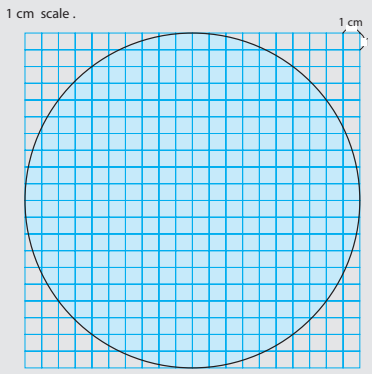
(a) How can we check the answers?

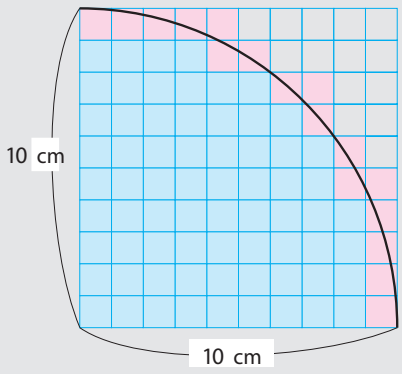
(b) Let's begin by dividing the circle into 4 equal parts and looking at one part?

(c) How many cm^2 is the area of the entire circle? (Consider complete squares as blue squares and incomplete squares as red square)

Key Ideas

- To find the area of a circle on the grid
  - Divide the circle into quarter
  - Start counting the squares that are completely in the quadrant beginning from the radius towards the arc
  - Then count squares that are incomplete.
- In circles all quadrants are equal





L41: Finding formula for area of circle

Lesson Objective: To discover formula to calculate the area of a circle by transform circle into a familiar shape with the same area to find the area of a circle. **(6.2.1.2)**

Materials: A4 papers, scissors, circular object (for drawing circle),blackboard

ASK-MT and Assessment

Attitudes/Values	Share their ideas on how to transform a circle into a known shape with the same area to make formulae of a circle.
Skills	Transform a circle into a familiar shape triangles to identify the formulae.
Knowledge	Formulae for area of a circle.
Mathematical Thinking	Think about a formula to calculate the area of a circle.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

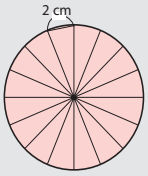
1 Let's think about how to find the area of a circle.

(a) Let's think about the formula by using figures that divides the circle into many equal sections from the radius?

(b) Tell the class your ideas about finding the area of a circle. Explain that to three other students.

(c) Think about how to make a formula to calculate the area of a circle by using the ideas above.

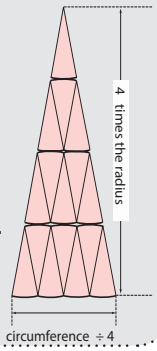
Mero's Idea



I divide a circle into a lot of small triangles

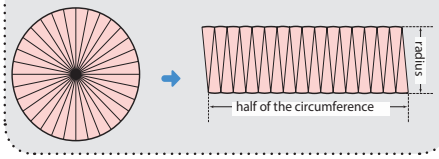
Yamo's Idea

I change the circle into a triangle.

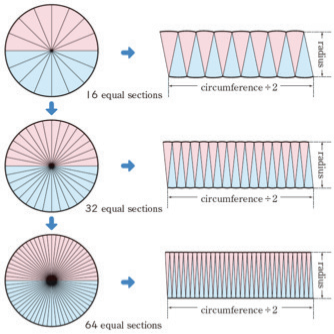


Ambai's Idea

I rearrange the circle to make a parallelogram.



(d) Make a formula based on Ambai's idea



The area of a rectangle = length × width

The area of a circle = ☐ × circumference ÷ 2

= radius × diameter × 3.14 ÷ 2

= radius × diameter ÷ 2 × 3.14

= radius × ☐ × 3.14

Key Ideas

The area of a circle can be calculated by using this formula

Area of a circle = radius x radius x 3.14

L42 : Calculate area of circles (1)

Lesson Objective: Find the area of two circles using the formula; to compare and examine how many times the circumference and the area of one circle to the other when the diameter of one of the circles is twice the size of the other. **(6.2.1.2)**

Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on the sizes of circumference and area of the circles when the diameter of one of the circles is twice the size of the other.
Skills	Calculate the area of circle using the formula.
Knowledge	Understand formula of circles.
Mathematical Thinking	Think about how big the area and circumference of the circle using the size of the diameter.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Calculate the area of these circles.

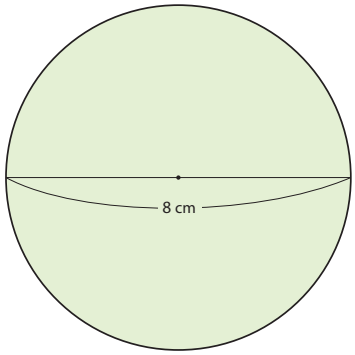
(a) A circle with 8 cm radius.

(b) A circle with 12 cm diameter.

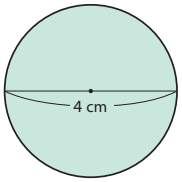
2 There are circles with 4 cm diameter and another with 8 cm diameter shown.

(a) Find the circumference and area of each circle.

(A)



(B)



(b) The diameter of (B) is twice of the diameter of (A). How many times are the circumference and the area of (B) to (A)?

Key Ideas

Area of a circle = radius×radius × 3.14

Exercises

These numbers are the circumferences of circles.

Find the radius and area of each circle.

(1) 62.8 cm (2) 18.84 cm (3) 15.7 cm

L43: Calculate area of circle (2)

Lesson Objective: Apply the formula of calculating area of a circle to the problems which involve half circles, squares and/ or quarter circles. **(6.2.1.2/3)**

Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on how to calculate area of half circle, squares,quarter circles.
Skills	Calculate half circles, squares and quarter circles.
Knowledge	Calculating area of half circle, squares,quarter circles.
Mathematical Thinking	Think about how to calculate half circles, squares,quarter circles.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

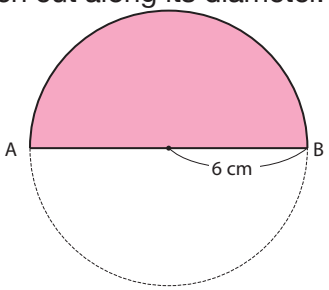
Teaching and Learning Activities

1 The figure on the right is a circle with 6 cm radius that has been cut along its diameter.

Answer the following.

(a) The length of the arc from A to B.

(b) The circumference and area of this half circle.

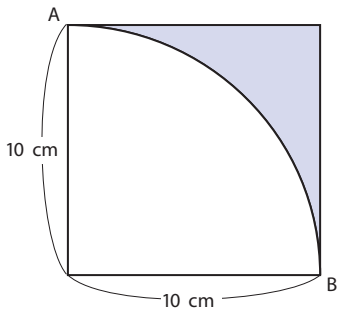


2 As shown on the right, one part of a circle fits exactly inside a square with 10 cm sides.

Answer the following.

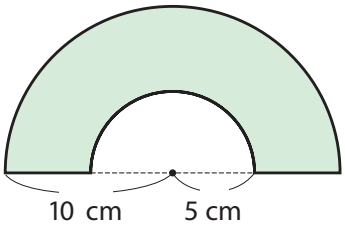
(a) The length of the arc from A to B.

(b) The area of the coloured section.



Exercises

Let's find the area of the coloured section on the right.



L44 : Calculate approximate area of figure

Approximate Area

Lesson Objective: Calculate the approximate area of figures in the surroundings by applying basic mathematics rules. **(6.2.1.1)**

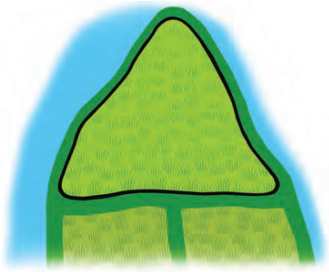
Materials: Graph paper,blackboard

ASK-MT and Assessment

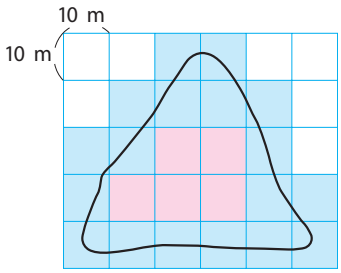
Attitudes/Values	Share ideas on how to estimate area of irregular figures.
Skills	Estimate and calculate area of irregular figures.
Knowledge	Approximate area of irregular figures.
Mathematical Thinking	Think about how to estimate and calculate area of irregular figures.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

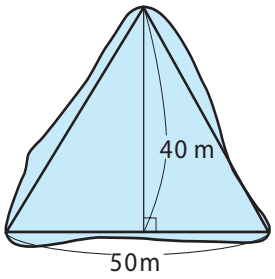
1 What is the area of the field bordered by 2 rivers as shown on the right?



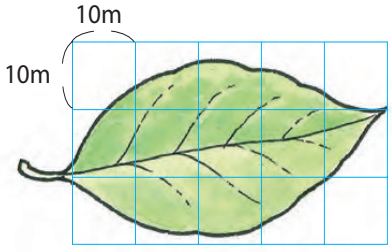
(a) How many squares are there inside the curved area?
Calculate the area of the field by considering the area of any 2 squares that the line passes through as $100m^2$.



(b) Calculate the area by considering the shape of the field as a triangle.



2 Calculate the area of various leaves by using the method in Task1.



Unit checkpoint

Review on calculating area of various shapes

Calculating Area of Various Shapes	Name:	Score /100

1. Find the area of the following circles. [2 × 10 points = 20 points]

(1) A circle with the radius of 4cm

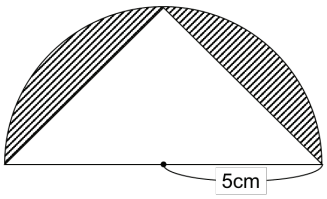
Answer:

(2) A circle with the diameter of 16 cm

Answer:

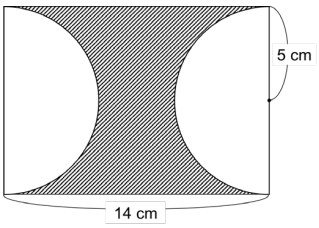
2. Find the area of the following circles. [2 × 10 points = 20 points]

(1)



Answer:

(2)



Answer:

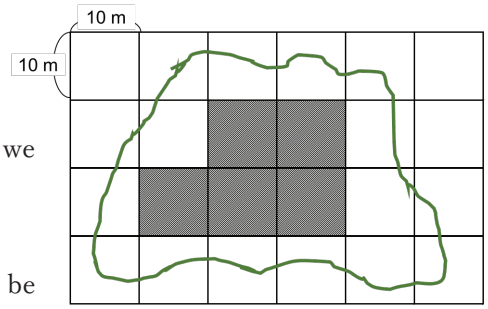
3. Find the approximate area of the park as shown below.

(1) Write numbers in ☐. [5 × 8 points = 40 points]

The number of shaded box inside the border of the park is ☐.

There are ☐ boxes which are crosscut by the border, therefore we consider 2 crosscut boxes for ☐ m^2.

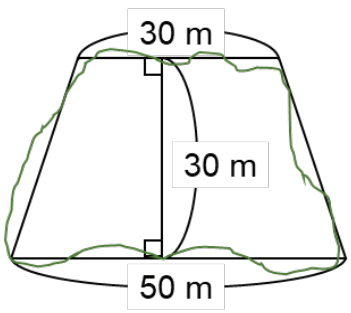
Therefore, the area of the park can be calculated as;



☐ × 100 + ☐ × 100 ÷ 2 = ☐

Answer: Approximately ☐ m^2

(2) Calculate the area of the park by considering the shape of the park as a trapezium.



Mathematical expression:

Answer:

L45 : Ordering (1)

Ordering

Lesson Objective: To understand ways to examine and identify the order of things based on tables and figures. **(6.4.4.1/2)**

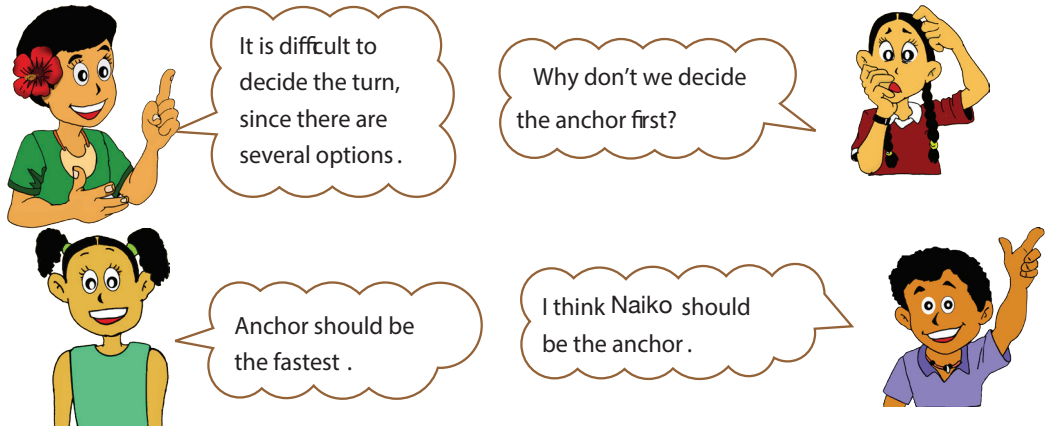
Materials: table of chart,blackboards

ASK-MT and Assessment

Attitudes/Values	Share their ideas on how to examine and identify the order of things.
Skills	Analyse systematically the order of various things using figures and tables with careful attention to avoid duplication and overlooking.
Knowledge	Understand various things using figures and tables.
Mathematical Thinking	Think about how to order various things using figures and tables.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Naiko, Kara, Tema and Noma are running the relay race. Lets decide their turn that they run.



(a) When Naiko is the anchor, how many different orders can there be for the first, second and the third runners?

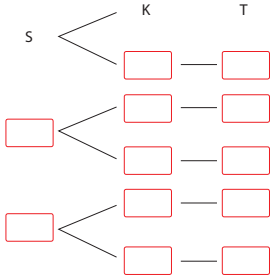
(b) Let's consider the following method.

i. Draw a table

ii. Determine the first runner and fill the rest of the table.

First runner	Second runner	Third runner

(c) It is easier to see when you write a tree, rather than write it down on a table. Complete the following tree diagram.



Teaching and Learning Activities

How many different orders are there when Noma is the anchor?

d). There are four cards with numbers 1 2 3 and 4. Use all cards and make four digit numbers. How many numbers can you make?

i. Vavi came up with the following order.

First, Naoko → Tema → Kara
Second, Kara → Naoko → Tema
Third, Tema → Kara → Naoko

(a) Are there other ordering other than what Vavi found?

(b) Discuss how to find all the orders systematically and efficiently.

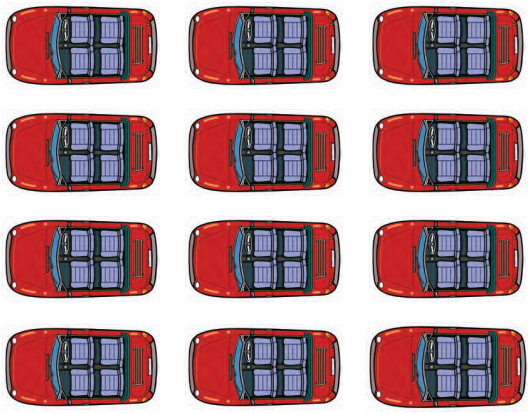
L46 : Ordering (2)

Lesson Objective: To think about how many different orders there can be on given conditions. **(6.4.4.1/2)**
Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on how to examine and identify the order of things.
Skills	Analyse systematically the order of various things using figures and tables with careful attention to avoid duplication and overlooking on given conditions.
Knowledge	The order of various things on given conditions.
Mathematical Thinking	Think about how many different order there can be on given conditions.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let's explore the order of setting options for this task. Meva is going for a ride with his parents and sister. If the car has four seats, how many seating options are there? Both his mother and father can drive.



L47: Combinations (1)

Combination

Lesson Objective: To systematically think about the combination when selecting two objects from a set of five objects.**(6.4.4.1/2)**

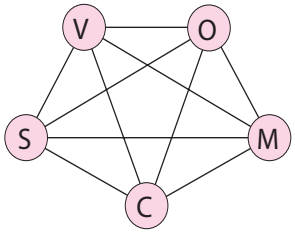
Materials: blackboard

ASK-MT and Assessment

Attitudes/Values	Share their ideas on how to examine and identify the combination of things.
Skills	Analyse systematically the combination of various things using figures and tables with careful attention to avoid duplication and overlooking.
Knowledge	Combination of various things using figures and tables.
Mathematical Thinking	Think about how to combine various things using figures and tables.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let us look at combining things. Nukuwe is going to buy ice cream. She can buy two kinds from five flavours shown below. The same information is illustrated.



(a) How many combinations are there?

(b) Look at the figure on the right and write all combinations.

Combinations with vanilla..... (V)–(S), (V)–(C), (V)–(M), ◯–◯

Combinations with strawberry..... ◯–◯, ◯–◯, ◯–◯, ◯–◯

Combinations with chocolate..... ◯–◯, ◯–◯, ◯–◯, ◯–◯

Combinations with melon ..... ◯–◯, ◯–◯, ◯–◯, ◯–◯

Combinations with orange..... ◯–◯, ◯–◯, ◯–◯, ◯–◯

i. Are there same combinations in the figure?

ii. Erase one combination that overlapped?

The order does not matter, so V-C and C-V is same.

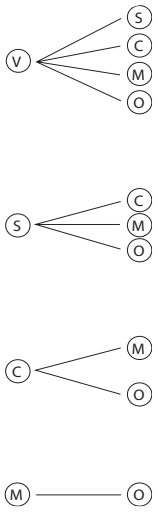
iii. How many combinations are there, if you buy two kinds of flavours from five?

iv. Yembi wrote a table below. Fill the blank.

(V)	◯									
(S)	◯									
(C)										
(M)										
(O)										

Teaching and Learning Activities

v. Haro used the diagrams below. Explain his methods.



Exercises

If you are buying three flavours, how many combinations are there?

If you are buying four flavours, how many combinations are there?

L48 : Combinations (2)

Lesson Objective: To systematically think about combination when selecting two objects from a set of six objects. **(6.4.4.2)**

Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on how to examine and identify the combination of things.
Skills	Analyse systematically the combination of various things using figures and tables with careful attention to avoid duplication and overlooking.
Knowledge	Understand the combination of various things using figures and tables.
Mathematical Thinking	Think about how to combine various things using figures and tables.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let us determine the combination of participants in a basketball tournament. There are six teams which will participate in a basketball tournament. Each team will play with other five teams.

(a) In this tournament, how many games are played in total?

Ambai's Idea

I numbered the teams, and found there combinations.

1 - 2 - 1 - 3 - 1- 4 - 1 - 5 - 1 - 6

2 - 3 - 2 - 4 - 2 - 5 - 2 - 6

Mero's Idea

I numbered the teams and made a table.

	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

Exercises

There is a baseball tournament with seven teams participating. Each team plays one time with each other. In this tournament, how many games are played in total?

Unit checkpoint

Review on order and combination

Order and Combination	Name:	Score /100

1. You will make 4-digits whole numbers by arranging 4 cards of 1, 4, 6 and 8.

(1) List all the whole numbers made with the given cards and find the number of the whole numbers made. [2 × 15 points = 30 points]

Number of whole numbers:

(2) How many odd numbers have you made? [20 points]

Number of odd numbers:

2. 5 female workers of A, B, C, D and E at a restaurant will share cleaning. 2 workers will clean outside and 3 will clean inside.

