KURIKULUM STANDARD SEKOLAH MENENGAH

MATHEMATICS FORM 3

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Introduction

This Form 3 Mathematics Textbook is prepared based on *Kurikulum Standard Sekolah Menengah (KSSM)*. This book contains 9 chapters arranged systematically based on Form 3 Mathematics *Dokumen Standard Kurikulum dan Pentaksiran (DSKP)*.

At the beginning of each chapter, students are introduced to stimulating materials related to daily life to stimulate their thinking about the topic. In addition, Learning Standard and word list also give a visual summary about the chapter's content.

This book contains the following special features:

	Description
What will you learn?	Contains learning standard that students will learn in each chapter.
Why do you learn this chapter?	Applications of knowledge in this chapter in related career fields.
🛞 Exploring Era	History of ancient academy or original exploration of the chapter in Mathematics.
WORD B A N K	Word list contained in each chapter.
Individual In pairs In groups	Helps students to understand the basic mathematical concept via individual, pair or group activities.
BULLETIN	Gives additional information about the chapter learned.
	Questions that test students' capability to understand certain technique in each chapter.
	Grabs students' attention to additional facts that need to be reminded of, mistakes that students commonly make, and carelessness to be avoided.
TIPS	Exposes students to additional knowledge that they need to know.
SMART MIND	Presents mind-stimulating questions for enhancement of students' critical and creative thinking.



	Description
	Exposes students to the use of technological tools in the learning of mathematics.
	Develops communication skills mathematically.
FLASHBACK	Helps students to remember what they have learnt.
SMART FINGER	Shows the use of scientific calculators in calculations.
000000	Enables students to carry out assignments and then present their completed work in class.
	Test students' understanding on the concepts they have learnt.
4	Indicates HOTS questions to help in developing students' higher order thinking skills.
Dynamic Challenge 🙀	Prepares more diversified exercises which incorporate the elements of LOTS, HOTS, TIMSS and PISA assessment.
	Enables students to scan QR Code using mobile device.
	Covers applicable concepts of digital tool calculators, hands on activities and games that aim to provides additional activities to effectively enhance students' understanding.
CONCEPT MAP	Overall chapter summary that students learnt.
(SELF-REFLECT)	Looks back whether students have achieved the learning standard.
Checking Answers	Checks answers with alternative methods.
STEMA	Activities with elements of Science, Technology, Engineering and Mathematics.



Symbols and Formulae

SYMBOLS

	root	≥	is more than or equal to
π	pi	<	is less than
a:b	ratio of <i>a</i> to <i>b</i>	≤	is less than or equal to
$A \times 10^{n}$	standard form where	Δ	triangle
	$1 \le A < 10$ and <i>n</i> is an integer		angle
=	is equal to	0	degree
\approx	is approximately equal to	'	minute
¥	is not equal to	"	second
>	is more than		
		1	

FORMULAE





http://bukutekskssm. my/Mathematics/F3/ Index.html Download the free *QR Code* scanner to your mobile devices. Scan *QR Code* or visit the website http://bukutekskssm.my/Mathematics/F3/Index.html to download files for brainstorming. Then, save the downloaded file for offline use.

Note: Students can download free *GeoGebra and Geometer's Sketchpad* (*GSP*) software to open related files.



CHAPTER Scale Drawings



Scale Drawings

Why do you learn this chapter?

- Scale drawings are used to give an idea of object measurements or actual distances.
- Scale drawings are frequently used in architecture, engineering, photography, technological design, and so on.

Housing developers usually prepare models of the housing scheme they are going to build. These models give the buyers an idea of the housing zone and other facilities provided by the developer.

Also, the plans of the houses to be built are drawn using a certain scale with measurements being in proportion to the actual measurements of the houses. These plan drawings allow buyers to choose the type of house to buy based on house size, facilities and also needs and affordability. Have you ever seen your house plan?









😩 Exploring Era

Angkor Wat in Cambodia is one of the famous monuments in Southeast Asia. It was built by Suryavarman II after his victory over Champa and subsequently uniting Kampuchea. This monument symbolises the strength and sovereignty of Suryavarman II's government. Its height is 213 metres and its area is 208 hectares. The altar is at the centre. It has four storeys with every corner having walls measuring 850 metres wide and 1000 metres long built from laterite and sandstones found outside. Carvings depicting stories from the epic Ramayana and Mahabharata decorate the walls.



http://bukutekskssm.my/Mathematics/F3/ ExploringEraChapter4.pdf

WORD B A N K

- original
- geometrical shape
- degree
- grid
- sketch
- object
- size
- scale

- asal
- bentuk geometri
- darjah
- grid
- lakar
- objek
- saiz
- skala



4.1 Scale Drawings

proportional to the actual distance.



What is the relationship between the actual measurements

Do you know that the maps found in navigation software are drawn to

and the measurements of various sizes of drawings of an object?

The distance between two towns shown in the software is

LEARNING STANDARD

Investigate and explain the relationship between the actual measurements and the measurements of various sizes of drawings of an object, and hence explain the meaning of scale drawing.

For example, in the picture above, the distance between Johor Bahru and Kuala Lumpur is shown using a scale of 1 cm : 50 km.

Example / 1

a certain scale?

The diagram below shows the drawings representing object PQRST drawn to different sizes.



What can you say about the size of Diagram 1, Diagram 2 and Diagram 3 compared to object *PQRST*?

Solution:

- Diagram 1: Lengths of all sides and sizes of all angles are the same as object.
- Diagram 2: Lengths of all sides reduced by a certain proportion compared to object but sizes of all angles unchanged.
- Diagram 3: Lengths of all sides increased by a certain proportion compared to object but sizes of all angles unchanged.

In conclusion, all sides of Diagram 1, Diagram 2 and Diagram 3 follow a certain scale that is proportional to the object whereas angle size remains unchanged. Therefore, Diagram 1, Diagram 2 and Diagram 3 are scale drawings of object *PQRST*.



LEARNING STANDARD

Interpret the scale of a

scale drawing.

Scale drawing is the drawing of an object with all measurements in the drawing proportional to the measurements of the object.

MIND TEST 4.1a

1. The diagram below shows drawings representing object ABCDE drawn to different sizes.



State the diagram which is the scale drawing of object *ABCDE*.

2. Using grid paper, draw all the shapes below using (a) the same size (b) smaller size (c) bigger size



The scale used to draw a scale drawing depends on the ratio of measurement of scale drawing to measurement of object, which is

Scale = $\frac{\text{Measurement of scale drawing}}{\text{Measurement of object}}$

This ratio can also be written in the form;

Measurement of scale drawing : Measurement of object

Usually, for scale drawings, we use scale in the form of ratio.



1: n means one unit on the scale drawing will represent n units on the object.



Brainstorming 1 In pairs A Interpret the scale of a scale drawing. Aim: **Steps:** 1. Study the diagrams below. R R P'Q'Diagram 3 P Object Q R' *P'[∎]Q'* Diagram 4 P'P'Diagram 2 Q' $P'_{\text{Diagram 5}}Q'$ Р \mathcal{Q}' Diagram 1

2. Complete the table below based on the diagrams above.

Diagram	Scale drawing		Object		Scale	
Diagram	Side	Length (unit)	Side	Length (unit)	Ratio	1 : <i>n</i>
Diagram 1	P'Q'	12	PQ	4	12 : 4	$1:\frac{1}{3}$
	P'R'	24	PR	8	24:8	$1:\frac{1}{3}$
Diagram 2	P'Q'		PQ			
	P'R'		PR			
Diagram 3	P'Q'		PQ			
	P'R'		PR			
Diagram 4	P'Q'		PQ			
	P'R'		PR			
Diagram 5	P'Q'		PQ			
	P'R'		PR			

Discussion:

Discuss the results based on the table above.



From Brainstorming 1, it is found that;

- If n < 1, then the size of the scale drawing is bigger than the size of the object.
- If n > 1, then the size of the scale drawing is smaller than the size of the object.
- If n = 1, then the size of the scale drawing is the same as the size of the object.
- 11 *n* 1, then the size of the scale drawing is the same as the size of the oc





EARNING

Determine the scales, measurements of objects or measurements of scale drawings.

Example / 2

The diagram below shows object *PQRS* and scale drawing P'Q'R'S' drawn on a grid of equal squares. State the scale used in the form 1:n.



Solution:



Example / 3

The diagram below shows object *KLM* and scale drawing K'L'M' drawn on a grid of equal squares. State the scale used in the form 1: n.