(1) Find all the combinations of 2 people for cleaning outside by filling in the table below. [30 points]

A	✓	✓										
B	✓											
C		✓										
D												
E												

(2) How many combinations are there? [20 points]

Answer:

L49: How to express speed

Speed

Lesson Objective: Explore ways to express speed in relation to distance and time using the formulas. **(6.2.2.1)**

Materials: blackboard

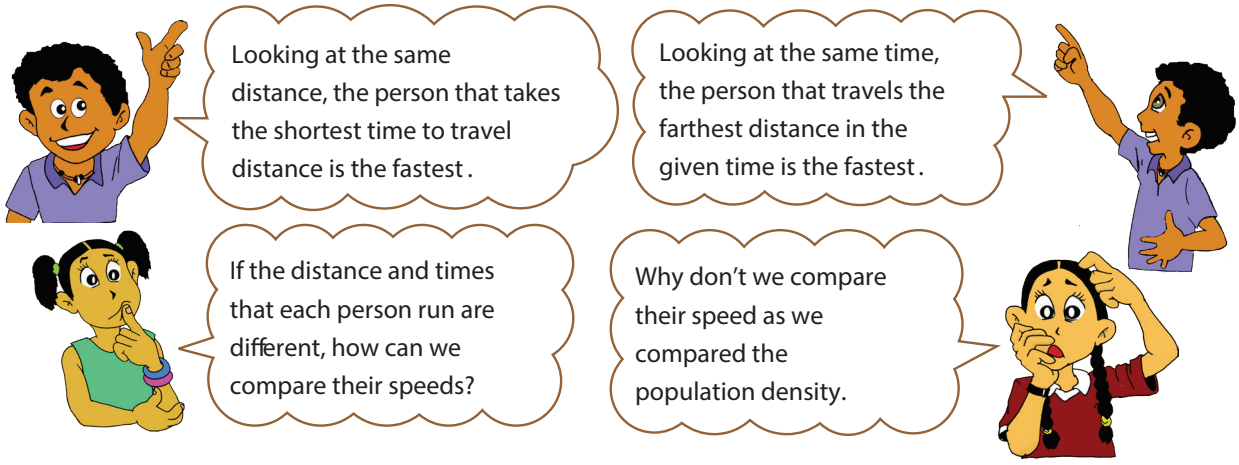
ASK-MT and Assessment	
Attitudes/Values	Share their ideas on how to calculate speed, time and distance from given Mathematical problems and graphs.
Skills	Calculate speed, time and distance from given mathematical problems and graphs
Knowledge	Relationships between speed, time and distance from given mathematical problems and graphs.
Mathematical Thinking	Think about how to calculate speed, time and distance from given mathematical Problems and graphs.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 A Physical Education Class wants to measure speed of individual students. They got into two groups. One group timed others that ran certain distances. Another group measured the distance other students ran in a time period.

Speed is expressed as distance per unit of time.

Speed = Distance ÷ time



The distance and time of 3 students are shown in the table below.

Distances and Times

Groups	Distance (m)	Time (time)
Ⓐ	40	5
Ⓑ	30	5
Ⓒ	30	4

Teaching and Learning Activities

(a) Which student is the fastest?

(b) Compare their speed.

Comparing Ⓐ and Ⓑ, → ☐ is faster .

Comparing Ⓑ and Ⓒ, → ☐ is faster .

Comparing Ⓐ and Ⓒ, → ☐ is faster .

2 Special transport company travels between Lae and Mt Hagen. It travels the distance of 553km in three hours. Special press company travels between Lae and Madang, it travels the distance of 334km in two hours.

(a) Which company truck is fastest?

(b) What is press company speed per hour?

Key Ideas

1. The speed of moving objects is calculated by the distance covered by the object over the time taken. Mathematically, this can be expressed as

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \qquad S = \frac{D}{T}$$

Speed is expressed in various ways depending on the unit of time. Speed is a kind of measurement per unit.

Speed per hour… Speed expressed by the distance travelled in an hour.

Speed per minute…Speed expressed by the distance travelled in a minute.

Speed per second…Speed expressed by the distance travelled in a second.

Exercises

(1) Who is faster, one who ran 50m in 8 seconds, or one who ran 60m in 10 seconds? Compare their speeds in seconds.

(2) Who is faster, one who walks 432m in 6 minutes, or one who walks 280m in 4 minutes? Compare their speeds in minute.

L50: Correlation between speed and time

Lesson Objective: Explore ways to express speed in relation to distance and time using the formulas. **(6.2.2.1/2)**

Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on how to express speed in relation to distance and time using the formulas.
Skills	Express speed in relation to distance and time using the formulas.
Knowledge	Express speed in relation to distance and time.
Mathematical Thinking	Think about how to express speed in relation to distance and time using the formulas.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

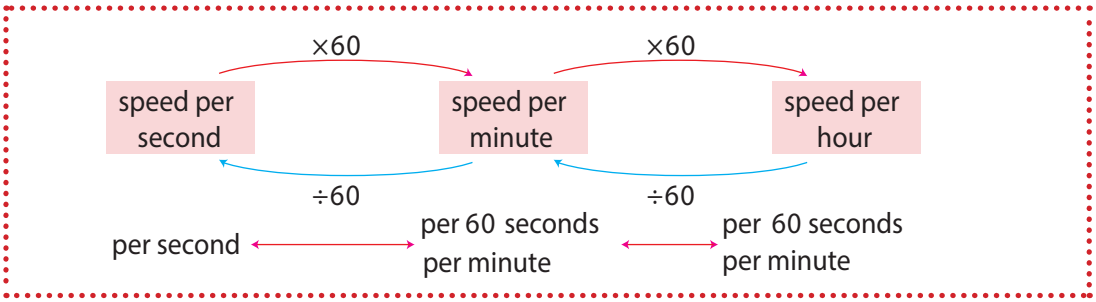
Teaching and Learning Activities

1 A marathon runner ran 36km in 2 hours.

(a) What is his speed in k/h (kilo metre per hour) ?

(b) What is his speed in m/m (metre per minute)?

(c) What is his speed in m/s (metre per second)?



Key Ideas

Speed Unit conversions (Hours → Minutes → Seconds, Kilometres → metres → centimetres)

Exercises

Let's compare (1) to (3) below, which is the fastest?

(1) A car which covers 30m per hour.

(2) A bike which runs 510 metres per minute.

(3) A sprinter who run 100m in 10 metres per second.

L51: Finding distance and time

Lesson Objective: To think about how to find distance when speed and time are made known or to find time when speed and distance are made known. **(6.2.2.2)**

Materials: blackboard

ASK-MT and Assessment

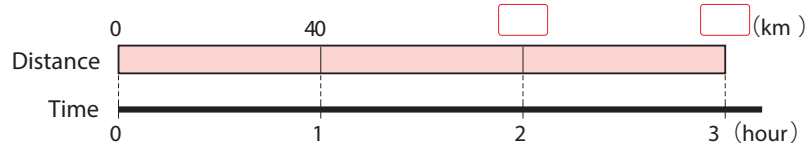
Attitudes/Values	Share their ideas on how to calculate time and distance from given mathematical Problems and graphs.
Skills	Calculate time and distance from given mathematical problems and graphs.
Knowledge	Relationships between time and distance from given mathematical problems and graphs.
Mathematical Thinking	Think about how to calculate time and distance from given mathematical problems and graphs.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 There is a car traveling at 40km per hour.

(a) How many km would it travel in two hours?

(b) How many km would it travel in three hours?



If (a) and (b) each car has travelled x Km each, then,

Distance (km)	40	x
Time (hour)	1	2

(×2 above and ×2 below)

Distance (km)	40	x
Time (hour)	1	3

(×3 above and ×3 below)

2 A cyclist travels 400m per minute. How many minutes does he take to travel 2400m?

If the time he takes is x, let's find the answer !

Distance = speed × time

$2400 = 400 \times x$

$x = 2400 \div 400$

Distance (km)	400	2400
Time (hour)	1	x

(×x above and ×x below)

Key Ideas

Distance = speed × time

Time = distance ÷ speed

Exercises

A person walks at the speed of 80m per minute.

(1) How many metres will this person walk in 5 minutes?

(2) How many minutes will it take for this person to walk 2000m?

L52 : Speed and graph

Speed and graphc

Lesson Objective: To solve word problems on speed by completing tables and graphs. **(6.2.2.2)**

Materials: blackboard

ASK-MT and Assessment

Attitudes/Values	Share their ideas on how to solve speed from tables and graphs.
Skills	Calculate speed, time and distance from tables and graphs.
Knowledge	Solving speed problems from tables and graphs.
Mathematical Thinking	Think about how to solve speed from tables and graphs.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let's look at Speeds and Graphs.

Joshua's father is walking from his house to a bus top at a speed of 6km per hour. 10 minutes after his father had gone, Joshua noticed his father's wallet in the house, and he started after his father by bicycle at a speed of 18km per hour. There is one road between his house and the bus stop, and the distance between them is 3km.

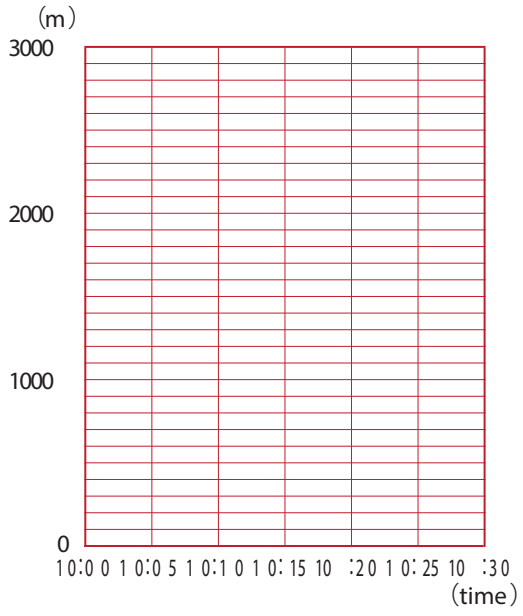
(a) Let's complete the following table to represent the relationship between time in minutes and distance in metres for Joshua's father.

Time (minutes)	0	5	10	15	20	25	30
Distance (m)							

(b) Let's draw the line graph below to represent the relationship between time in minutes and distance in metres for Joshua's father.

(c) Let's complete the table to represent the relationship between time in minutes and distance in metres for Joshua's ride by bicycle.

(e) At what time did Joshua catch up with his father? Let's read it from the graph.



Exercises

A train travels the distance of 210 km in 3 hours, and a car travels the distance of 160 km in 2 hours.

(1) What is the speed of the train in km per hour? (2) What is the speed of the car in km per hour?

Unit checkpoint

Review on speed

Speed	Name:	Score /100

1. Find distance, speed or time taken. [3 × 20 points = 60 points]

(1) Distance for a person to walk for 3 hours in 4 km per hour.

Answer:

(2) Speed of a bicycle traveling 8.4 km in 24 minutes.

Answer:

(3) Time taken of a bus traveling 1 km in a speed of 20 m per second

Answer:

2. An airplane travels 2600km in 4 hours. How many hours does it take to travel 3900 km? [20 points]

Answer;

3. The speed of a car is 20m per second. Find the speeds per minute and per hour. [2 × 10 points = 20 points]

Speed per minute:

Speed per hour;

L53: Finding formula for volume of prism

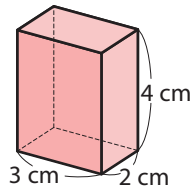
Volume of prism

Lesson Objective: Find out the volume formula by applying the idea of base and their layers **(6.2.4.1)**
Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Appreciate finding volume of prism by using the volume formula.
Skills	Calculate the volume of quadrangular prisms.
Knowledge	How to find volume with base area and idea of layer.
Mathematical Thinking	Think about how to find the volume of prisms and cylinders.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

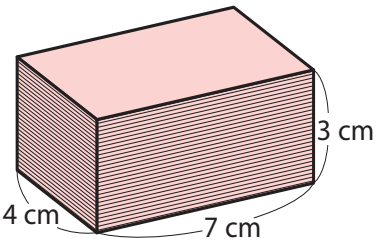
Teaching and Learning Activities

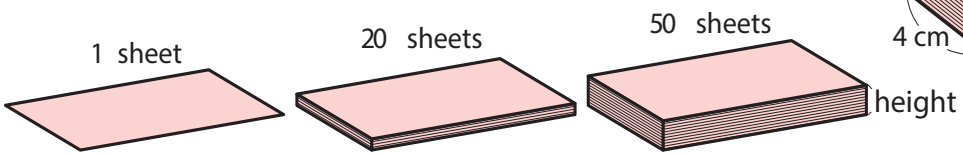
1 Lets find the volume of a rectangular prism on the right.



The rectangular prism is a kind of quadrangular prism with a base by 3cm and 2cm. Think about how to find the volume of a quadrangular prism.

(a) How many 1cm^3 are on the base?
(b) When the height is 4cm, how many 1cm^3 are there in all?
(c) Write an expression for the volume of the quadrilateral prism and find the answer





1. What is the volume in cm^3?
2. This rectangular prism is a quadrangular prism with a rectangular base by 7cm and 4 cm.

Lets find the formula for the volume of the quadrangular prism.

Volume of a rectangular prism = length x width x height
Volume of quadrangular prism = ☐ x height

Key Ideas

Calculate the volume of the quadrangular prism by getting first the base area and multiply it by height.

Volume of Prism = area of the base x height
Volume of a rectangular prism = length x width x height
Volume of quadrangular prism = length x width x height

The area of the base of the prism is called **the base area**

L54 : Finding volume of prisms

Lesson Objective: Think about how to find the volume of prisms based on quadrangular prism.**(6.2.4.1/2)**
Materials: blackboard,charts diagram of prism

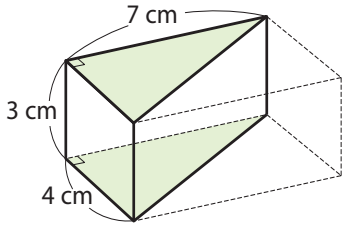
ASK-MT and Assessment	
Attitudes/Values	Confident calculate the volume of prism.
Skills	Correctly calculate the volume of prisms.
Knowledge	How to find the volume of prisms based on quadrangular prism.
Mathematical Thinking	Think of how to find the volume of prism based on quadrangular prism.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

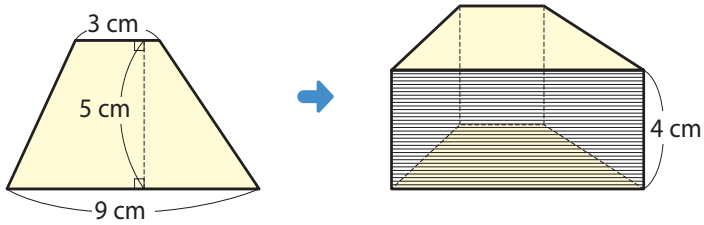
1 The figure on the right is a triangular prism.

(a) What is the area of the base of the triangular prism in cm^2?

(b) Find the volume of the triangular prism on the right.



2 Vagi made a quadrangular prism by stacking sheets of trapezoid card as follows. Let's find the volume of the quadrangular prism.



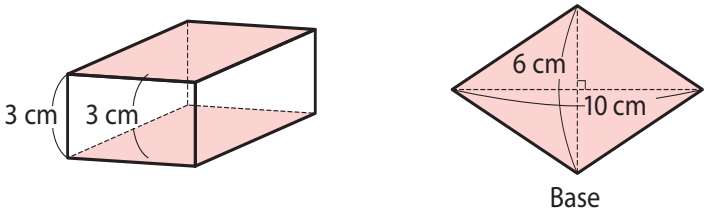
Key Ideas

The volume of all prism can be calculated as follows

Volume of prism = area of base x height

Exercises

The following is a quadrangular prism with 3cm height and the base is a rhombus. Find the volume of this quadrangular prism.



L55: Finding formula for volume of cylinder

Volume of cylinder

Lesson Objective: To find out the volume formula of cylinder by applying the idea of unit cube and the layers made and formula V= *area of base* x *height.* **(6.2.4.1/2)**

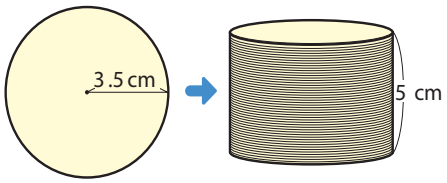
Materials: Images for b/board displays, many circular sheet papers and a corresponding cylinder

ASK-MT and Assessment

Attitudes/Values	Share and communicate their ideas with others on finding volume of cylinder
Skills	Calculate the volume of cylinder applying the same formula for quadrangular prism which is the base area x height.
Knowledge	Finding the base area of the cylinder and height to calculate volume.
Mathematical Thinking	Think of how to find out volume of different types of prism, apply the way of calculating quadrangular prism.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Circular sheets of paper with the radius of 3.5 are stacked as shown to form a cylinder.



(a) What is the area of the circular sheet of paper in cm^2?

(b) Stack the circular sheets to the height of 1cm. The volume of and the area of the base are the same.

Stack the sheets to the height of 5cm. What is the volume of this cylinder?

(c) Think about how to calculate the volume of the cylinder.

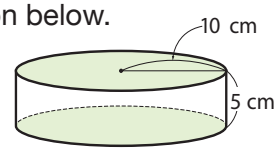
Key Ideas

The area of the base of a cylinder is called area of the base ,too.

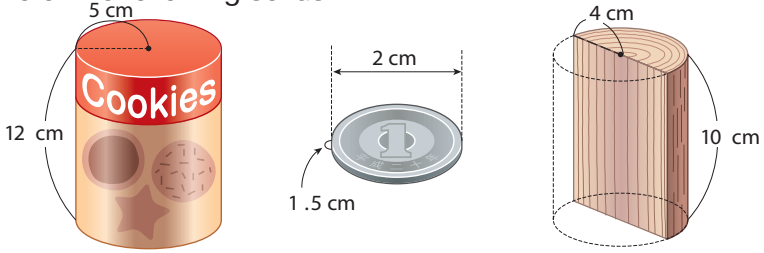
Volume of cylinder = area of the base x height.

Exercises

(1) Find the volume of the cylinder on below.



(2) Find the volume of the following solids.



L56 : Compare volume of various solids

Lesson Objective: To investigate volume of cylinder and pyramid. **(6.2.4.1/2)**

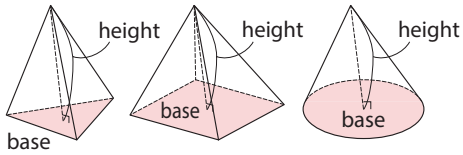
Materials: cone cups, cylinder glasses, pyramid glass with same base and height and sand, soil or water

ASK-MT and Assessment	
Attitudes/Values	Share and communicate their ideas with others on comparing volume of shapes.
Skills	To calculate volume of cone and cylinder.
Knowledge	Relationship between the volume of pyramid and cone.
Mathematical Thinking	Think of how to find out volume of pyramids and cones, apply the way of calculating volumes of cylinders and prisms.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

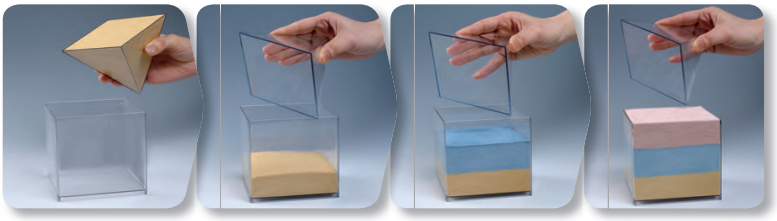
Teaching and Learning Activities

This task is a practical activity where students will have to make predictions about the bases of the given solids.

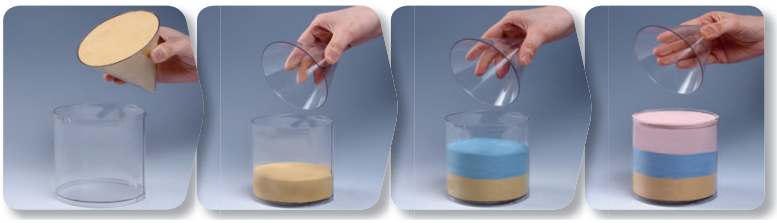
The figures below are called pyramids and cone. The base of te pyramid is polygons such as the pentagon and so on.



1 Compare the volume of the pyramid with that of the quadrangular prism when their bases and height are the same. Conduct experiment as shown below.



2 Compare the volume of the cone with that of the cylinder when their bases and height are the same. Conduct experiment as shown below.



3 From the experiment what did you observe? Let's discuss.

4 Karo used the formula to calculate the volumes of pyramids and cones as follows. Let's fill the ☐ with numbers and discuss what the height is.