Example 4

The diagram below shows object PQR and scale drawing P'Q'R' drawn on a grid of equal squares of different sizes. Determine the scale used in the form 1:n.



Example 5

The diagram below shows object *KLMN* and scale drawing K'L'M'N' drawn on a grid of equal squares of different sizes. Determine the scale used.









Solution:



Example/6

A map is drawn to a scale of 1 : 300 000. Calculate the actual length, in km, of a river that is 3 cm long on the map.

Solution:



Example 7

The map of Johor is drawn to a scale of 1 cm to 10 km. Calculate the actual distance between Kluang and Ayer Hitam if the distance on the map is 2 cm.

Solution:





Example / 8

Khairul draws a square to a scale of $1:\frac{1}{3}$. If the actual length of sides of the square is 6 cm, what is the length of sides, in cm, of the scale drawing?

Solution:



MIND TEST 4.1b

1. Determine the scale used for each scale drawing below in the form 1: n.





LEARNING

objects and vice versa.

STANDARD
Draw the scale drawings of

- 2. A poster has a length of 24 cm and a width of 8 cm. Calculate the length and width of the scale drawing of the poster, in cm, that is drawn to a scale of 1 : 4.
- **3.** A map is drawn to a scale of 1 : 400 000. What is the actual length, in km, of a river with a length of 2.5 cm on the map?
- 4. Siew Lin draws a right-angled triangle to a scale of $1:\frac{1}{3}$. If the hypotenuse of the scale drawing is 18 cm, calculate the length of the hypotenuse of the original triangle.

How do you draw the scale drawings of objects and vice versa?

Drawing the scale drawing of an object.

There are three ways to draw the scale drawing of an object.

- (a) Use grid paper of the same size for different scales or;
- (b) Use grid paper of different sizes or;
- (c) Draw on a blank paper according to the given scale.

Example 9

Draw the scale drawing of shape PQRS on a grid of equal squares using a scale

S'

P'

of $1 : \frac{1}{2}$

Solution:

The scale given is $1:\frac{1}{2}$. Therefore, every

side of the scale drawing is two times longer than the length of sides of object *PQRS*.



QULZ If you have to draw the scale drawing of your school field, what is the suitable scale to be used? Why?

Example/10

- (a) Diagram $\triangle PQR$ is drawn on a grid of 1 cm \times 1 cm. Redraw $\triangle PQR$ on grid paper with dimensions
 - (i) $1.5 \text{ cm} \times 1.5 \text{ cm}$
 - (ii) $0.5 \text{ cm} \times 0.5 \text{ cm}$
- (b) Calculate the scale used in (a)(i) and (a)(ii) in the form 1 : n.



R'

Q'





CHAPTER

For objects with given angles, the angles of the scale drawing must be accurately drawn and the lengths of sides are drawn to scale.

B Drawing the objects for a scale drawing.

Example/12

The diagram shows a scale drawing drawn on a grid of equal squares to a scale of 1:2. Draw the actual object for P'Q'R'S'T'.



Scan the QR Code or visit http://bukutekskssm. my/Mathematics/F3/ Chapter4Grid.pdf to download grid paper of various sizes.





Solution:



The scale used is 1 : 2, that is the size of scale drawing is two times smaller than the object. Therefore, every side of actual object is two times longer than the sides of scale drawing.

Example/13

The diagram shows the scale drawing of a flower drawn on $1 \text{ cm} \times 1 \text{ cm}$ grids. Draw the actual object on grids of

- (a) $0.5 \text{ cm} \times 0.5 \text{ cm}$
- (b) $1.5 \text{ cm} \times 1.5 \text{ cm}$



Solution:

Object must be drawn on grids of different sizes. Thus, the number of units of sides of object is the same as the number of units of sides of scale drawing.







MIND TEST 4.1c

- (b) (a)
- 1. Draw the scale drawing of each object below to a scale of $1:\frac{1}{2}$ and 1:3.

- 2. (a) The object in the diagram is drawn on $1 \text{ cm} \times 1 \text{ cm}$ grid paper. Redraw the shape of the object on a grid paper of
 - (i) $2 \text{ cm} \times 2 \text{ cm}$
 - (ii) $0.5 \text{ cm} \times 0.5 \text{ cm}$
 - (b) Calculate the scale used in (a)(i) and (a)(ii).



- 3. Draw the scale drawing of the following shapes to the given scale.
 - (a) Scale 1:3
- (b) Scale 1:200





- (c) Scale 1 : $\frac{1}{2}$ 4 cm 2 cm
- 4. The diagram shows the scale drawing of a composite shape that is drawn on a grid of equal squares to a scale of $1:\frac{1}{2}$. Draw the actual object for the shape.





LEARNING

STANDARD

scale drawings.

How do you solve problems involving scale drawings?

Example/14

The distance on a map between Bintulu and Miri is 4 cm.

- (a) If the scale used to draw the map is 1 cm : 50 km, calculate the actual distance, in km, between Bintulu and Miri.
- (b) If the map is redrawn to a scale of 1 : 2 000 000, calculate the distance between Bintulu and Miri on the new map. **TIP** 2
- (c) Mr Dominic Lajawa and family wants to visit Miri. If he plans to drive to Miri at a speed of 80 kmh⁻¹, calculate the time taken to drive from Bintulu to Miri in hours and minutes.

If the scale of scale drawing and requirement of question are in the same unit, the scale need not be changed to cm.

Solution:

Understanding the problem

- Actual distance for 4 cm drawn to scale of 1 cm : 50 km.
- Distance on scale drawing drawn to scale of 1 : 2 000 000.
- Time in hours and minutes for journey from Bintulu to Miri at speed of 80 kmh⁻¹.

Planning a strategy

 $Scale = \frac{Distance on drawing}{Actual distance}$

 $Time = \frac{Distance}{Speed}$

Making a conclusion

- Actual distance between Bintulu and Miri is 200 km.
- Distance between Bintulu and Miri on the map of scale of 1 : 2 000 000.
- Time taken for Mr Dominic Lajawa to drive from Bintulu to Miri at a speed of 80 kmh⁻¹ is 2 hours 30 minutes.

Implementing the strategy

(a) Scale =
$$\frac{\text{Distance on drawing}}{\text{Actual distance}}$$

 $\frac{1}{50 \text{ km}} = \frac{4 \text{ cm}}{\text{Actual distance}}$
Actual distance = $\frac{4 \text{ cm} (50 \text{ km})}{1 \text{ cm}}$
Actual distance = 200 km
(b) Scale = $\frac{\text{Distance on drawing}}{\text{Actual distance}}$
 $\frac{1}{2 000 000} = \frac{\text{Distance on drawing}}{200 \text{ km}}$
Distance on drawing = $\frac{(200 \times 100 000) \text{ cm}}{(2 000 000) \text{ cm}}$
Distance on scale drawing = 10 cm
(c) Time = $\frac{\text{Distance}}{\text{Speed}}$
 $= \frac{200 \text{ km}}{80 \text{ kmh}^{-1}}$
 $= 2.5 \text{ hours}$
Time taken
 $= 2 \text{ hours 30 minutes}$
 $\mathbf{FLASHBACK}$



MIND TEST 4.1d

1. The diagram shows a right-angled triangle. A scale drawing of the triangle is drawn to a scale of $1 : \frac{1}{3}$. Calculate the area, in cm², of the scale drawing.



2. The diagram shows a room in the shape of a rectangle. Calculate the perimeter, in cm, of the scale drawing of the room which is drawn to a scale of 1 : 50.



- 3. The measurements of a rectangular room on a scale drawing are 7 cm \times 5 cm. If the scale used is 1 : 400, calculate the actual area of the room in m².
- 4. A regular polygon with exterior angle of 36° is redrawn using a scale of 1 : 5. If the actual length of sides of the regular polygon is 10 cm, calculate the perimeter of the scale drawing of the regular polygon.



CHAPTER



The diagram above shows a scale drawing of a rectangular field.

- (a) If the scale used is 1 : 2 000, calculate the actual area of the field in square metres.
- (b) Mr Dany cuts the grass on the field at a rate of 400 square metres in 8 minutes. Calculate the time, in hours and minutes, that Mr Dany takes to cut all the grass on the field.



Dynamic Challenge 🙀

Test Yourself

1. The diagram below shows triangle P which is the scale drawing of triangle Q with a scale of 1:n. Calculate the value of n.