Volume of pyramid or cone = area of the based x height x $\frac{1}{\square}$

Unit checkpoint

Review on volume of prisms and cylinders

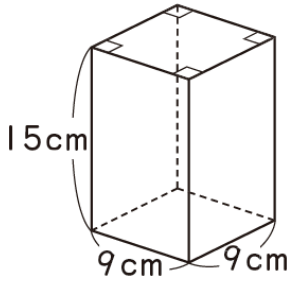
Volume	Name:	Score /100

1. Fill a word in ☐ for completing the formula. [10 points]

Volume of a cylinder = Base × ☐

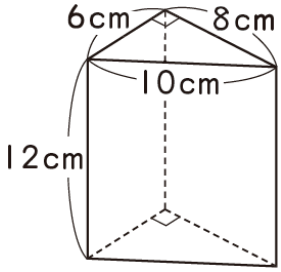
2. Find the area of the following circles. [4 × 20 points = 80 points]

(1)



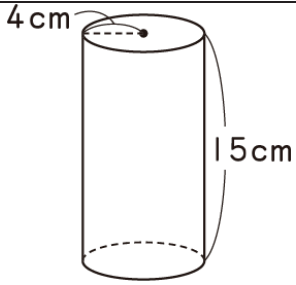
Answer:

(2)



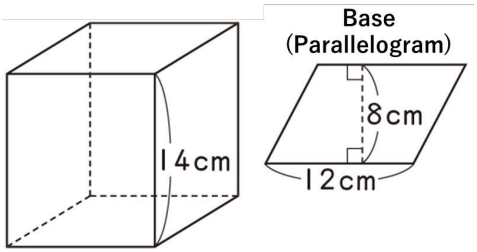
Answer:

(3)



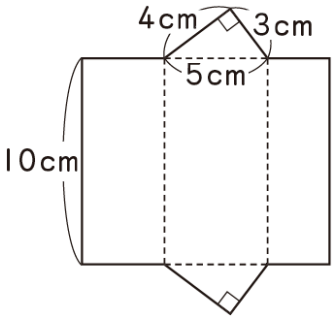
Answer:

(4)



Answer:

3. Find the volume of the solid formed from the net below. [10 points]



Answer:

L57 : How to express ratio

Ratio

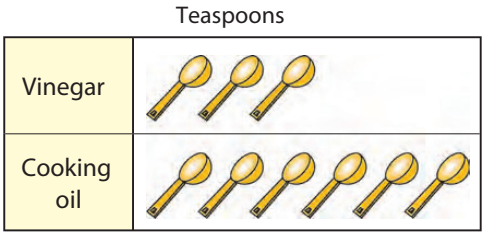
Lesson Objective: Explain the meaning of ratio and how to express it.**(6.4.1.1/2)**
Materials: blackboard

ASK-MT and Assessment

Attitudes/Values	Share their ideas on how to express ratios from concrete situations.
Skills	Identify ratios and apply them in daily situations.
Knowledge	Meaning of ratio.
Mathematical Thinking	Think about how to express ratio.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Ayao is trying to make French dressing. (Use the figure on the right)



(a) He prepares 3 teaspoons of vinegar and 6 teaspoons of cooking oil like the chart on the right. How are the quantities of vinegar and cooking oil represented by ratio?

3:6 is also read as "**ratio of 3 to 6**".

(b) Represent the ratio of cooking oil and soy sauce in Japanese dressing.

☐ : ☐

(c) Represent the ratio of mayonnaise and ketchup in sauce aurora.

☐ : ☐

Key Ideas

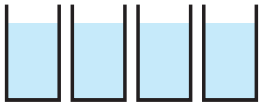
1. The quantity of cooking oil is 6 and the quantity of vinegar is 3, is represented by " : "

3 : 6

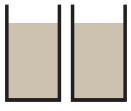
3 : 6 is read as "**three is to six**". This way of representation is called **ratio.**

Exercises

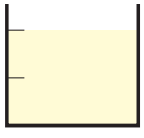
Let's represent the ratio.



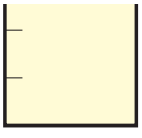
80 mL of water



40 mL of soup



10 mL



15 mL

L58: How to find the value of ratio

Lesson Objective: To find the value of ratio and the value of equal ratio. **(6.4.1.1)**
Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on how to find the value of ratio and value of equal ratio.
Skills	Identify value of ratios and value of equal ratio.
Knowledge	Value of ratio and value of equal ration.
Mathematical Thinking	Think of ways to identify the values of ratio and the value of equal ratio.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Volume of rice and water needed to boil rice for 3 people is shown on the right.

Rice.....300ml
Water.....360ml

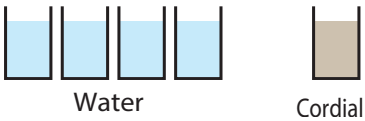
(a) The volume of rice and water needed to boil rice for 3 people is:
(b) How many times is of the volume of rice compared to the volume of water in fraction form?

2 How to mix cordial with water:

Water..... 4

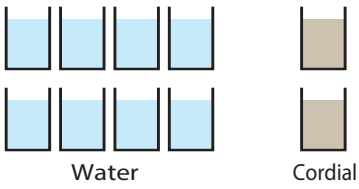
Cordial..... 1

(a) Ani uses small cups.



Value of ratio 4 : 1 is ☐

(b) Buru uses the same cup and makes the drink for 2 people.



Value of ratio 8 : 2 is ☐

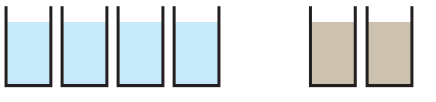
Is the concentration level that Ani and Buru made the same?

Key Ideas

When the value of 2 ratios are equal, we say, the two ratio are equal and it is written as 4:1 = 8:2

Exercises

Let's represent the ratio.



L59 : Properties of ratio

Lesson Objective: To think about multiplication and division of ratios. **(6.4.1.1/2)**
Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on how to multiply and divide ratios.
Skills	Multiply and divide ratios.
Knowledge	Multiplication and division of ratios.
Mathematical Thinking	Think about multiplication and division of ratios.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 There are 3 different combinations of rice and water.

(a) Value of ratio in Ⓐ and Ⓒ are both ☐,

Therefore, 60 : 72 = 300 : 360.

60 : 72 = (60 x ☐) : (72 x ☐)

= 300 : 360

60 : 72 = 300 : 360 (× ☐ / × ☐)

(b) Values of Ⓒ and Ⓑ are both ☐,

Therefore, 300 : 360 = 100 : 120.

300 : 360 = (300 ÷ ☐) : (360 ÷ ☐)

= 100 ÷ 120

300 : 360 = 100 : 12 (÷ ☐ / ÷ ☐)

Key Ideas

The ratio A : B is equal to the ratio which is made by multiplying the same number to A and B and dividing A and B by the same number.

Exercises

1. Which ratio is equal to 3 :1?

(a) 6 : 3 (b) 6:2 (c) 1: 3 (c) 13 : 10 (d) 13 : 10 (e) 9 : 3

2. Write 3 ratios that are equal to 6 : 9.

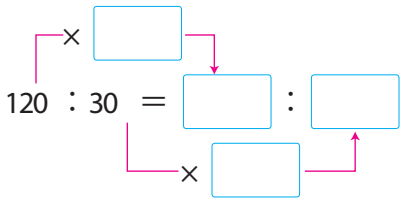
L60: Finding equal ratios

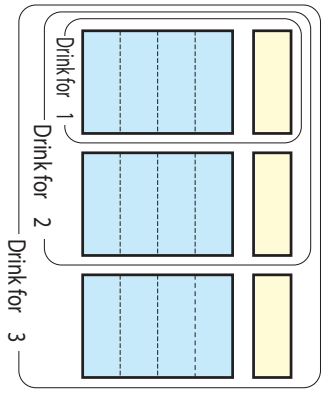
Lesson Objective: To understand how to find equal ratios. **(6.4.1.1/2)**
Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on how to multiply and divide ratios.
Skills	Find the equal ratio.
Knowledge	Equal ratios.
Mathematical Thinking	Think about how to find equal ratio using the properties of ratios.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

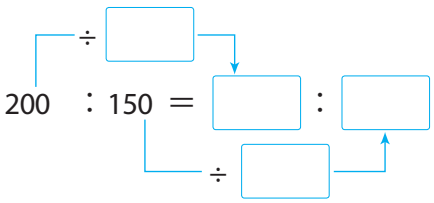
Teaching and Learning Activities

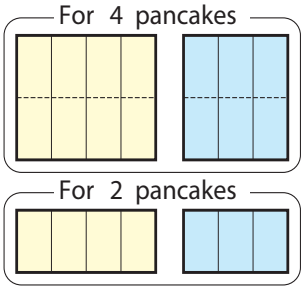
1 A drink for 1 person is made by mixing 120 mL of water and 30 mL of cordial.
To prepare a drink for 3 people with the same concentration, how much water and cordial do you have to prepare?





2 200 g of flour and 150 g of water is needed to make 4 pancakes.
To make 2 pancakes how much flour and water is needed?





Exercises

1 Find the number for x.

(a) $2 : 3 = x : 9$ (b) $4 : 5 = 100 : x$ (c) $12 : x = 3 : 5$ (d) $x : 20 = 5 : 4$

2. You draw a rectangle in which the ratio of the length and width is 1:2. If the length is 12 cm, how long is the width?

L61 : Simplifying ratios

Lesson Objective: : To simplify ratio using the properties of ratio. **(6.4.1.1)**

Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on how to simplify ratios.
Skills	Simplify ratios utilizing dividing ratios.
Knowledge	Simplifying of ratios.
Mathematical Thinking	Think about of ways to simply ratios using the properties of ratios.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Find a ratio that is equal to 12 : 18 and write it in its smallest whole number.

Simplify the following ratios.

(a) $1.2 : 3.2 = (1.2\times10) : (3.2 \times 10)$

$= \square : \square$

$= \square : \square$

(b) $\frac{2}{5} : \frac{3}{8} = \frac{16}{40} : \frac{15}{40}$

$= \left(\frac{16}{40} \times \square\right) : \left(\frac{15}{40} \times \square\right)$

$= \square : \square$

Expected Ideas

Asa's Idea

$12 : 18 = (12 \div 2) : (18 \div 2)$

$= 6 : 9$

$= (6 \div 3) : (9 \div 3)$

$= 2 : 3$

Kila's Idea

$12 : 18 = (12 \div 6) : (18 \div 6)$

$= 2 : 3$

Key Ideas

1. Not changing the value of the ratio and changing the ratio into smaller whole numbers is called **simplifying a ratio.**

Exercises

Simplify the following ratios.

(1) $25 : 35$ (2) $7 : 28$ (3) $180 : 120$ (4) $0.6 : 2.9$ (5) $\frac{3}{4} : \frac{2}{3}$

L62: Solving ratio problems

Application of ratio

Lesson Objective: Solving problems applying ratio properties. **(6.4.1.1/2)**

Materials: blackboard,chart of drawings

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on applying ratio properties to solve problems.
Skills	Apply ratio properties solving problems.
Knowledge	Be able to understand how to apply ratio properties in solving problems.
Mathematical Thinking	Think about how to apply ratio properties in solving problems.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

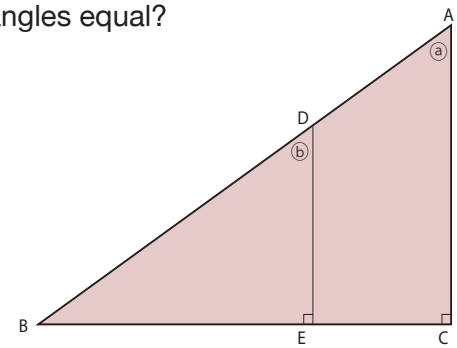
Teaching and Learning Activities

1 From the length of shadow, find the height of the tree.

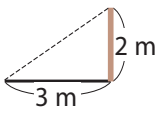
(a) There is a right triangle ⓐ. You put point E on side BC and made a right triangle ⓑ.
Are the ratios of lengths of the two triangles equal?
Measure the lengths to

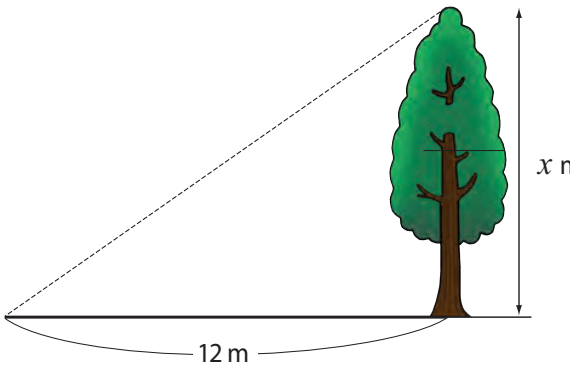
DE : EB = ☐ : ☐

AC : CB = ☐ : ☐

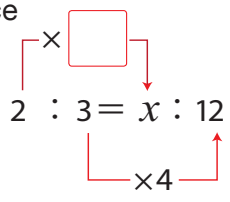


(b) A 2m of pole makes 3m of shadow. In this situation, how long is the height of the tree, when its shadow is 12m?





Represent the height of the tree as x, make a mathematical sentence by using the equality of two ratios and fill the blank.



Exercises

How long is the height of the tree if its shadow is 15m in the same situation as problem in activity (b) ?

L63 : Dividing by Ratio

Lesson Objective: To understand how to calculate dividing by ratio **(6.4.1.1/2)**

Materials: blackboard/diagram of tape diagram

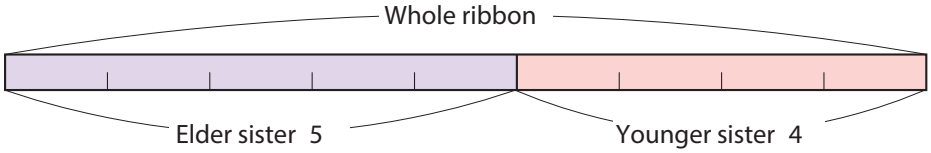
ASK-MT and Assessment

Attitudes/Values	Share their ideas on dividing by ratio
Skills	Divide by ratio
Knowledge	Divide by ratio
Mathematical Thinking	Think about how to divide by ratio
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 We divide 72 cm of ribbon for the elder sister and younger sister in the ratio of 5 : 4.

How long is each ribbon going to be?



Kua's Idea

We use the ratio of the elder sister's ribbon to the whole ribbon for finding the length of elder sister's ribbon .

If the length of the elder sister's ribbon is x cm,

$5 : 9 = x : 72$

We use the same method to find the length of the younger sister's ribbon.

Asa's Idea

We assume that the whole ribbon is 1 and consider how long is the elder sister's ribbon out of 1 .

Elder sister's ribbon..... $\frac{5}{9}$ out of the whole ribbon $72 \times \frac{5}{9} = \square$

We use the same method to find the length of the younger sister's ribbon.

Exercises

We divide 500mL of milk for Kenji and his father in the ratio of 2 : 3. How much milk does Kenji get?

(i) For the quantity of cooking oil and vinegar.

(ii) For the length of side AB and AC in a set-square.

Unit checkpoint

Review ratio and the application

Ratio	Name:	Score /100

1. Simplify the following ratios and find the value of each ratio. [4 × 10 points = 40 points]

(1) $0.4 : 2$ = ☐ Value of Ratio ☐

(2) $0.25 : \frac{2}{3}$ = ☐ Value of Ratio ☐

2. Find x. [2 × 10 points = 20 points]

(1) $12 : x = 3 : 5$ ☐

(2) $3.6 : 0.6 = x : 2$ ☐

3. Judy is reading a book. The ratio of the number of read pages to unread pages is 7 : 4. How many pages are unread if the number of read pages is 42. [20 points]

Answer:

4. There are 981 student in a school. Find the number of boys and girls if the ratio of boys to girls is 5 : 4. [2 × 10 points = 20 points]

Number of Boys :

Number of Girls :

L64 : Understanding similar figures

Englarge and reduce figures

Lesson Objective: To find the meaning of "similar shapes" by focusing on the length of the corresponding sides and the size of corresponding angles among given figures.**(6.3.2.1)**

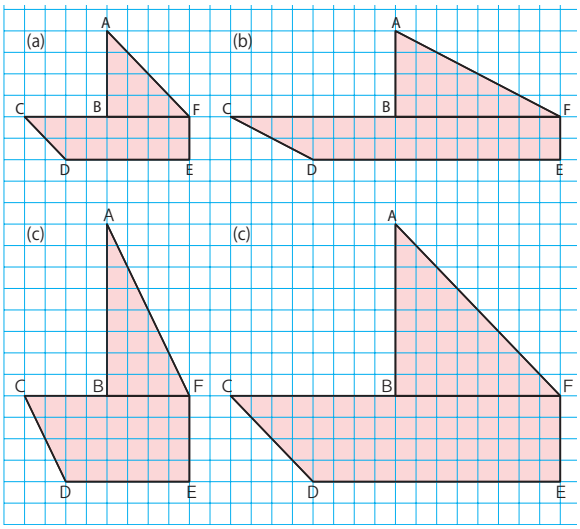
Materials: blackboard

ASK-MT and Assessment

Attitudes/Values	Enjoy using mathematical tools such as rulers and protractors to investigate similar figures.
Skills	Investigate similar figures by measuring the length of corresponding sides and size of Corresponding angles.
Knowledge	Understand the meaning of similar shapes.
Mathematical Thinking	Think about similarity of figures based on congruency of corresponding angles and ratio Relationship of corresponding lengths.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 From the shapes drawn, (b), (c) and (d) below, which has the same shape as (a)?



Compare shapes.

(a) Measure the lengths and angles of the 4 shapes and organize them on the chart below.

	Length of side (cm)			Angle (Degree)			
	Side AB	Side CD	Side AF	Angle A	Angle C	Angle D	Angle E
(a)	2	1.4	2.8	45	45	135	90
(b)							
(c)							
(d)							

(b) Compare the lengths of the 3 sides. Which shape has the length 2 times the length of (1)?

(c) Compare the size of the 4 angles. Which shape has the same size angles as in (1)?

Key Ideas

Meaning of "similar shapes"

Similar shapes are two or more figures

- whose lengths of corresponding sides share a common ratio and
- the size of their corresponding angles are congruent or equal in value.

L65 : Features of enlarged and reduced figures

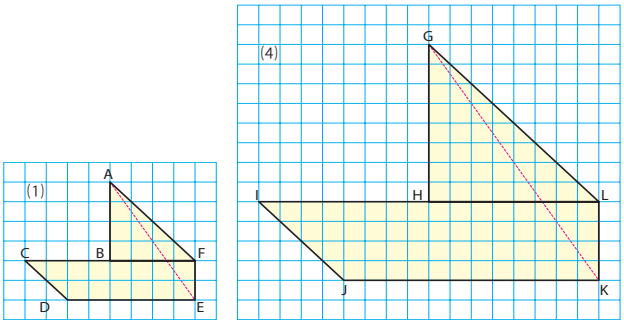
Lesson Objective: To investigate characteristics (features) of 2 X (times) enlarged sides and angles of figures. (**6.3.2.1)**

Materials: Figures 1-4(L01), ruler, protractor and tracing papers,blackboard

ASK-MT and Assessment	
Attitudes/Values	Enjoy using mathematical tools such as rulers and protractors to investigate similar figures.
Skills	Investigate similar figures by measuring the length of corresponding sides and size of corresponding angles.
Knowledge	Similar shapes.
Mathematical Thinking	Think of about similarity of figures based on congruency of corresponding angles and ratio relationship of corresponding lengths.
Assessment	Use the ASK-MT to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 The figures below are figure (1) and (4) from lesson#1. The points of each figure have been renamed as A-F and G-L for the activity.



(a) Find the simplified ratio of the length of the side DE to the length of side JK.
How many times is the length of corresponding sides of figure (4) longer than figure (1)?

Side DE ： Side JK ＝ ☐ ： ☐

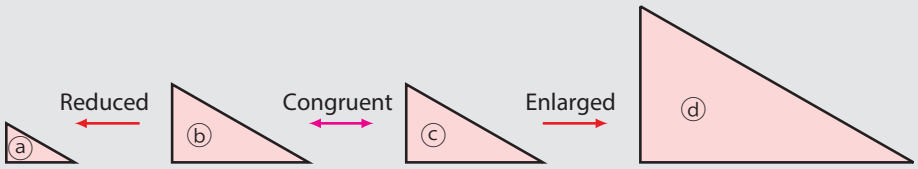
Side DE ÷ Side JK ＝ $\frac{\square}{\square}$ ＝ ☐ (times more)

Investigate the other corresponding side lengths

Teaching and Learning Activities

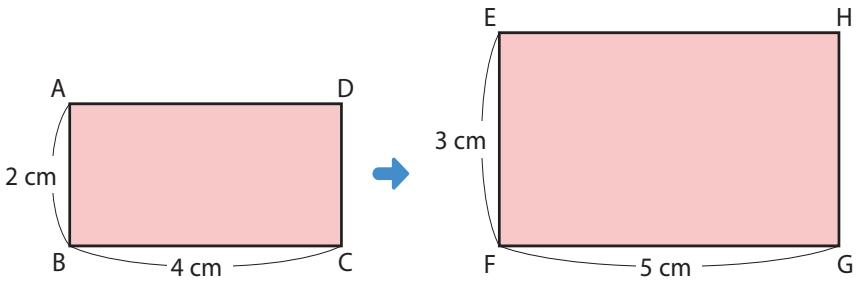
Key Ideas

- If each corresponding angle is equal, and all lengths of corresponding sides are extended in the same ratio, this is called enlarged drawing. If shortened in the same ratio this is called reduced drawing.
- In an enlarged drawing and a reduced drawing, all lengths of corresponding sides are in the same ratio and all corresponding angles are equal.
- Figure (A) is 2 times enlarged drawing of figure (1), and figure (1) is a 1/2 reduced drawing of figure (A).
- The ratio value of corresponding sides are either increased to make enlarged figures or are decreased to make reduced figures while it remains the same for congruent figures .



Exercises

1 Rectangle ABCD is enlarged by 1cm to draw rectangle EFGH.



(1) Is rectangle EFGH an enlarged figure of rectangle ABCD?

(2) If you want to enlarge rectangle EFGH 1.5 times rectangle ABCD, how long is the length?

L66 : Ratio of enlarged and reduced figures

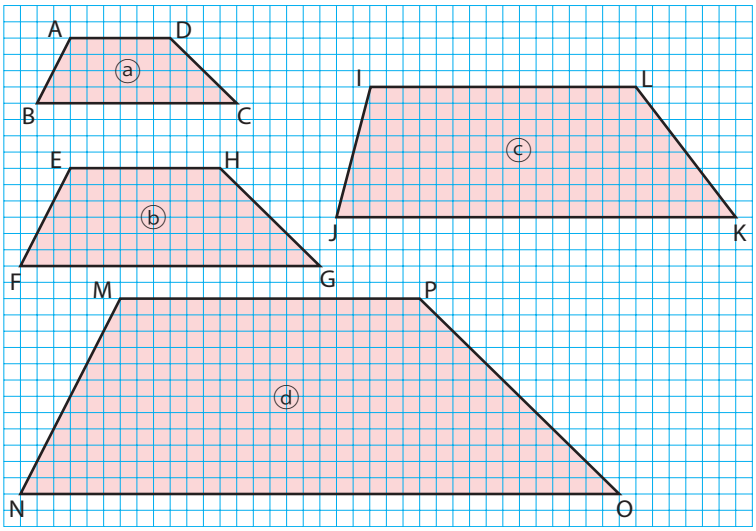
Lesson Objective: identify the ratio and value of ratio by which the original figure is extended or reduced. **(6.3.2.1)**

Materials: Ruler, protractor and tracing papers,blackboard

ASK-MT and Assessment	
Attitudes/Values	Share the idea of how to find the ratio and value of ratio by which the original figure is extended or reduced.
Skills	Calculate the ratio of enlarged or reduced figures by measuring the length of corresponding sides and size of angles.
Knowledge	Ratio of enlarged and reduced figures.
Mathematical Thinking	Think about how to find the ratio and value of ratio by which the original figure is extended or reduced.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let's investigate the figures below.



(a) Which is an enlarged drawing of figure (a)?

(b) Which is a reduced drawing of figure (d), and by how much is it reduced?

2 Look around you and find enlarged and reduced figures.

L67 : How to draw using grid paper

How to draw enlarged & reduced drawings

Lesson Objective: To experience drawing an enlarged drawing of a given figure using grid paper. **(6.3.2.1)**

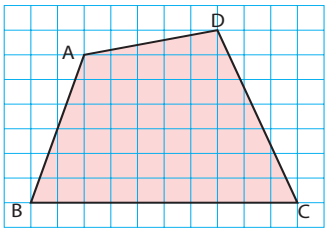
Materials: : Ruler, protractor and graph papers, blackboard

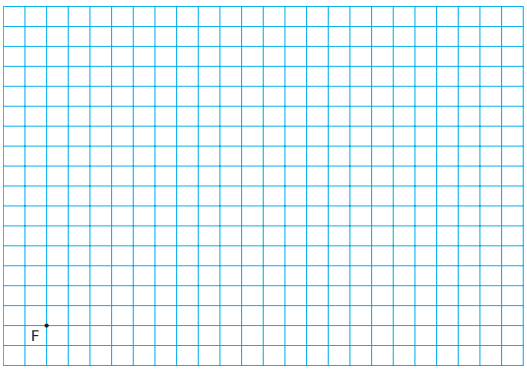
ASK-MT and Assessment

Attitudes/Values	Enjoy and experience drawing enlarged and reduced figures by counting the grids of the original figure and doubling it to get the length of enlarged figure.
Skills	Draw enlarged and reduced figures by counting the grids of the original figure and doubling it to get the length of enlarged figure.
Knowledge	Draw an enlarged drawing of a given figure using grid paper.
Mathematical Thinking	Think about how to draw an enlarged drawing of a given figure using grid paper.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

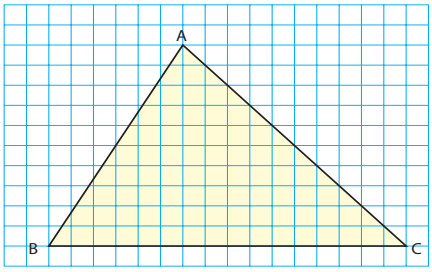
1 Let's think about how to draw an enlarged drawing EFGH which is 2 times of quadrilateral ABCD. Point F corresponding to point B is already drawn on the grid paper.



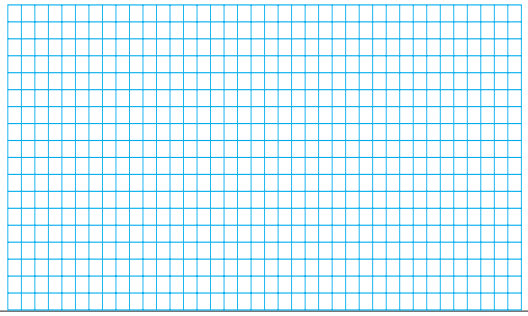


2 Draw triangle DEF, which is triangle ABC reduces by $\frac{1}{2}$, on the two grid papers below.

(a) Draw it on the grid paper, in which the side length of the square is reduced by $\frac{1}{2}$,compared to the grid paper above.



(b) Draw it on the grid paper, in which the side length of the square is equal to the one above.



L68 : How to draw using sides and angles

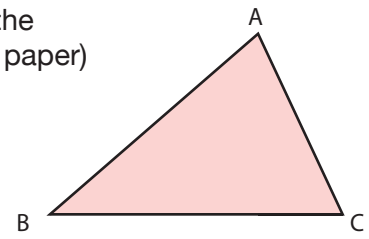
Lesson Objective: Draw enlarged figure by using compass or protractor to measure sides and angles. **(6.3.2.1)**

Materials: Protractor and compass,blackboard

ASK-MT and Assessment	
Attitudes/Values	Enjoy drawing enlarged figure by using compass or protractor to measure sides and angles.
Skills	Draw enlarged figure by using compass or protractor to measure sides and angles.
Knowledge	Drawing enlarged figure.
Mathematical Thinking	Think about how to draw enlarged figure by using compass or protractor to measure sides and angles.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

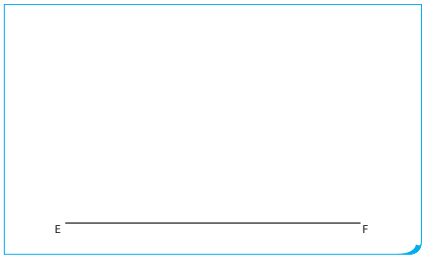
Teaching and Learning Activities

1 Let's think about the method to draw triangle DEF, which is 2 times the enlarged drawing of triangle ABC. (How can we draw without a grid paper)

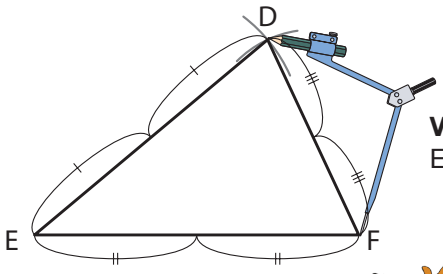


(a) Which sides and angles should you measure?

(b) Line EF, which is twice the enlarged line of line BC, is already drawn. Point D, is the corresponding point of point A. Think about where point D should be placed and finish the drawing.



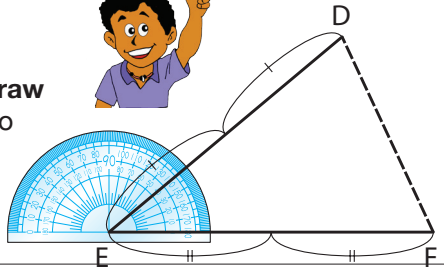
(c) Discuss the 3 ideas from Vavi, Mero and Naiko.

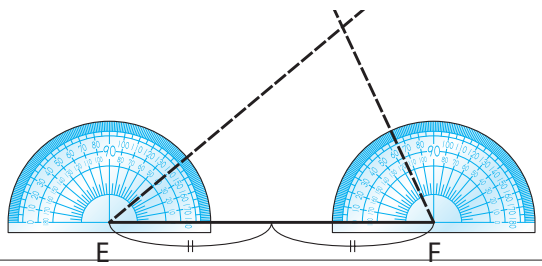


Vavi's Method to Draw
Enlarge all 3 sides into twice length

Naiko's Method to Draw
Enlarge all 3 sides into twice length

Mero's Method to Draw
Enlarge all 3 sides into twice length





L69 : Drawing reduced figures

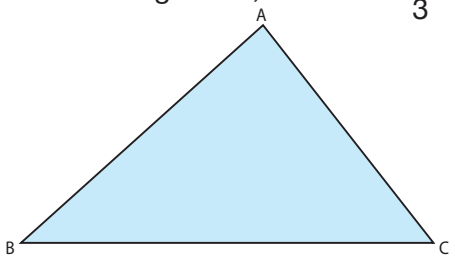
Lesson Objective: Draw a reduced figure of a given figure by using previous learned methods.**(6.3.2.1)**

Materials: Ruler, protractor and graph papers,blackboard

ASK-MT and Assessment	
Attitudes/Values	Enjoy and experience drawing reduced figures using previous learned methods.
Skills	Draw a reduced figure of a given figure by using previous learned methods.
Knowledge	Using previous learned methods to make reduced figure.
Mathematical Thinking	Think about how to draw a reduced figure using previous learned methods.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let's think about the way to draw triangle DEF, which is a $\frac{1}{3}$ reduced drawing of triangle ABC.

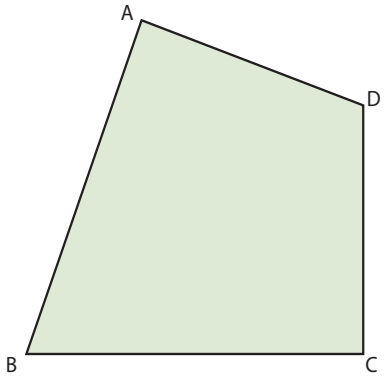


(a) Draw triangle DEF in your own way and explain how to draw it to your friend.

(b) Whose method is similar to how you drew your triangle?

Exercises

Let's draw a 2 times enlarged drawing and $\frac{1}{2}$ reduced drawing of the quadrilateral below.



L70 : How to draw using centre point(1)

Lesson Objective: To draw an enlarged figure by using a vertex of the original figure as a centre point. **(6.3.2.1)**

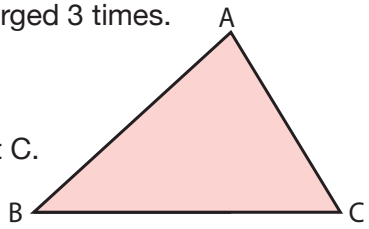
Materials: Ruler, protractor and graph papers,blackboard

ASK-MT and Assessment

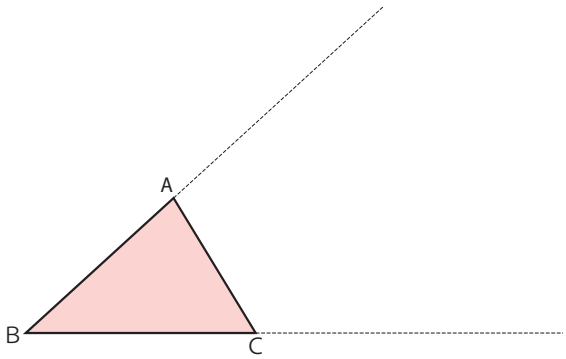
Attitudes/Values	Enjoy and experience drawing enlarged figures by using a vertex of the original figure as a centre point
Skills	Draw an enlarged figure by using a vertex of the original figure as a centre point.
Knowledge	Using a vertex of the original figure as a centre point to make enlarged figure
Mathematical Thinking	Think about how to draw an enlarged figure by using a vertex of the original figure as a centre point.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 By focusing on point B, use line BA and BC, to draw triangle ABC enlarged 3 times.



(a) Extend line BA and place point D, corresponding point of point A, and extend line BC and place point E, corresponding point of point C.



(b) Check and see if triangle DBE is 3 times triangle ABC.

Key Ideas

Line in the example above, we can draw enlarged drawings and reduced drawings using 1 point and its connected lines. The point you use is called centre point.

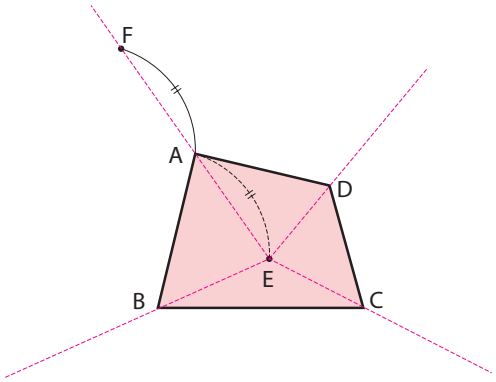
L71 : How to draw using center point(2)

Lesson Objective: Draw an enlarged figure by using the centre point on any part of the figure.**(6.3.2.1)**
Materials: Ruler, protractor and graph papers,blackboard

ASK-MT and Assessment	
Attitudes/Values	Enjoy and experience drawing enlarged figures by using the centre point on any part of the figure.
Skills	Draw an enlarged figure by using the centre point on any part of the figure.
Knowledge	Using centre point on any part of the figure to make enlarged figure.
Mathematical Thinking	Think about how to draw an enlarged figure by using the centre point on any part of the figure.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

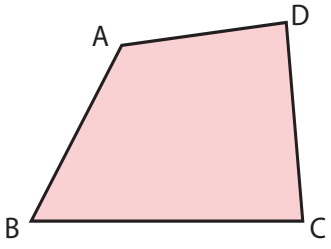
1 Use point E as a centre point and think about the way to draw a 2 times enlarged quadrilateral FGHI, which corresponds to quadrilateral ABCD.



Line EA is extended and point F, corresponding to Point A, is already drawn in the diagram above. Let's continue and finish the drawing.

Exercises

Place a centre point and draw a 2 times enlarged drawing and a $\frac{1}{2}$ reduced drawing of quadrilateral ABCD.



L72: Application of reduced drawing

Uses of reduced drawing

Lesson Objective: To understand the meaning of reduced scale and how to express it and to find the real length from reduced figures, which student's draw. **(6.3.2.2)**

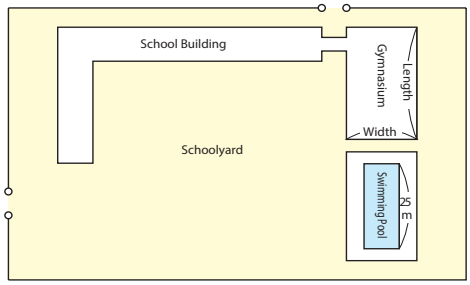
Materials: Ruler, protractor and graph papers,blackboard

ASK-MT and Assessment

Attitudes/Values	Share their ideas on application of reduced drawings.
Skills	Solve problems of reduced drawings.
Knowledge	Application of reduced drawings.
Mathematical Thinking	Thinks about ways to solve problems of reduced drawings.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 The picture on the right is a reduced drawing of Lea's school.
(a) The actual width of the swimming pool is 25m.
How long is it in cm and mm on the reduced drawing?



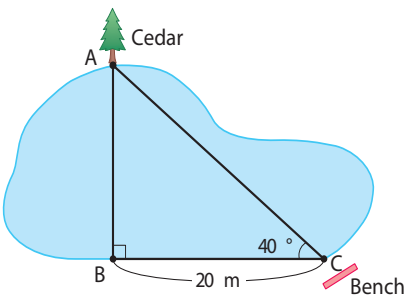
(b) How long in metres is the actual length of 1cm on the reduced drawings

(c) What is the actual length and width of the gymnasium in metres?

Width…2 × 1000 = ☐ cm Length…3.3 × 1000 ☐ (cm)

2 Kelon went to the pond in the park. She walked from point C to point B.
What should you do to find the distance from point B to point A where the cedar grows?

(a) Follow the steps below and draw a reduced drawing of the right triangle ABC in $\frac{1}{500}$ reduced scale.

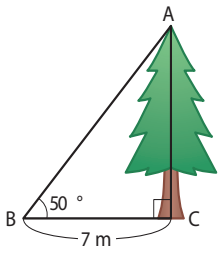


Teaching and Learning Activities

1. Find the length of line BC and draw it.
2. From point B, draw a line perpendicular to line BC.
3. Measure a 40°angle from point C and place point A.
4. Draw the right angle ABC.

(b) Measure line AB of the reduced figure and find the actual distance to the cedar.

3 How tall in metres is the tree shown on the diagram below? Explain the way to solve using mathematical sentences, figures, and words.



Key Ideas

The ratio that represents how much it is reduced from the real length is called reduced scale.

The ratio that represents how much it is reduced from the real length is called reduced scale. The picture above is a reduced drawing $\frac{1}{1000}$ in reduced scale. There are 3 ways to show a reduced scale.

(A) $\frac{1}{1000}$ (B) 1 : 1000 (C) 0 10 20 30 m

Unit checkpoint

Review on enlarged and reduced drawings

Reduced and Enlarged Drawings	Name:	Score /100

1. Quadrilateral ABCD is enlarged drawing of Quadrilateral EBGF.

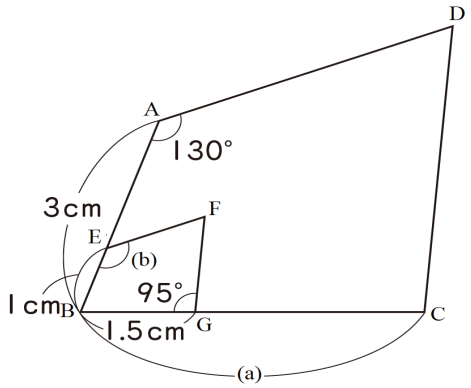
[4 × 15 points = 60 points]

(1) Which line corresponds to Line EF?

Answer:

(2) Find the ratio of Quadrilateral ABCD and Quadrilateral EBGF.

Answer:



(3) Find (a) and (b).

(a)

(b)

2. A $\frac{1}{1000}$ reduced figure of a school yard is drawn as a rectangle whose length is 10 cm and width is 6 cm.

(1) Find the actual length and width of the school yard. [2 × 10 points = 20 points]

Answer:

Answer:

(2) A 50 m line is drawn on the school yard. Find the length of a reduced line in the same scale if we draw the line on the reduced figure. [20 points]

Answer

L73: How to numbers of objects change in a related manner

Proportion

Lesson Objective: Understand how two numbers of objects change in a related manner. **(6.4.2.1/2)**

Materials: Pile/bundle of paper, scale and ruler,blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas through experimenting how to find the number of papers in a Bundle and appreciate the concept of proportion in their daily lives.
Skills	Estimate how two numbers of objects changes in a related manner.
Knowledge	How two numbers of objects change in a related manner through activities.
Mathematical Thinking	Think about how two numbers of objects change in a related manner.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let's investigate the relationship between the number of papers and weight. (experiment)

(a) Weigh each number of papers, and fill in the table

Number of Papers and Thickness

Number of papers (sheets)	10	20	30	40	50
Thickness (L)					

(b) Think about and discuss how to count the numbers of paper based on the experiment with weight.

Key Ideas

- There is a relationship between weight and the number of papers because weight increases when the number of papers increases as well.
- The thickness of the bundle is related because it gets thicker as the number of papers increases.

Exercises

Investigate the relationship between the number of papers and thickness

(1) Count the number of papers that correspond to the thickness of the pile and fill in the table.

Number of Papers and Thickness

Number of papers (sheets)					
Thickness (cm)	1	2	3	4	5

(2) Think about and discuss how to count the numbers of paper based on the experiment with thickness.

L74 : Direct proportion (1)

Lesson Objective: To determine the relationship between the number of sheets of paper and its weight. **(6.4.2.2)**

Materials: Table of results from experiment,blackboard

ASK-MT and Assessment

Attitudes/Values	share their ideas on how to find the number of papers using weight and appreciate the concept of proportion in their daily lives.
Skills	Explain the relationship between the number of sheets of paper and its weight
Knowledge	Relationship between number of sheets of paper and its weight.
Mathematical Thinking	Be able to determine the number of papers in a bundle considering the number of papers and its relation to weight.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

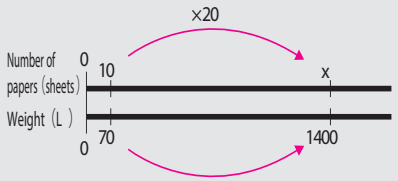
1 Let's find the number of papers that weighs 1400g using the results of the experiment.

(a) Describe the relationship of the change in the number of papers and the weight.

		2times	3times	4times	5times
Number of papers (sheets)	10	20	30	40	50
Weight (g)	70	14	210	28	350
		2times	3times	4times	5times

Key Ideas

- The weight is 20 times more than 70g, therefore the number of papers is also 20 times more.



- Find how many papers there are in 1g 10÷ 70 = 1/7.
  It is 1400 times more than 1g of paper 1/7×1400= 200g

×1400

Number of papers (sheets)	$\frac{1}{7}$	?
Weight (L)	1	1400

- Represent the number of papers in 1400g with x and think about the ratio of numbers and the ratio of the weights.