2. The diagram below shows five rectangles.



- (a) Among rectangles I, II, III and IV, which are the scale drawings of rectangle *S* drawn to a certain scale?
- (b) For each answer in (a), determine the scale used.
- (c) (i) Calculate the area of each rectangle, in cm^2 , for your answer in (a).
 - (ii) Determine the ratio of area of S to area of each answer in (c)(i).What are your conclusions about the ratios obtained?
- **3.** The diagram shows a scale drawing of a circle with centre O and triangle *PQR*. Given that diameter of circle is 6 cm and the scale of the drawing is 1 : 3.
 - (a) Calculate the actual length of *PR* in cm. State your answer correct to 3 significant figures.
 - (b) Using your answer in (a), calculate the actual area of the shaded region in cm². State the answer correct to 4 significant figures.









The distance by air from Kuching to Kota Kinabalu on a map is 5.4 cm. Given the scale of the map is 1 cm : 150 km. If an aeroplane takes off from Kuching International Airport at 1240 hours and lands at Kota Kinabalu International Airport at 1410 hours, calculate the average speed of the aeroplane in kmh⁻¹.

- CHAPTER
- 2. The diagram shows the scale drawing of Puan Farah's living room. The scale of the drawing is 1 : 50. Puan Farah wants to lay tiles throughout the entire living room. She intends to use tiles measuring 30 cm × 30 cm which cost RM2.80 a piece. Puan Farah's husband suggests to use tiles of 50 cm × 50 cm at RM6 a piece. Which tile should Puan Farah choose if she wants to save money? State the reason for your answer.
- **3.** The diagram shows the scale drawing of a rectangular farm owned by Pak Hassan. Given the scale of the drawing is 1 : 2 000.
 - (a) Calculate the actual area of the freshwater fish pond to the nearest square metre. $\left[\pi = \frac{22}{7}\right].$
 - (b) Calculate the ratio of the area planted with durian trees to the area planted with banana trees.
 - (c) Calculate the area, in m^2 , of the vacant land.
 - (d) Pak Hassan wants to fence up his farm. If the cost of one metre of fencing is RM5.50, calculate the total cost of fencing, in RM.







Self Mastery

- 1. The diagram shows the scale drawing of the floor plan of a shophouse that is drawn to a scale of 1 : 400.
 - (a) Calculate the actual area of the storeroom, in m^2 .
 - (b) State the ratio of the area of the shophouse to the area of the storeroom.
 - (c) If the actual height of the shophouse is 3.75 m, calculate the volume, in m³, of the three-dimensional shophouse.



Diagram 1 shows the scale drawing of a rectangular football field.

- (a) If this scale drawing is drawn to a scale of 1 : 1 000, calculate the actual area, in m², of the football field.
- (b) Sharon wants to redraw the scale drawing in Diagram 1 on a piece of A4-sized paper. What is the maximum scale that Sharon can choose? State the reasons for your answer.
- (c) Several canopies will be set up on the football field as in Diagram 2 for a carnival.
 - (i) If the dimensions of the base of a tent are $5 \text{ m} \times 4 \text{ m}$, calculate the maximum number of tents that can be erected.
 - (ii) The rent for a tent is RM100 a day. A 25% discount will be given if the tent is rented for five days or more. Calculate the total rent, in RM, if the carnival lasts for one week.







DBODBCD

Draw the map of the district where you live using a suitable scale. You can mark the location of your house, school and interesting places in your district using symbols or suitable illustrations. Exhibit your project in the classroom.







SELF-REFLECT

At the end of this chapter, I can:

- 1. Investigate and explain the relationship between the actual measurements and the measurements of various sizes of drawings of an object, and hence explain the meaning of scale drawing.
- 2. Interpret the scale of a scale drawing.
- 3. Determine the scales, measurements of objects or measurements of scale drawings.
- 4. Draw the scale drawings of objects and vice versa.
- 5. Solve problems involving scale drawings.

EXPLORING MATHEMATICS

- 1. Download grid paper of various sizes.
- 2. Draw your favourite object as shown in Diagram 1 or Diagram 2 on one of the grid papers chosen.





Scan the QR Code or visit http://bukutekskssm. my/Mathematics/F3/ Chapter4Grid.pdf to download grid paper of various sizes.

- 3. Redraw the drawing on all the grid papers of different sizes.
- 4. Can you easily draw your favourite object on grids of different sizes?
- 5. Exhibit your work at the mathematics corner of your classroom.