10 : x = 70 : 1400 (÷ □ on the left, ÷ □ on the right)

- Represent the number of papers in 1400g with x and think about the ratio of the number of papers to weight.

10 : 70 = x : 1400 (× □ on the left, × □ on the right)

The relationship of the number papers to weight is directly proportional.

L75 : Direct proportion (2)

Lesson Objective: To determine the relationship between the number of sheets of paper and its thickness. **(6.4.2.2)**

Materials: Table of results from exercise,blackboard

ASK-MT and Assessment

Attitudes/Values	Share their ideas on how to find the number of sheets of papers and its thickness and appreciate the concept of proportion.
Skills	Estimate how two sets of numbers of objects changes in a related manner.
Knowledge	How two sets of numbers of objects change in a related manner.
Mathematical Thinking	Think about the number of sheets papers in and its relation to thickness.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let's use the table below to identify the relationship between the number of papers and their thickness.

(a) Make a mathematics report based on the table below.

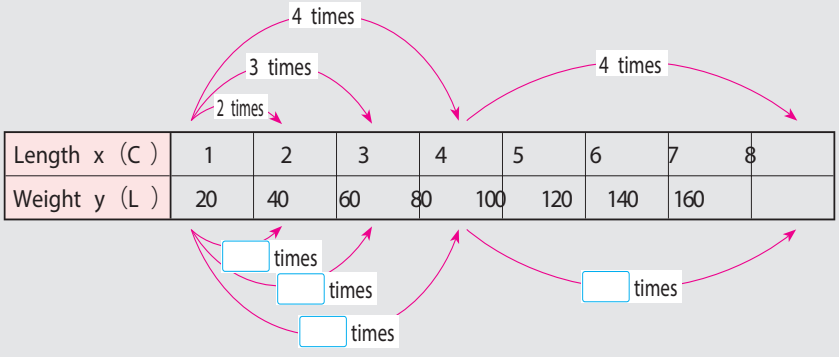
Number of Papers and Thickness

Number of papers (sheets)	105	210	315	420	525
Thickness (cm)	1	2	3	4	5

(b) If the thickness of the bundle is 9cm. How many sheets of paper are there?

Key Ideas

It is easier to find the rule between two numbers of objects by making a table that shows the set of two numbers of objects that change in a related manner.



- The thickness is 9 times more than 1cm, therefore the number of papers is also 9 times more. 9 x 105 = 945

The relationship of the number of papers to the thickness is directly proportional.

L76: Direct proportion (3)

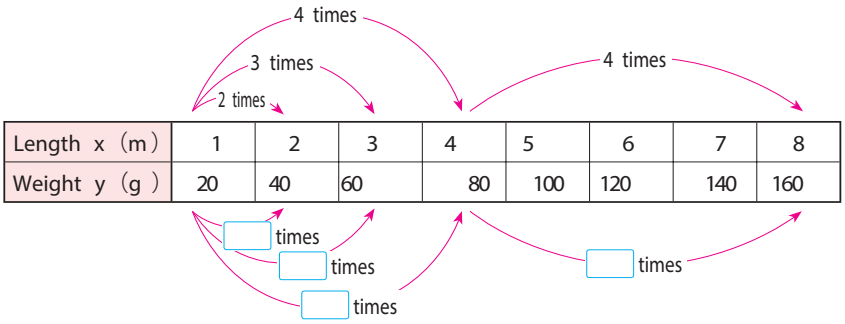
Lesson Objective: To determine how the lengths and weight of a wire changes. **(6.4.2.1/2)**
Materials: tables/chart,blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on how the length and width of a wire change relatively to appreciate the concept of proportion.
Skills	Identify the relationship of variables (x) and (y).
Knowledge	Relationship of variables (x) and (y)
Mathematical Thinking	Think about the length (x) and width (y) based on their proportional relationships.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

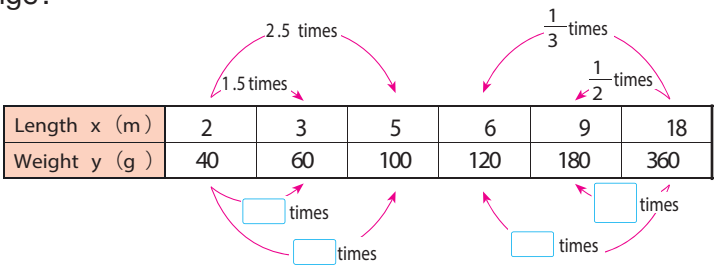
Teaching and Learning Activities

1 Let's investigate the relationship between the length of a wire and its weight.

(a) If you represent the length of a wire with (x)m and weight with (y)g, y increases as x increases. When the value of x changes 2 times, 3 times, 4 times more, how does the corresponding value of y change?



(b) When y is proportional to x, and the value of x changes 1.5 times, 2.5 times more, how does the value of y change?



(c) When y is proportional to x, and the value of x changes $\frac{1}{2}$ times, $\frac{1}{3}$ times more, how does the value of y change?

Teaching and Learning Activities

Key Ideas

When there are two changing quantities, x and y, and if the value of x changes 2 times, 3 times and so on, and the value of y also changes 2 times, 3 times and so on, respectively, we say that y is proportional to x.

Exercises

Let's investigate the relationship between x and y.

(1) Fill in the blanks on the table with numbers.

(a) Time and Distance, Running at Speed of 40 km per Hour

Time x (hours)	1	2	3	4	5	6	7
Distance y (km)	40	80	120				

(b) Side and Area of a Square

Side x (cm)	1	2	3	4	5	6
Area y (cm^2)	1	4	9			

(2) In which example is y proportional to x?

L77 : Mathematical sentence of proportion (1)

Lesson Objective: To determine the rules of proportion with the relationship of volume and depth of water. **(6.4.2.1/2)**

Materials: tables/chart/blackboard

ASK-MT and Assessment

Attitudes/Values	Share ideas on how the volume and depth of water in a tank change in proportion.
Skills	identify the proportional relationship of variables (x) and (y) in a mathematical sentence.
Knowledge	mathematical sentence of proportion.
Mathematical Thinking	Thinking about the rules of proportion based on the relationship of volume (y) and depth (y) of water in a tank.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

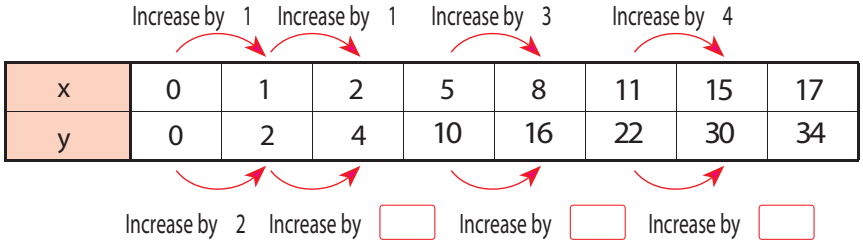
1 The relationship between the volume of water (x) L and depth (y) cm in a tank is organized in the table below.

Volume of Water and Depth of Water in the Tank

Volume of wate x (L)	0	1	2	3	5	8	11	15	17
Depth y (cm)	0	2	4	6	10	16	22	30	34

(a) Is the depth of water (y)cm proportional to the volume of water (x)L?

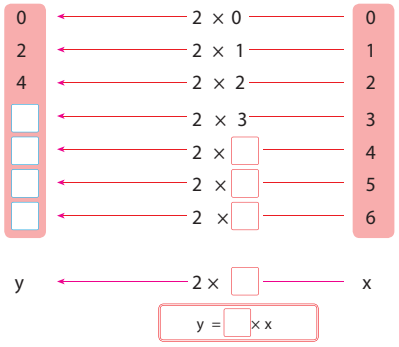
(b) How much does the value of y increase when the value of x increases by 1?



(c) By looking at the table, use corresponding values of x and y to calculate y ÷ x.

(i) What does the quotient of $y \div x$ mean?
(ii) Compare the quotient and the rule of how the water increases.

(d) Investigate the relationship between the volume of water and the depth, and represent the relationship of x and y in a mathematical sentence.



Teaching and Learning Activities

(e) Use the mathematical sentence above for finding the depths when you pour 10L and 20L of water into the tank.

Key Ideas

- The rule:

  When 1L of water is poured into the tank, the depth of water increases by 2cm.

- The depth of 1L does not change and is constant
- The proportional relationship of x and y in a mathematical sentence is $y =$ ☐ x x

L78 : Mathematical sentence of proportion (2)

Lesson Objective: To show the relationship of proportion in an equation. **(6.4.2.1/2)**
Materials: Table of proportion,blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on expressing the relationship of length and weight of a wire in mathematical sentence.
Skills	Represent the proportional relationship of variables (x) and (y) in a mathematical sentence.
Knowledge	Relationship of proportion in an equation.
Mathematical Thinking	Think about the rules of proportion based on the relationship of (x), (y) and constant.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Represent the relationship of length of a wire (x) m and weight (y) g in a mathematical sentence.

Length of a Wire and Weight

Length x (m)	1	2	3	4	5	6
Weight y (g)	20	40	60	80	100	120

(a) Find the quotient of $y \div x$.

(b) Represent the relationship of x and y in a mathematical sentence. Y = ☐ x ☐

(c) Find the weight of 12m of wire.

Key Ideas

- When there are 2 changing quantities, x and y, and y is proportional to x, their relationship can be represented in the mathematical sentence:

  y = constant number x x

- The constant number in a proportional relationship represents:
  - (a) How much value of y increases when x value increases by 1
  - (b) Quotient of $y \div x$
  - (c) Value of y when value of x is 1

Exercises

Represent the relationship between the time (x)hour that a car travels, and the distance (y) km, in a mathematical sentence.

Time and Distance, Running at Speed of 40 km per Hour

Time x (hours)	1	2	3	4	5	6
Distance y (km)	40	80	120	160	200	240

L79: Mathematical sentence of proportion (3)

Lesson Objective: To examine the proportional relationship of side length of a regular polygon and its perimeter, and to express it in a sentence. **(6.4.2.1/2)**

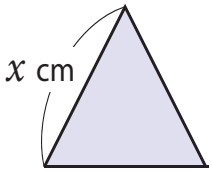
Materials: Blank Tables,blackboard

ASK-MT and Assessment

Attitudes/Values	Share ideas on how to find the proportional relationship of length and perimeter of polygons.
Skills	Represent the proportional relationship of side length of a polygon and its perimeter in a mathematical sentence.
Knowledge	Proportiona relationship of side length of a polygon and its perimeter.
Mathematical Thinking	Think about how to extend the rules of proportion based on the relationship of x and y to Develop and complete tables.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Represent the side of the equilateral triangle with (x)cm, and its perimeter with (y) cm.



Side and Perimeter of a Equilateral Triangle

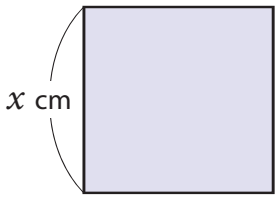
Side x (cm)	1	2	3	4	5	6
Perimeter y (cm)	3	6				

(a) Let's fill the table.

(b) Is y directly proportional to x?

(c) Represent the relationship of x and y in a mathematical sentence. What does the constant number represent?

2 Represent the relationship between x and y when the side of a square is (x)cm, and the perimeter is (y) cm,



Key Ideas

When y is proportional to x, it is also represented by a mathematical sentence:

y = x x constant number

Exercises

Draw a table to show the relationship between x and y and write a mathematical sentence for the following. What the constant mean?

(i) Diameter (x)cm and perimeter (y)cm

(ii) A side (x)cm and perimeter (y)cm

L80 : Making graphs of proportion

Graphs of Proportion

Lesson Objective: To understand that the proportional relationship of two numbers shown on the graph by a **(6.4.2.1/2)**

Materials: Graph Paper,blackboard

ASK-MT and Assessment

Attitudes/Values	enjoy drawing graphs to show proportional relationships.
Skills	correctly plot points and draw graphs of proportion.
Knowledge	proportional relationships on a graph have a straight line through the origin.
Mathematical Thinking	think about how to interpret corresponding values (x) and (y) presented it on the graphs of proportion.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Let's make a graph that represents the relationship between the volume of water (x)L and the depth (y)cm when poured into a tank.

Volume of water x (L)	0	1	2	3	4	5
Depth y (cm)	0	2	4	6	8	10

(a) Place points that represent the pairs of values, the value of x and its corresponding value of y, on the graph.

(b) How are the points lined up?

(c) Complete the table below and put points that represents a pair of values, the value of x and its corresponding value y, on the graph.

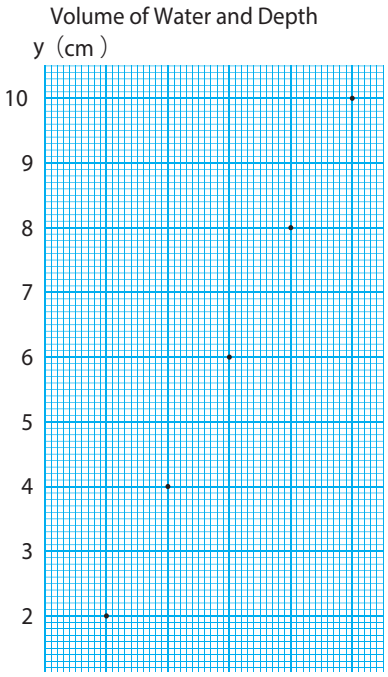
Volume of Water and Depth

Volume of wate x (L)	0	0 .1	0 .2	0 .5	1	2 .4	3 .9
Depth y (cm)	0				2		

(d) Can we connect any 2 points with one straight line?

Key Ideas

- The dots on the graph are in straight line, incline to the right.
- When you draw a proportional relationship in the graph, it becomes a straight line that goes through the origin (0).



L81 : Relationship of proportional graph

Lesson Objective: To read and understand the relationship of numbers of objects(variables) from graphs of proportion. **(6.4.2.1/2)**

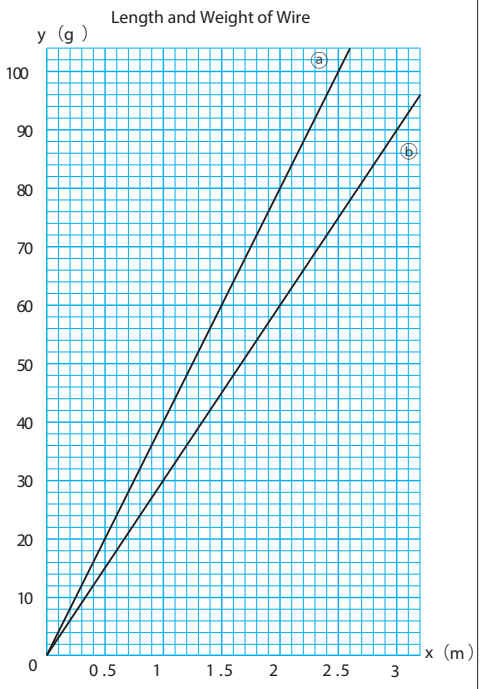
Materials: Graph Paper,blackboard

ASK-MT and Assessment

Attitudes/Values	enjoy reading graphs of proportion.
Skills	correctly read and interpret graphs of proportion.
Knowledge	characteristics and features of a graph of proportion.
Mathematical Thinking	think about how to interpret corresponding values (x) and (y) on graphs of proportion and make valid judgements based on the relationships.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 The graph represents the relationships between the length of a wire (x)m, and its weight (y)g of two different wires (a) and (b).



(a) Which wire weighs more? How did you find it from the graph?

(b) Read the lengths of each wire:

(i) Weight of 2.4m of wire (ii) Length of 48 grams of wire

(c) How much is the weight of each wire per meter?

(d) What do the following wires represent, (a) or (b)?

(i) 3.8m and 114g of wire (ii) 4.2m and 168g of wire

Key Ideas

- Understand that they can compare using same quantity, by measuring the weight of same length.
- Understand how to read from the graph to get the weights of the same length.
- In a graph that indicates two proportional relationships, understand that one above the other is heavier.

L82: Use proportion to solve problem (1)

Use the properties of proportion

Lesson Objective: To apply proportional relationships in problem solving. **(6.4.2.2)**
Materials: Table of proportional Relationship,blackboard

ASK-MT and Assessment

Attitudes/Values	Appreciate and enjoy solving problems that involve proportional relationships in their daily lives.
Skills	Correctly use equations and graphs of proportion in solving problems.
Knowledge	Using properties of proportion to solve problems.
Mathematical Thinking	Think about how to use properties of proportion to solve problem.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

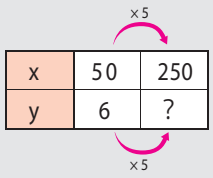
1 The table below represents the relationship between the volume of coke and the weight of sugar in it.

Volume of Coke and Sugar

Volume of coke x (mL)	0	1	50	100	150	180	250
Weight of sugar y (g)	0		6	12	18		

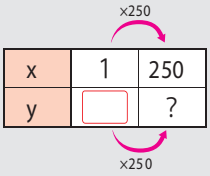
Sare's Idea

- 250mL of coke is 5 times more than 50mL, therefore the weight of sugar is 5 times more.
  6 x 5 = 30g



Vavi's Idea

- The weight of the sugar per millilitre of coke is constant. Therefore, we can make a mathematical sentence.
  y = 0.12 x x which is, y = 0.12 x 250



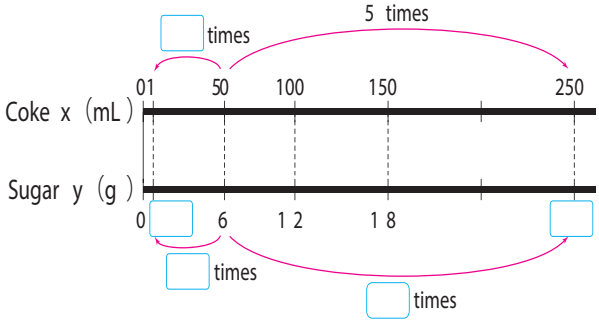
(a) Is the weight of sugar (y)g, proportional to the volume of coke (x)mL ?

(b) How many grams of sugar are in 250mL of coke?

(i) Let's find the answer using the constant(5)

(ii) Represent the relationship between x and y in a mathematical sentence.

$Y = \square \times x$



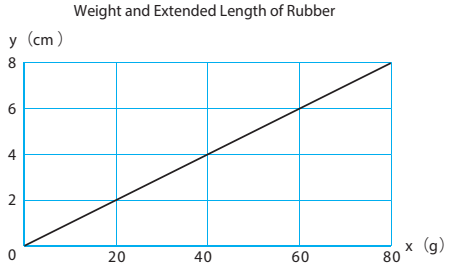
L83 : Use proportion to solve problems (2)

Lesson Objective: To solve the problem with hints from the graph of proportion. **(6.4.2.2)**
Materials: Graph of proportion,blackboard

ASK-MT and Assessment	
Attitudes/Values	Appreciate and enjoy solving problems involving graphs of proportion.
Skills	Apply the relationship on graphs of proportion to solve problems.
Knowledge	Meaning and properties of graphs of proportion.
Mathematical Thinking	Think about how to solve problems and expand results to predict values using proportion.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 The table below represents the relationship between the weight (x) g and the extended length of rubber (y) cm.



(a) If the weight increases 20g more, how long does the rubber extend in cm?

(b) Represent the relationship between x and y in a mathematical sentence.

(c) If a stone is placed onto the rubber, it extends 13cm. What is the weight of this stone?

Exercises

(1) Is y proportional to x?

(2) Find the number that goes into (a), (b) and (c).

(3) Represent the relationship between x and y in a mathematical sentence.
How many nails are there if the weight is 240g?

Number of Nails and Weight

Number of nails x (nails)	0	1	50	100	150	200	250
Weight of nails y (g)	0	ⓐ	300	600	900	ⓑ	ⓒ

L84 : Application of proportion

Lesson Objective: To understand that it is useful to apply the relationship of proportion in order to predict the phenomenon. **(6.4.2.2)**

Materials: Graph paper,blackboard

ASK-MT and Assessment	
Attitudes/Values	Appreciate the usefulness of proportion in their daily lives.
Skills	Apply the skills of reading graphs of graphs of proportion to predict natural phenomenon.
Knowledge	Using application of proportion.
Mathematical Thinking	Think about how to apply proportion and predict future events and natural phenomenon based on proportional relationships.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

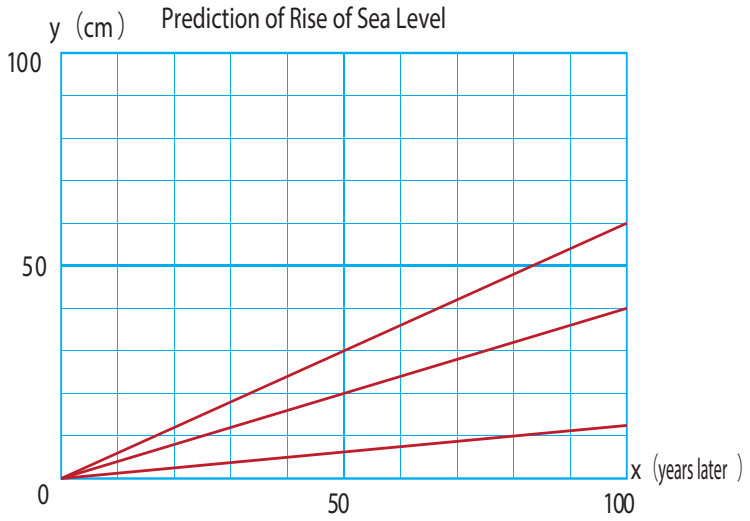
Teaching and Learning Activities

1 It is predicted that there will be a lot of influence on our lives due to global warming. One of the influences is the rise of sea levels due to the melting of ice in the north pole, and the part of the land could be covered by the ocean because of it. Predict the rise of sea level by using the idea of proportion.

(a) There are a lot of predictions about how fast the sea level will rise. Using the three predictions below, make a graph for each and calculate in centimetres how much the sea level will rise.

Ⓐ Rise 12 cm in past 100 years. It will continue to rise.
Ⓑ Rise 4 cm in next 10 years.
Ⓒ Rise 6 cm in next 10 years.

(b) After how many years, will the land that is 50cm above sea level be covered by the sea completely?



L85 : Understanding inverse proportion

Inverse proportion

Lesson Objective: To understand the meaning of inverse proportion and investigate the relationship of two quantities where one increases and the other decreases. **(6.4.2.3)**

Materials: blackboard

ASK-MT and Assessment

Attitudes/Values	Share their ideas through experimenting to find the length and width of different rectangles with a fixed area.
Skills	Calculate how the length and width of different rectangles changes in a related Manner.
Knowledge	Relationship of two quantities where one increases and the other decreases.
Mathematical Thinking	Think about how to express inverse proportion of two quantities.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

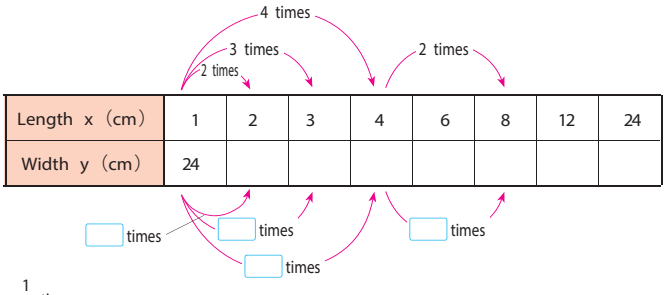
1 How does the length and width of a rectangle with fixed area of 24 cm² change?

(a) Make many kinds of different rectangles using 24 of 1cm² squares and develop the table on the right.

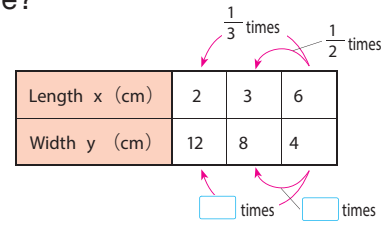
Length and Width of a Rectangle with an Area of 24 cm²

Length x (cm)	1	2	3	4	6	8	12	24
Width y (cm)	24							

(b) If the value of x changes 2 times, 3 times and so on, how does the value of y change?



(c) If the value of x changes $\frac{1}{2}$ and $\frac{1}{3}$ times, how does the value of y change?



Key Ideas

When there are two changing quantities, x and y , and if the value of y changes $\frac{1}{2}$ and $\frac{1}{3}$ times, as the value of x changes 2 and 3 times respectively, we say that y is inversely proportional to x

Exercises

Are two quantities inversely proportional?

Length x (cm)	1	2	3	4	5	6
Width y (cm)	11	10	9	8	7	6

(a) The x cm length and y cm width of a rectangle, when the fixed sum of all its lengths is 24cm.

Speed x (km/h)	5	10	20	25
Time y (hour)	20	10	5	4

(b) Speed and time when you ride 100km by bicycle.

L86: Mathematical sentence of inverse proportion

Lesson Objective: To represent the relationship of inverse proportion and express it with mathematical sentences. **(6.4.2.3)**

Materials: blackboard

ASK-MT and Assessment

Attitudes/Values	Share their ideas to how express mathematical sentences.
Skills	Express mathematical sentence of inverse proportion.
Knowledge	Be able to understand the rules of inverse proportion Y x y = constant number and y = constant number ÷ y
Mathematical Thinking	Think about how to express mathematical sentence of inverse proportion.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Represent the relationship of length x cm and width y cm of a rectangle, when its fixed area is 24 cm² in a mathematical sentence.

Length and Width of a Rectangle, with a Fixed Area of 24 m^2

Length x (cm)	1	2	3	4	6	8	12	24
Width y (cm)	24	12	8	6	4	3	2	1

(a) What kind of pattern is there between x and y?

(b) Find the product of corresponding values of x and y. What does the product mean?

(c) Find the value of y when value of x is 5.

$5 \times y = 24$
$y = 24 \div 5$

Length (cm)		Width (cm)		Area (cm)
1	×	24	=	24
2	×	12	=	24
3	×	8	=	
4	×	6	=	
x	×	y	=	

Key Ideas

- When there are 2 quantities, x and y, and y is inversely proportion to x, their relationship can be represented in the mathematical sentence:

  $x \times y$ = constant number

- When y is inversely proportion to x, it is also represented in the mathematical sentence:

  y = constant number ÷ x

L87 : Graph of inverse proportion

Lesson Objective: To represent the relationship of inverse proportion in a graph. **(6.4.2.3)**

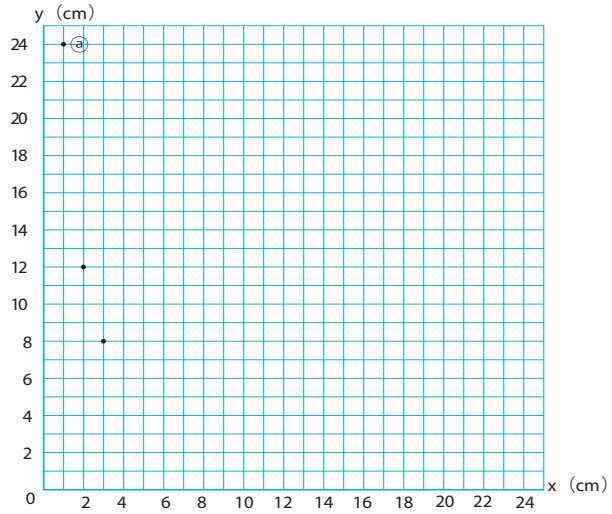
Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Enjoy drawing graphs to represent inverse proportion.
Skills	Be able to correctly plot points and draw graphs of inverse proportion.
Knowledge	Be able to understand how two sets of numbers change inversely on a graph and mathematical sentence.
Mathematical Thinking	Be able to determine the relationship of inverse proportion on a graph from 2 quantities that are inversely proportional to each other with a product(constant).
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Place points on the pair of x and its corresponding value of y on the graph and connect them with a line. (Refer to table from previous lesson)

(a) Compare it with a graph that shows proportion.



2 There is a job which takes 60 days to complete when 1 person does the same amount of work per day.

(a) Represent the relationship of x and y in a mathematical sentence.

(b) Using the mathematical sentence from (1), find how many days it takes to complete with 5 people.

(c) Using the mathematical sentence from (1), find how many people are needed to complete the work in 10 days.

Unit checkpoint

Review on proportion and inverse proportion

Proportion and Inverse Proportion	Name:	Score /100

1. We checked the relationship between the depth of poured water in a container in the shape of a rectangular solid and time taken.

Time for pouring water and its depth

Time: x (minutes)	0	1		3	4		8
Depth: y (cm)	0	4	8		16	24	

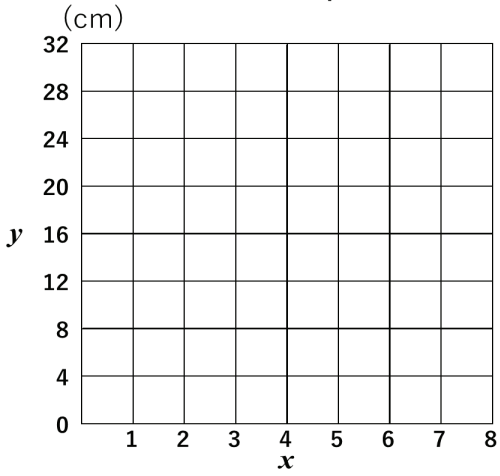
(1) Fill in the table above. [4× 5 = 20 points]

(2) Express the relationship between x and y as an mathematical expression. [10 points]

Answer:

(3) Draw a graph on the grid for expressing the relationship between x and y . [10 points]

Time taken and depth of water



(4) How many minutes does it take for water to be filled up to 60 cm depth. [10 points]

Answer:

2. We researched on the relationship between the length x cm and width y cm of a rectangle of 18 cm^2.

Length and Width of a rectangle of 18 cm^2

Length: x (cm)	1	2	3	4		9	
Width: y (cm)	18				3	2	1

(1) Fill in the table above. [4× 5 = 20 points]

(2) Express the relationship between x and y as an mathematical expression. [15 points]

Answer:

(3) Is the relationship between x and y proportional, or inverse-proportional? [15]

Answer:

L88: Comparing data

Mean

Lesson Objective: To use mean for comparing and interpret data. **(6.4.3.1)**
Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share ideas on how to compare and interpret data.
Skills	compare and interpret data from table
Knowledge	Using mean for comparing and interpreting data.
Mathematical Thinking	Think about how to compare and interpret data from table.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

The table below shows the data of the highest monthly temperature in NCD from 2009 to 2016.

Year \ Month	1	2	3	4	5	6	7	8	9	10	11	12
2009	31.0	30.1	28.9	31.3	30.9	30.0	29.9	30.0	30.0	30.8	30.9	30.8
2016	35.5	35.0	35.9	36.0	35.7	35.0	34.8	33.0	34.0	34.7	34.9	35.0

1 Lets talk about what you can tell from this table (Some expect response from the students)

(a) There was only slide difference between the temperature in 2009 and 2016.temperatures in 2016 were higher than the temperatures in 2009.

(b) Why don't we calculate the mean?

(c) The 2 months that record the highest temperatures in 2009 and 2016 are January and April.

(d) The highest temperature in is 5° C greater than the highest temperature for 2009.

Ratu looked at the table and decided to compare the average monthly highest temperature of the year. How is he calculating the mean? Fill ☐ with numbers and explain.

How to calculate the mean of monthly highest temperature of the year in 1995.

Sum of monthly highest temperature from January to December ÷ ☐

Key Ideas

The mean of a set of numerical data is the value obtained by dividing the sum of all data elements by the number of data elements.

Exercises

Number of class in 16 primary schools in Port Moresby in 2009 is as shown below.
Calculate the mean and round off to tenth place. 6, 12, 6, 6, 6, 12, 16, 6, 16, 10, 11, 12, 12, 6

L89: Finding the mean

Lesson Objective: Understand how to calculate the average of scores as the mean. **(6.4.3.1)**

Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on how to calculate average scores.
Skills	To be able to calculate a set of data to find average score.
Knowledge	Be able to understand mean and how to find the average score.
Mathematical Thinking	Be able to think of how to obtain mean from a set of numerical data.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 The numbers below shows the heights of 13 members of a basketball team.
What is the average height of this team in centimetres? Round off to tenths place.

188 , 198 , 179 , 183 , 191 , 205 , 195 , 196 , 185 ,
203 , 187 , 194 , 199 (cm)

(a) Fill the ☐ with numbers and explain how to Find it.

Sare's Idea

(☐ + 198 + 179 + 183 + 191 + 205 + 195 + 196 + 185 + 203 + 187
+ 194 + 199) ÷ ☐ = ☐

Therefore, the mean is ☐ cm.

Vavi's Idea

(18 + 28 + 9 + ☐ + ☐ + ☐ + ☐ + ☐ + ☐ +
☐ + ☐ + ☐ + 29) ÷ ☐ = ☐

170 + ☐ = ☐

Therefore, the mean is ☐ cm.

(b) Compare Sare and Vavi's idea.

L90 : Comparing distribution of two sets of data

Distribution

Lesson Objective: To organised data on a number line and think about how to analyse the distribution. **(6.4.4.2)**

Materials: blackboard

ASK-MT and Assessment

Attitudes/Values	Share ideas on how to organise and analyse distribution of 2 sets of data.
Skills	Organise data and analyse the distribution of 2 sets data.
Knowledge	How to find the average score as the mean.
Mathematical Thinking	Think about how to analyse distribution of 2 sets of data.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

Record of Throwing a Softball

Group A				Group B			
Number	Distance (m)	Number	Distance (m)	Number	Distance (m)	Number	Distance (m)
❶	22	⓫	26	①	40	⑪	37
❷	31	⓬	16	②	34	⑫	30
❸	42	⓭	42	③	26	⑬	28
❹	23	⓮	18	④	30	⑭	32
❺	24	⓯	22	⑤	19	⑮	42
❻	35	⓰	38	⑥	21	⑯	37
❼	45	⓱	29	⑦	33	⑰	30
❽	23	⓲	28	⑧	16	⑱	32
❾	31	⓳	31	⑨	38	⑲	21
❿	41	⓴	33	⑩	24		

1 Which group has better record? Let's investigate the following statistics and talk about it.

(a) Best and worst throw

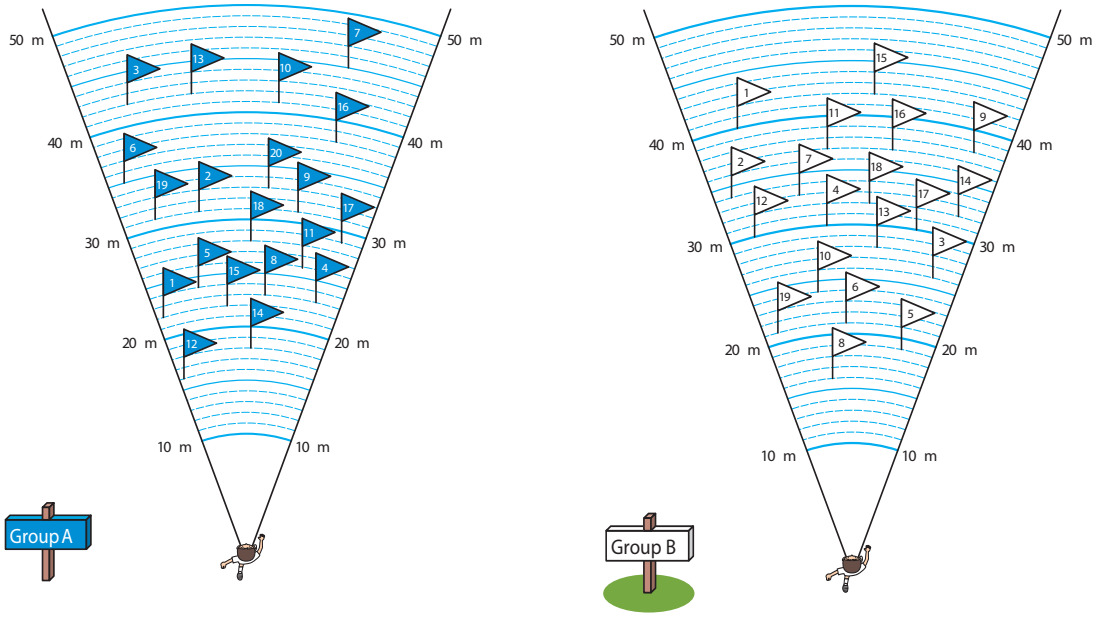
Who threw the furthest?

(b) Average

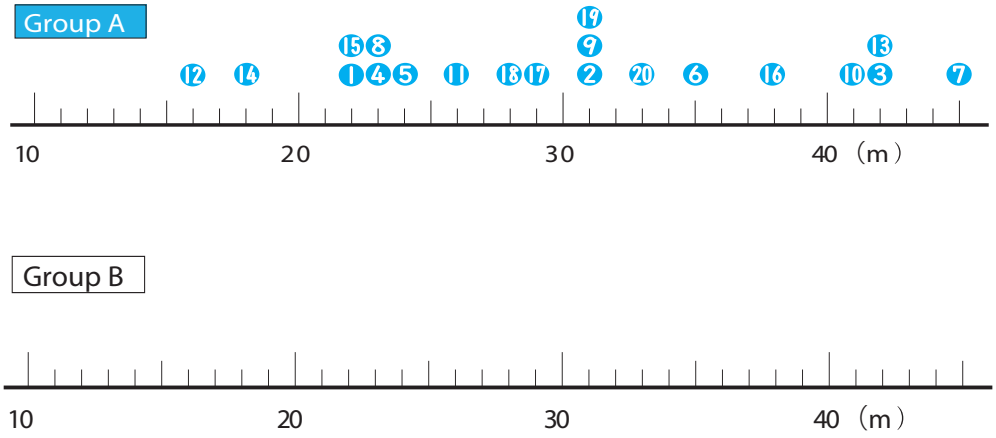
How many metres did most children throw?

Teaching and Learning Activities

1



To make the records easy to read, represent each data on the number line. Do the same for group B and compare the distribution.



L91 : Organising data in frequency table

Lesson Objective: Understand how to make and read the distribution on a frequency table and the meaning of greater than or equal to and Less than. **(6.4.2.2)**

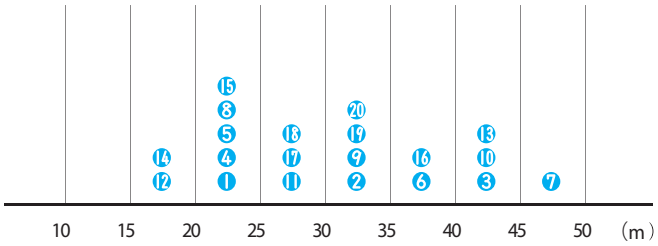
Materials: blackboard

ASK-MT and Assessment

Attitudes/Values	Share ideas with others on how to make and read the distribution on a frequency table.
Skills	Make and read the distribution on a frequency table.
Knowledge	Making and reading the distribution on a frequency table.
Mathematical Thinking	Think about how to make and read on a frequency table.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 To organize the distribution in more detail, they separated the data by intervals of 5m, and made a table.



(a) Organize the `distribution above on the table.

Record of Throwing a Softball (Group A)

Distance (m)	Number of children (children)
Greater or Equal 15 ~ Less Than 20	
20 ~25	
25 ~30	
30 ~35	
35 ~40	
40 ~45	
45 ~50	

This table above includes the shortest to longest records. They divided the recorded distance by 5m into 7 classes to find out how many children belong to each class.

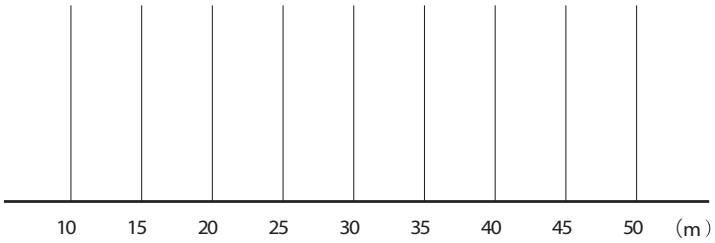
(b) How many children belong to the recorded distance that is greater or equal to 25 and less than 30?

(c) In which class, do 4 children belong to (Greater or Equal and Less Than)?

Teaching and Learning Activities

2 Explore the data for group B and compare it with group A.

(a) Separate the records by intervals of 5m and complete the table.



(b) Explore the distribution above on a table.

Record of Throwing a Softball (Group B)

Distance (m)	Number of children (children)
Greater or Equal 15 ～ Less Than 20	
20 ～25	
25 ～30	
30 ～35	
35 ～40	
40 ～45	
45 ～50	

(c) Compare the records of group A and B

(i) Which group has more records that are greater or equal to 40m?
(ii) Which group has more records that are less than 25m?
(iii) Which group has more records that are greater or equal to 25m and less than 35?

L92 : Organising data on histogram

Lesson Objective: Understand the word histogram and think about how to draw and read a histogram. **(6.4.2.2)**

Materials: graph paper,blackboard

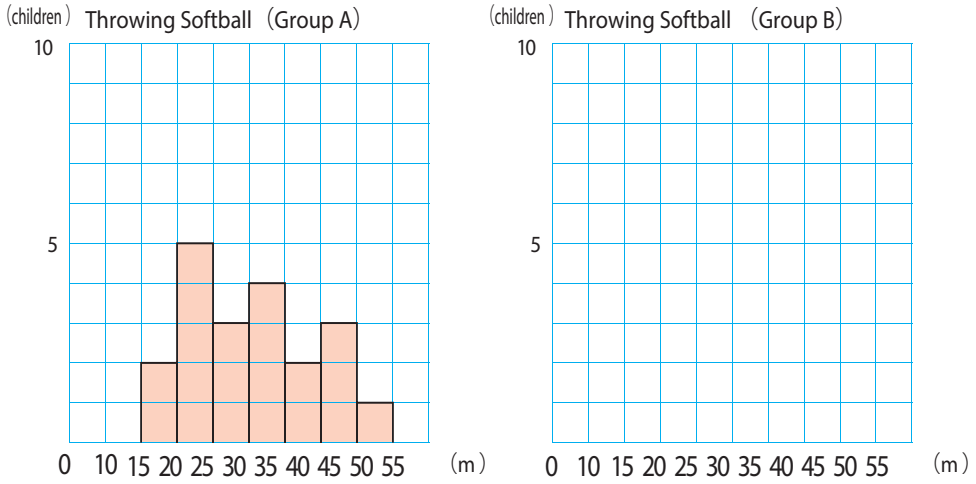
ASK-MT and Assessment	
Attitudes/Values	Share their ideas on how to draw and read a histogram.
Skills	Draw and read a histogram.
Knowledge	Understanding histogram and how to draw and read a histogram.
Mathematical Thinking	Think about how to draw and read a histogram.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 Based on the table of group A on page 135, they drew a graph to compare the distribution records of throwing a soft ball in group A and B.

(a) How many children threw a soft ball greater than or equal to 35 and less than 40 m in group A?

(b) In which class, greater or equal and less than, does 1 child belong to in a group A?



(c) Draw a histogram for group B

(d) Compare the shapes of the two histogram and discuss about how they are distributed.

(e) In which class greater or equal and less than does most children belong to in each group? What is the percentage ratio of this class is it out of all for each group?

(f) In which class greater or equal and less than does the fifth children belong to for each group.

Teaching and Learning Activities

2 Fill the table to compare the distribution records of group A and B. What can you tell from this table?

	Group A	Group B
Longest Record (m)		
Shortest Record (m)		
Mean (m)		
Class that most children belong to (m)	Greater or Equal ~ Less Than	Greater or Equal ~ Less Than
Percentage of children whose record is less than 20 m (%)		
Percentage of children whose record is greater or equal to 20 m and less than 35 m (%)		
Percentage of children whose record is greater or equal to 40m (%)		

3 Let's investigate about records of throwing softball in your school.

Key Ideas

The graph, which looks like the above is called histogram. It is easy to read the distribution by looking at the bars. In the histogram, the horizon axis represents the range and vertical axis represent how many children are in that range

L93: Data on frequency table and histogram

Lesson Objective: Organise data and analyse distribution on a frequency table or graph. **(6.4.2.2)**

Materials: graph paper, blackboard

ASK-MT and Assessment

Attitudes/Values	Share their ideas on how to organise data and analyse distribution on a frequency distribution table or graph.
Skills	Organise data and analyse distribution on a table or graph.
Knowledge	Organising data analysing distribution on a frequency distribution table or graph.
Mathematical Thinking	Think about how to organise data and analyse the distribution on frequency distribution table or graph.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

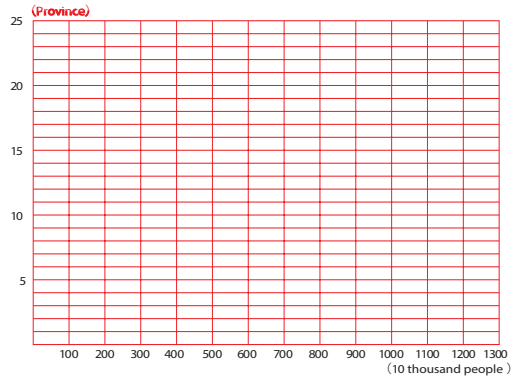
Teaching and Learning Activities

The data on the right shows the population of each Province in Japan.

(a) Find the average population of 47 provinces.
Which province is the closest to the average?

(b) Fill the number of provinces on the table to explore

(c) Draw a histogram based on the table.



The distribution of the population

Population by Province

Population (10 thousand) Greater or Equal / Less Than	Province
0 ～100	
100 ～200	
200 ～300	
300 ～400	
400 ～500	
500 ～600	
600 ～700	
700 ～800	
800 ～900	
900 ～1000	
1000 ～1100	
1100 ～1200	
1200 ～1300	

Statistics of Population in 2007 (10 thousand)

Hokkaido	555	Shiga	137
Aomori	140	Kyoto	259
Iwate	136	Osaka	864
Miyagi	234	Hyogo	551
Akita	112	Nara	140
Yamagata	119	Wakayama	102
Fukushima	206	Tottori	60
Ibaraki	293	Shimane	73
Tochigi	199	Okayama	194
Gunma	198	Hiroshima	284
Saitama	700	Yamaguchi	146
Chiba	602	Tokushima	80
Tokyo	1249	Kagawa	100
Kanagawa	875	Ehime	145
Niigata	239	Kochi	78
Toyama	109	Fukuoka	502
Ishikawa	116	Saga	86
Fukui	80	Nagasaki	145
Yamanashi	86	Kumamoto	182
Nagano	215	Ooita	120
Gifu	206	Miyazaki	114
Shizuoka	372	Kagoshima	173
Aichi	717	Okinawa	137
Mie	183	Total	12613

(d) In the histogram above which class is, greater or equal and less than.
Does the average That you calculated on problem one belong to?

(e) Lining up the provinces from the one with the least population. Which province? belongs to the centre, 24th place? And in which class is greater than, does that province belong to?

(f) In which class is greater or equal and less than, does the most number of provinces belong to ?

(g) Based on what you have answered on problem 4, 5 and 6, which one explains the date Well? Talk about it with your friends

Key Ideas

Histogram or bar graph graph using vertical or horizontal bars whose lengths indicate quantities. Along with the pie chart the histogram is the most common format for representing but gives an immediate impression of the distribution of the data. In fact a histogram is representation of a frequency distribution.

Unit checkpoint

Review on how to explore data

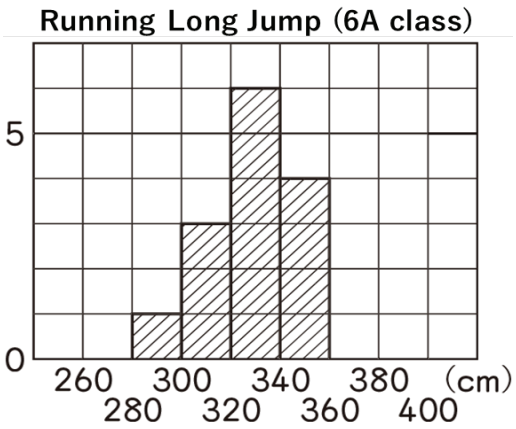
How to Explore Data	Name:	Score /100

1. The graph below shows the result of boys' running long jump in 6A class.

Answer each question.

(1) Complete drawing the histogram on the right by adding the following records;[3 × 10 = 30 points]

greater than or equal to 260 cm and less than 280 cm : 2 boys
greater than or equal to 360 cm and less than 380 cm : 3 boys
greater than or equal to 380 cm and less than 400 cm : 1 boy



(2) How many boys are there in 6A? [10 points]

Answer:

(3) Which class do the most boys belong to? And find the number of boys in the class and its percentage.

[2 × 10 points = 30 points]

greater than or equal to less than

and

boys %

(4) Which class does the 5th best boy belong to? [10 points]

greater than or equal to less than

and

(5) The record of Peter was 304 cm. Assess his record by comparing to other records in 6A with reasons.

[20 points]

L94 : Representing quantity

Represent quantities and units

Lesson Objective: To understand discrete quantities and continuous quantities. **(6.2.3.1)**

Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on what kind of quantities you find in your daily life.
Skills	Distinguish between discrete quantities and continuous quantities.
Knowledge	Discrete quantities and continuous quantities.
Mathematical Thinking	Think about the difference between discrete quantities in their daily life.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 What kinds of units are used to represent following quantities.

(a) Organize the information on the table.

Quantities	Quantities
Distance from home to school	Km, m
Volume of juice	L, dL, mL
Weight of a bag	Kg, g
Area of a classroom	m^2
Area of an island	km^2
Tame taken to go to school	minute

(b) Let's think about other units that are used around you.

L 95 : Units of Length

Lesson Objective: To summarise the units of length and represent quantities using units of length. **(6.2.3.1)**
Materials: blackboard

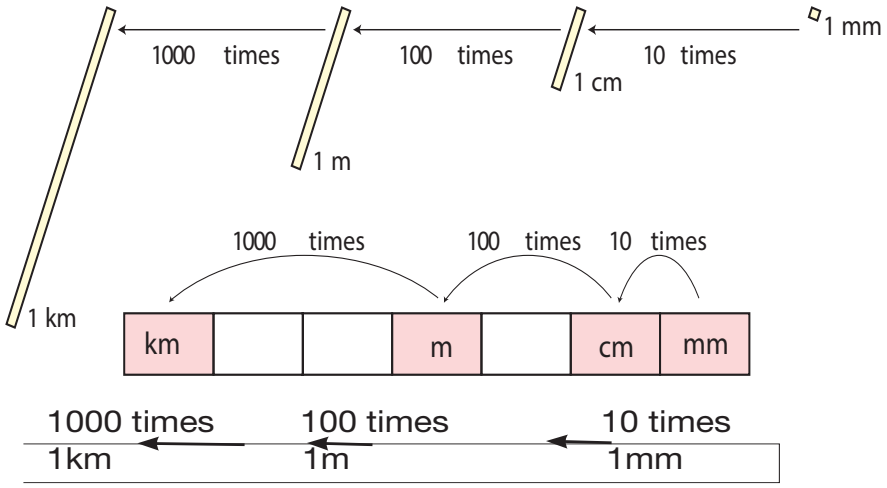
ASK-MT and Assessment	
Attitudes/Values	Share their ideas on how to identify appropriate units of length.
Skills	Identify appropriate units of length and represent them correctly.
Knowledge	Units of length.
Mathematical Thinking	Think about how to identify appropriate units of lengths and represented them correctly.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 What kinds of units are used to represent the following lengths?

(a) Length of Fly river: 1050..... ☐
(b) Length of swimming pool.....25 ☐
(c) Width of a textbook.....25.7 ☐
(d) Thickness of a notebook..... ☐

2 Relationship among unit of length.



Fill the ☐ with a number.

(a) 6m = 600 cm (b) 2km = 200m (c) 124cm = 1.24m (d) 0.5cm = 5mm

Convert Unit 0.6km = ☐ m

L : 96 Units of area

Lesson Objective: To summarise the units of area **(6.2.3.1)**

Materials: blackboard

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on the relationship between units of area and units of length.
Skills	Calculate area using the relationship between units of area and units of length.
Knowledge	Units of area.
Mathematical Thinking	Think about the appropriate units of area.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 What kind of units are used to represent the following area?

(a) Area of central province: 29998 km^2 ☐

(b) Area of tennis court: 2 a ☐

(c) Area of postage stamp: 5.5 cm^2 ☐

2 Units of area are made based on units of length.
Let's integrate the relationship of units of area.

10 times ←

A side of square	1 km	100m	10 m	1m	1cm
Area of the square	1 km^2	1ha	1a $100m^3$	$1m^2$	$1cm^2$

← 100 times

3 Convert unit.

7km^2 ☐ ha

Key Ideas

1a = $100m^2$ 1ha = 100a = $1000m^2$

L 97 : Units of Volume

Lesson Objective: To summarise the units of volume and understand that there are two types of units in volume a unit base on length and a unit base on "L". **(6.2.3.1)**

Materials: blackboard,relationship chart

ASK-MT and Assessment	
Attitudes/Values	Share their ideas on the relationship between units of volume.
Skills	Calculate volume of various objects and convert freely between units of volume
Knowledge	Understand l as a standard unit for dl, or ml. and the relationship of units of volume
Mathematical Thinking	Be able to think about the relationship between units of volume considering the solid volume and liquid volume.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 What kind of units are used to represent the following volumes?

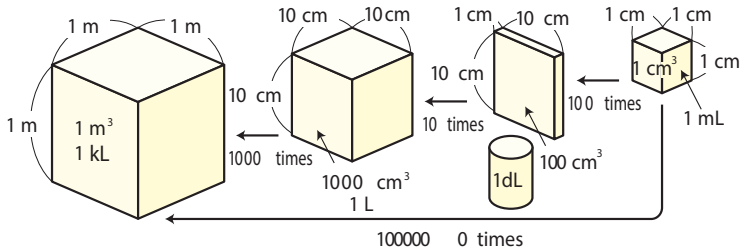
(a) Volume of water in school swimming pool……375 ☐

(b) Volume of a eraser…… 8 ☐

(c)Volume of pack of milk…… 1 ☐

(d)Volume of water in a plastic bottle……500 ☐

2 Units of volume are also made based on units of length. Let's integrate the relationship of units of volumes.



Side length of a cube	1 m	10 cm		1 cm
Volume of a cube	$1\ m^3$ 1 kL	$1000\ m^3$ 1 L	1 dL	$1\ cm^3$ 1 mL

(a) Convert Unit

$0.5\ m^3$ ☐ L

Key Ideas

- Use "L" as a standard unit for "dL", or "mL".
- There is a unit called kilolitre kL.

$$1kL = 1000L = 1\ m^3$$

L98: Units of weight

Lesson Objective: To know the unit "milligram and explain the relationship between volume of water and weight.**(6.2.3.1)**

Materials: Ruler, protractor and graph papers,blackboard

ASK-MT and Assessment	
Attitudes/Values	Share the ideas on the relationship between volume of water and weight
Skills	Explain the relationship between volume of water and weight.
Knowledge	Understand relationship between volume of water and weight
Mathematical Thinking	Think about how to explain the relationship between volume of water and weight.
Assessment	Use the key concepts below to assess the students learning progress during the lesson.

Teaching and Learning Activities

1 What kind of units are used to represent the following weights?

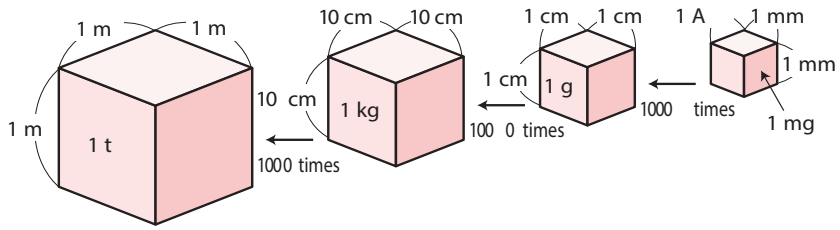
(a) Weight of an adult male.....65 ☐

(b) Weight of 10 toea coin.....1 ☐

2 Weight of 1cm^3 of water is 1g.

(a) find the volume of the following cubes.

(b) Let's integrate the relationship between each volume and weight of water.



Key Ideas

There is a unit called milligram (mg), other than t, kg, and g for units of weight.

Exercises

1. Convert the units.

4 t = ☐ kg

	t			kg			g			mg
	4									

4 0 0 0

Unit checkpoint

Review on quantity and unit

Quantity and Unit	Name:	Score /100

1. Find appropriate numbers for ☐. [4 × 10 points = 40 points]

(1) 0,36 g = ☐ mg (2) 0.47 dL = ☐ mL

(3) 520 ha = ☐ km^2 (4) 810 kg = ☐ t

2. You have 3.8L of water in a kettle. How many glasses do you need if you pour 200mL for each glass? [10 points]

Answer:

3. The length of a field is 100 m and the width is 32 m. [2 × 10 = 20 points]

(1) Find the area of the field in *ares* [a].

Answer: a

(2) Find the weight of groundnuts harvested in the field in tons if the land can cultivate 50 kg of groundnuts per 1 a.

Answer: t

4. The length of a sidewalk is 150 m and the width is 3 m. [2 × 15 = 30 points]

(1) The sidewalk will be covered by square tiles with a side of 30 cm. Find the total number of tiles covering the sidewalk.

Answer: tiles

(2) Each tile weighs 2.5 kg. Find the total weight of the tiles covering the sidewalk in t.

Answer: t

Assessment, Recording and Reporting

Assessment, recording and reporting is an integral part of the delivery of any curriculum used in the schools.

The primary purpose of assessment is to improve students' learning and teachers' teaching as both respond to fulfilling the following:

- inform and improve students' progress and achievements in learning
- provide valuable information that enable teachers, schools and Department of Education to make decisions about how to improve the quality of teaching and learning in the education system
- inform teachers of the progress of students learning in order to adjust teaching and planning to improve student learning
- inform parents and guardians, about their children's progress and achievements
- schools and systems, about teaching strategies, resource allocations and curriculum; and other educational institutions, employers and the community, about the achievements of students in general or of particular students.

Effective and meaning assessment must be maintained at all times. The content standards written in the syllabus are expected curriculum for this grade prescribed by units and sets the basis for planning and conducting on - going assessment.

Ongoing classroom assessment is done to:

- support students learning
- monitor students learning needs
- diagnose students learning needs
- evaluate teaching program and
- inform students reporting process.

Assessment Strategies and Methods

1. Assessments Methods

Assessment is an integral part of students learning and can be done using different methods.

Teachers are encouraged to use two or more types of assessment when assessing students learning. Standards Based Curriculum specially promotes three types of assessment. These are;

- Assessment ***As*** Learning **(AAL)**
- Assessment ***For*** Learning **(AFL)**
- Assessment Of Learning **(AOL)**

2. Assessment Strategies

2.1 Answering Questions and Tasks during the Lesson

The use of questioning or an activity during the teaching of every lesson is an example of AAL that assesses student's achievement (key concepts) of the lesson. It allows student the opportunity to reflect on their own learning and identify areas of their strength and weakness during the lessons.

2.2 Exercises

All exercises given in every lesson are example of AFL. It is not used to evaluate learning but to help learners learn better. It helps the students to see the learning in relation to the goals.

2.3 Checkpoints

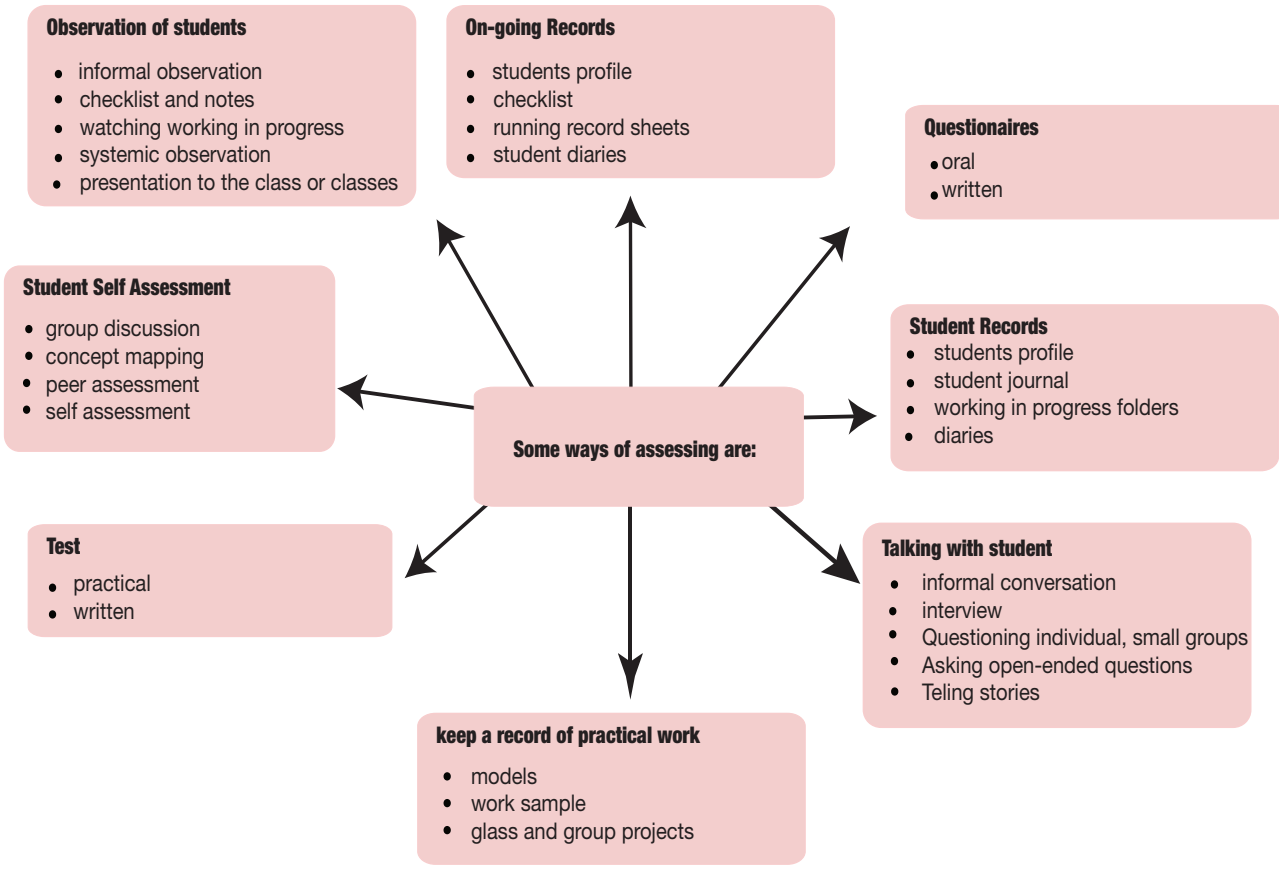
In the Teacher guide there is a check point. It is a Unit Review exercise that appears at the end of the all guided lessons of a particular unit. The exercises are based on basic key concepts to recheck the understanding of students. Teachers are encouraged to use these as classroom assessments apart from tests and assignments. This Unit Review exercises is an example of AOL that teachers can use to measure, record and report on a student's level of achievement in regards to specific learning expectations.

2.4 Written Test/Assignment/Homework

These assessment strategies are used to assess students' performance of their learning formatively or summative. Class teachers prepare these with careful considerations of;

- the knowledge and skills to assess the students
- the level of language to be used
- the construction of questions - clear and precise
- the intended content to be assess
- how much each question is worth and how to award scores for each questions.

Below are some other ways of assessing apart from what has been give above.



Assessment Plan and Tasks

It is important to plan assessment for the whole year using the content overview and the yearly or term plans. Assessment.

Assessment tasks form the basis of the assessment processes of assessing each learner in relation to the content standards. Assessment tasks are learning activities created from the benchmarks. These are written and specifically designed and planned before administering. This particular activity assessing has key concepts (ASK-MT) that must be achieved at the end of each Content Standards.

Assessment Plan

To plan assessment tasks, teachers must decide which type of assessment methods will be used to demonstrate to achieve the content standards. Standard statements are the point of reference in the process of identifying and planning assessment tasks.

In the process of writing and planning assessment tasks, the following are some points to consider;

- Choose assessment methods suitable for the assessment task. (Refer to sample in Appendix.5)
- Develop assessment rubric based the Key Concepts (ASK-MT). (Refer to sample in Appendix.5)
- Consulting the Bloom's Taxonomy as per the student's cognitive level.

Assessment Tasks

Sample assessment tasks given are examples for teachers to use and plan their own to suit their context and the learning needs of the grade six students in the classroom. The tasks are very specific and direct the teacher to the content of learning stated in the syllabus.

Teachers should be ensured that all assessment tasks are;

- Clearly stated in simple language that students can easily interpret
- Link to the content standards
- Balanced, comprehensive, reliable and fair
- Should create assessment criteria (rubrics) to be demonstrated in each tasks and are made known to students.

Grade (6) Yearly Assessment Plan and Task Overview

According to the grade (6) content and yearly plan, a suggested yearly assessment plan and tasks overview has been planned and placed. Teachers are encourage to utilize this according to the school overall assessment program.

Strand	Unit	Content Standard	Assessment Task
Number and Operation	Multiplication and Division of fraction	**6.1.2**	• Multiply fraction by fraction
			• Divide fraction by fraction
Quantities and Measurements	Calculating areas of various shapes	**6.2.1**	• Calculate the area of various shapes
	Speed	**6.2.2**	• Calculate speed, time and distance from given mathematical problems
	Volume of prisms and cylinders	**6.2.4**	• Calculate volume of prisms and cylinders using the formulas
Geometrical Figures	Symmetry	**6.31**	• Distinguish and identify symmetric figures with line symmetry and point symmetry
	Reduce and Enlarge Figures	**6.3.2**	• Explain the properties of enlarge and reduce drawings
Data and Mathematical Relationships	Mathematical Letter and Expression	**6.4.3**	• Solve expressions using variables
	Ratio	**6.4.1**	• Solve problem using ratio
	Proportional relationship	**6.4.2**	• Solve problems using propositional relationships
	Order and Combination	**6.4.5**	• Find the possible outcomes using diagram and tables

Recording and Reporting

Recording and reporting of students achievements in the classroom is very important. Teachers should use a range of tasks to ensure that commended standards statements are equally assessed and reported. This helps the teachers to reflect the effectiveness of their teachings.

Recording

Teachers must keep accurate records of students' achievement of their learning. They must report these achievements in fair and accurate ways to parents, guardians, teachers and students. Teachers should records the evidence of students' demonstrations of achievements of standards using assessment instruments that are manageable.

Examples of recording methods include;

- Anecdotal notes in a journal or dairy
- Checklist
- Portfolios of students' work
- Progressive records
- Work samples with comments written by the teacher.

Reporting

Reporting is important in assessment and should be done effectively. Teachers should report what students have done well and how they can improve further. Students' reports should be based on assessment information collected from students learning progress and other related areas such as behaviours. Schools will decide on how reports will be presented according to the needs of their communities.

Methods will include interviews and written reports. Written reports should include;

- A written record of content standards achieved by students since the previous report
- A written record of the content standards the student is now working towards
- Information about students' attitudes, values and other additional information that is specific to individual students.

Evaluation

- Evaluation is part of the process of continuously raising standards of student achievement in PNG. Assessment information used for evaluation purposes should be used in ethical and constructive ways.

- Teachers will use assessment information to evaluate the effectiveness of their teaching, learning to make improvements to their teaching practice in order to improve student learning. Evaluation tools such as written records, questionnaires, logs and diaries, submissions or records of meetings and discussion with general staff members, teaching staff, parents and other community members.

Glossary

Words	Meaning
Addend	A number to be added to another
Algorithms	A procedure or formula for solving a mathematical problem, based on conducting a sequence of specified actions.
Arbitrary Unit	Is a unit which is not part of an internationally accepted absolute system of units.
Augend	A number to which another number is added to form a sum
Bar graphs	a diagram in which the numerical values of variables are represented by the height or length of lines or rectangles of equal width.
Cardinals	Number denoting quantities e.g. 1, 2, 3, etc.
Centre	A point which all points on the circle or sphere are the same distance
Circumference	The enclosing boundary of a circle
Diameter	A straight line passing side to side through the centre of a figure especially circle and sphere
Difference	The result of subtracting one number from the other
Dividend	The number being divided
Divisor	A number that divides an integer evenly or a factor that will divide the dividend exactly
Equilateral triangle	A triangle in which all three sides are equal. It is also equiangular; all three interior angles are equal and measure 60°
Expression	A mathematical phrase that can contain ordinary numbers, variables (like x or y) and operations (like)
Fraction	A numerical quantity that is not a whole number e.g. , the top number is the numerator and the bottom number is the denominator
Horizontal axis	The line on a graph that runs horizontally (left-right) through zero. It is used as a reference line so you can measure from it; the x-axis.
Inequality	Two values are not equal and the symbols include (- not equal to, < less than, > greater than, - less than or equal to or - greater than or equal to)
Isosceles triangle	A triangle that has two sides of equal length
Length	The measurement or extent of something from end to end
Minuend	The first number in a subtraction, the number from which another number is to be subtract
Multiplicand	A number that is to be multiplied by another
Multiplier	A number by which another number is multiplied
Ordinals	Number defining the position of something in a series e.g. first, second, third, etc.
Partitive Division	A division problem where you know the total number of groups, and you are trying to find the number of items in each group
Product	The answer when two or more numbers are multiplied Involves taking a set of size ‘a’ and forming groups of size ‘b’. The number of groups of this size that can be formed, ‘c’ is the quotient of ‘a’ and ‘b’
Quotative Division	Involves taking a set of size ‘a’ and forming groups of size ‘b’. The number of groups of this size that can be formed, ‘c’ is the quotient of ‘a’ and ‘b’

Words	Meaning
Quotient	The quantity produced by division of two numbers
Radius	A straight line from the centre to the circumference of a circle or sphere, of the diameter
Remainder	The amount “left over” after performing some computation. Normally an integer “left over” after dividing one integer by another to produce and integer quotient
Sphere	A round solid figure with every point on its surface equidistant from its centre e.g. soccer ball
Subtrahend	The number that is to be subtracted
Sum	The result of adding two or more numbers
Vertex	A corner or a point where lines meet
Vertical axis	The line on a graph that runs vertically (up-down) through zero. It is used as a reference line so you can measure from it, the y-axis.
Weight	A body’s relative mass or the quantity of matter contained by it, giving rise to a down-ward force. The heaviness of a person or thing

Resources

Mathematics lessons require resources both for teachers and students. The recommended list of resources in this Teacher Guide are vital for making the teaching and learning meaningful and to understand concepts more precisely and clear.

1. List of Teaching Aids /Materials

- Set squares
- Protractors (Full circle and semi of various sizes)
- Compass (various sizes)
- Wall Clock
- Rulers (1m & 30cm)
- Tape measure (various sizes)
- Multiplication table chart
- Fraction wall chart (to be Improvised by the teacher)
- Stop watches
- Base ten materials (cubes, long, flat and blocks)
- Thermometer
- Models of 2D and 3D shapes
- Scissors/blades
- Square coloured papers
- A grid square papers.

2. Teaching Resources

- Melanesian School Mathematics Dictionary
- Community School Mathematics 6A & 6B
- Grade 6 Mathematics TV Students Workbook
- Grade 6 Mathematics TV Teacher Resource book
- Tingting Maths Grade 6 Teacher Resources book
- Tingting Maths Grade 6 Students book
- Mathematics Essential Skills 6 Outcomes Edition for PNG.

References

NDOE 2016, Mathematics Junior Primary SBC Syllabus, NDOE, Waigani

NDOE 2004, Mathematics Lower Primary Syllabus, NDOE, Waigani

NDOE 2004, Mathematics Lower Primary Teacher Guide, NDOE, Waigani
Elementary School Teaching Guide for the Japanese Course of Study (grade 1-6),

2010, CRICED, University of Tsukuba

Study with your Friends Mathematics for Elementary School, © Gakkohtosho Co. LTD, Taheshi Nara, Tosho Printing Co., LTD Japan

Appendices

Appendix 1: STEAM or STEM

- By exposing students to STEAM and giving them opportunities to explore STEAM-related concepts, they will develop a passion for it and, hopefully, pursue a job in a STEAM field.
- Providing real life experiences and lessons, e.g., by involving students to actually solve a scientific, technological, engineering, or mathematical, or Arts problem, would probably spark their interest in a STEAM career path. This is the theory behind STEAM education.
- By integrating STEAM content and real life learning experiences at different levels of the curriculum process (e.g., Curriculum frameworks, content standards, benchmarks, syllabi, teachers' guides and students' books, curriculum design and development, annual and term school programs and lesson plans, teaching methodologies.
- Teaching methodologies – Problem and project-based learning, partnerships with external stakeholders e.g., high education institutions, private sector, research and development institutions, and volunteer and community development organizations.
- They underpin STEM education. They are the main enablers of STEM education.
- The 21st century skills movement, which broadly calls on schools to create academic programs and learning experiences that equip students with the most essential and in-demand knowledge, skills, and dispositions they will need to be successful in higher-education programs and modern workplaces.
- The term 21st century skills refers to a broad set of knowledge, skills, work habits, and character traits that are believed - by educators, school reformers, college professors, employers, and others - to be critically important to success in today's world, particularly in collegiate programs and contemporary careers and workplaces.
- Generally speaking, 21st century skills can be applied in all academic subject areas, and in all educational, career, and civic settings throughout a student's life.
- The skills students will learn will reflect the specific demands that will be placed upon them in a complex, competitive, knowledge-based, information-age, technology-driven economy and society.

Appendix 2: The 21st Century Skills, Knowledge, Attitudes and Values

The following list provides a brief illustrative overview of the knowledge, skills, work habits, and character traits commonly associated with 21st century skills:

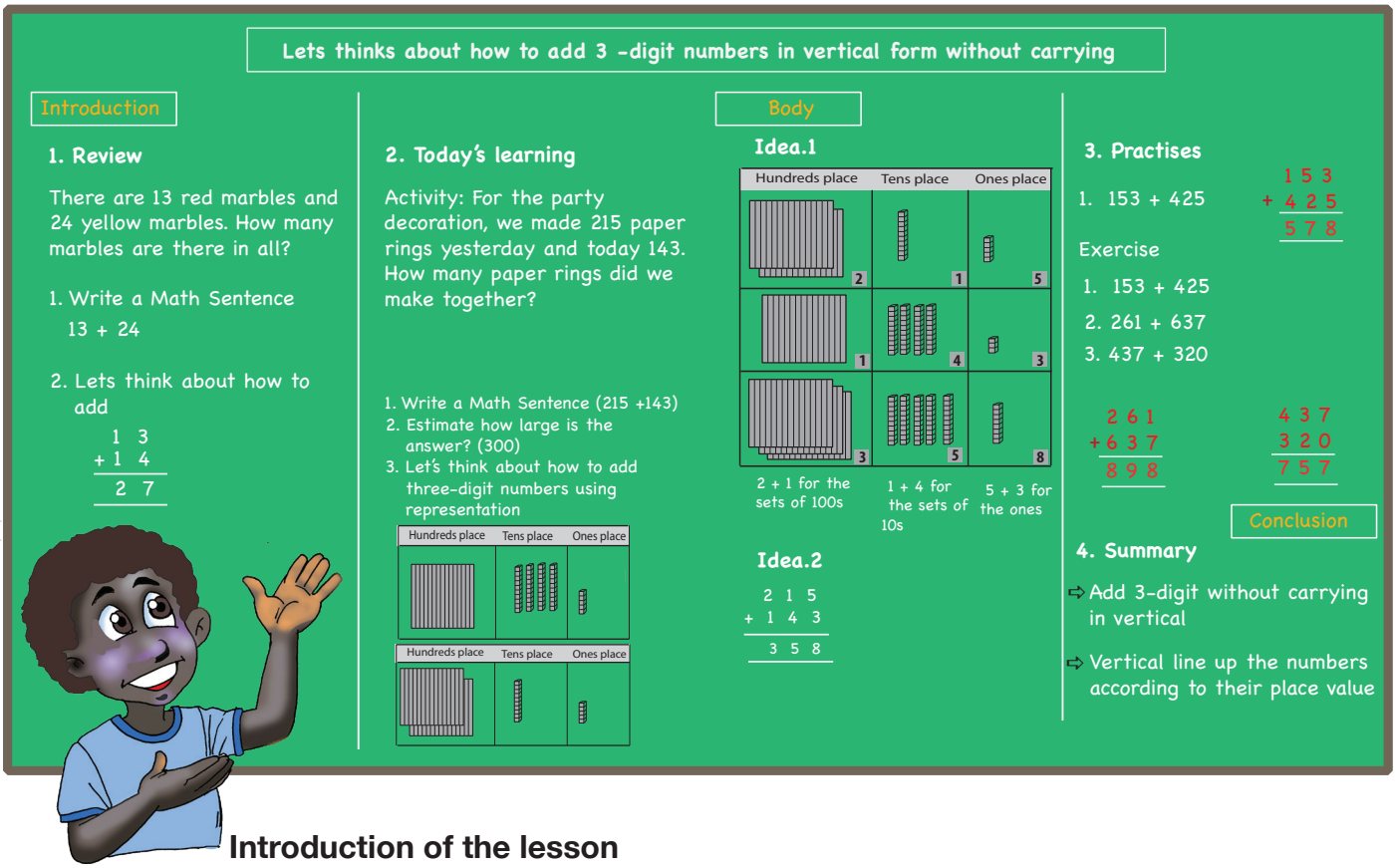
- Critical thinking, problem solving, reasoning, analysis, interpretation, synthesizing information
- Research skills and practices, interrogative questioning
- Creativity, artistry, curiosity, imagination, innovation, personal expression
- Perseverance, self-direction, planning, self-discipline, adaptability, initiative
- Oral and written communication, public speaking and presenting, listening
- Leadership, teamwork, collaboration, cooperation, facility in using virtual workspaces
- Information and communication technology (ICT) literacy, media and internet literacy, data interpretation and analysis, computer programming
- Civic, ethical, and social-justice literacy
- Economic and financial literacy, entrepreneurialism
- Global awareness, multicultural literacy, humanitarianism
- Scientific literacy and reasoning, the scientific method
- Environmental and conservation literacy, ecosystems understanding
- Health and wellness literacy, including nutrition, diet, exercise and public.

Appendix 3: The Blooms Taxonomy

BLOOM'S REVISED TAXONOMY

Remembering	Recalling information, Recognizing, listing, describing, retrieving, naming, finding. *E.g* How many ways can you travel from one place to another? List and draw all the ways you know. Describe one of the vehicles from your list, draw a diagram and label the parts. Collect "transport" pictures from magazines- make a poster with info.
Understanding	Explaining ideas or concepts, Interpreting, summarizing, paraphrasing, classifying, explaining. *E.g*. How do you get from school to home? Explain the method of travel and draw a map. Write a play about a form of modern transport. Explain how you felt the first time you rode a bicycle. Make your desk into a form of transport.
Applying	Using information in another familiar situation Implementing, carrying out, using, executing. *E.g* Explain why some vehicles are large and others small. Write a story about the uses of both. Read a story about "The Little Red Engine" and make up a play about it. Survey 10 other children to see what bikes they ride. Display on a chart or graph.
Analyzing	Breaking information into parts to explore understandings and relationships Comparing, organizing, de-constructing, interrogating, finding. *E.g* Make a jigsaw puzzle of children using bikes safely. What problems are there with modern forms of transport and their uses- write a report. Use a Venn Diagram to compare boats to planes, or helicopters to bicycles.
Evaluating	Justifying a decision or course of action, Checking, hypothesizing, critiquing, experimenting, judging. *E.g* What changes would you recommend to road rules to prevent traffic accidents? Debate whether we should be able to buy fuel at a cheaper rate. Rate transport from slow to fast etc..
Creating	Generating new ideas, products, or ways of viewing things, Designing, constructing, planning, producing, inventing *E.g* Invent a vehicle. Draw or construct it after careful planning. What sort of transport will there be in twenty years time? Discuss, write about it and report to the class. Write a song about traveling in different forms of transport.

Appendix. 4 - Sample Black board Plan



Introduction of the lesson

- Review
- If the lesson happens to be first lesson of a new unit or chapter. Should have an introductory activity related to establish new ASK-MT

Body of the lesson

- Today's learning activity based on lesson objective
- Practices

Conclusion of the lesson

- Summary

Appendix 5: Sample timetable

Here is the sample timetable for you to adopt and adjust to your need,

Start		End		Sessions	Minutes
8 : 00	~	8 :25	0:25	ASSEMBLY	25
8 : 25	~	9:05	0:40	1st Class	40
9 : 05	~	9:10	0:05	break	
9 : 10	~	9:50	0:40	2nd Class	40
9 : 50	~	10:25	0:45	RECESS BREAK	30
10 :25	~	11:05	0:20	3rd Class	40
11:05	~	11:10	0:45	break	
11:10	~	11:50	0:05	4th Class	40
11:50	~	12:20	0:45	LUNCH BREAK	30
12:20	~	13:00	1:00	5th Class	40
13:00	~	13:05	0:25	break	
13:05	~	13:45	0:45	6th Class	40
13:45	~	13:50	0:05	break	
13:50	~	14:30	0:45	7th Class	40
				Daily T/L Minutes	280
				Weekly T/L Minutes	1575
				T/L Minutes without Assembly	1350

Note: 5 minutes break in the above time table sample is the preparation time for students /teachers for the next lesson.

Appendix 6: Sample Assessment Task & Method

Name: **Class:** **Score:_____/100**

Strand: Geometrical Figures
Unit: Symmetry
Unit Test: Review on Symmetry
Task: Distinguish and identify symmetric figures with line symmetry and point symmetry

1. The figure below is point-symmetric. [4 × 10 points = 40 points]

(1) For locating the centre of symmetry, which pair of lines are appropriate to be drawn?

a: AC and CG

b: CH and DG

c: CG and DH

Answer:

(2) Write the part corresponding to;

a) Point A

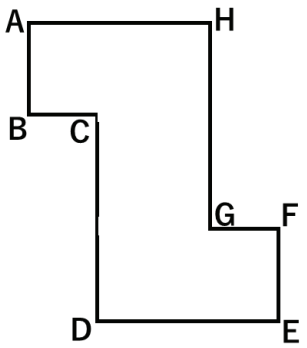
Answer:

b) Side DE

Answer:

(3) Let the centre of symmetry point I.
Find the side which is the same length as HI.

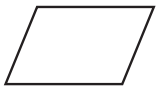
Answer:



2. Find all answers of the following questions about the figures below;

[3 × 20 points = 60 points]

(a) (b) (c)



(1) line symmetry figure. Answer :

(2) point-symmetric figure. Answer :

(3) figures with both features of line-symmetric and point-symmetric. Answer :

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