Perimeter and Area

What will you learn?

- Perimeter
- Area of Triangles, Parallelograms, Kites and Trapeziums
- Relationship between Perimeter and Area

Why study this chapter?

Perimeter and area are essentially basic knowledge of geometry and its related fields, hence they are widely used in agriculture, landscape and graphic designs. Discuss other fields that use perimeter and area.

Kedah is well known as *Jelapang Padi Malaysia* because almost the entire western part of the state is covered with paddy fields. Besides being the main rice producer in Malaysia, the scenery of the vast paddy fields is also one of the main attractions in Kedah.

Rhind Papyrus

The word 'perimeter' is derived from the Greek word 'peri' which means 'around' and 'meter' which means 'measure'. Notes regarding the concept of area were found in a mathematical document named Rhind Papyrus around 1650 B.C. in Egypt. In this document, a mistake in the formula for finding the area of quadrilaterals was noted. However, the formula is still valid for finding the areas of certain geometric shapes.

For more information:

https://goo.gl/9QTPb0

Word Link

• conjecture	• konjektur
• width	• lebar
• kite	• lelayang
• area	• luas
• length	• panjang
• perimeter	• perimeter
• formula	• rumus
• square	• segi empat sama
• parallelogram	• segi empat selari
• rectangle	• segi empat tepat
• triangle	• segi tiga
• height	• tinggi
• trapezium	• trapezium
• square unit	• unit persegi

Open the folder downloaded from page vii for the audio of Word Link.

Do you know the total area of all the paddy fields in Kedah? What is the perimeter of each paddy field?

10.1 Perimeter

▶ How do you determine the perimeter?

Perimeter is the total length around an enclosed area. For example, we can determine the perimeter of various shapes of swimming pools by finding the total length of all the sides of the swimming pool.

Photo (a)

Photo (b)

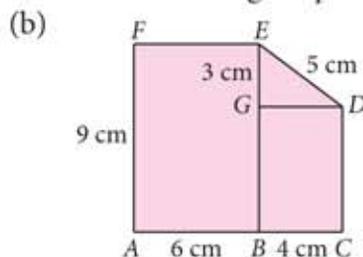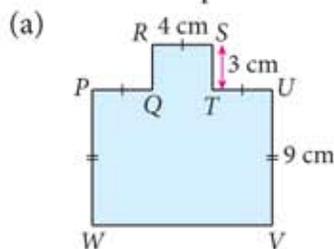How do you measure the length of a curved swimming pool in Photo (b)?

Example 1

Determine the perimeter of each of the following shapes.

(a)

(b)

Solution

(a) Perimeter $= PQ + QR + RS + ST + TU + UV + VW + WP$
$= 4 + 3 + 4 + 3 + 4 + 9 + 12 + 9$
$= 48$ cm

$VW = PQ + RS + TU$
$= 4 + 4 + 4$
$= 12$ cm

(b) Perimeter $= AB + BC + CD + DE + EF + FA$
$= 6 + 4 + 6 + 5 + 6 + 9$
$= 36$ cm

$CD = AF - GE$
$= 9 - 3$
$= 6$ cm

Example 2
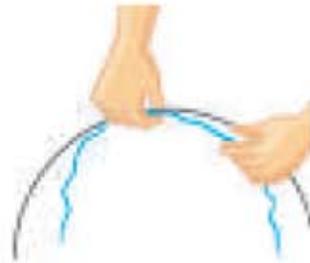
Measure the perimeter of the object in the diagram below.

Solution
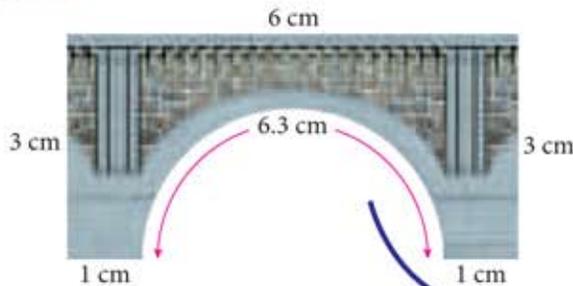
Perimeter $= 1 + 3 + 6 + 3 + 1 + 6.3$
$\qquad = 20.3$ cm

Measure the length of the curve by using a thread.

1. Determine the perimeter of each of the following shapes.

(a)
6 cm

5 cm

20 cm

(b)
11 cm   10 cm

6 cm   14 cm

(c)
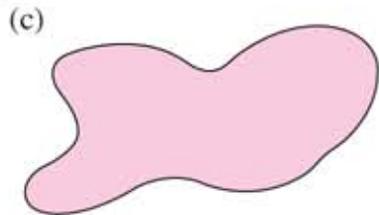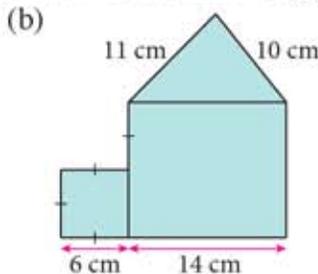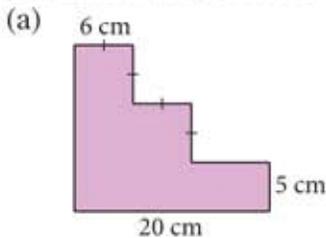
▶ **How do you estimate the perimeter accurately?**

We can use a square grid paper or a graph paper to estimate the perimeter of a shape.

LEARNING STANDARDS

Estimate the perimeter of various shapes, and then evaluate the accuracy of estimation by comparing with the measured value.

Exploration Activity 1 *Pair*

Aim: To estimate the perimeter of various shapes.
Instruction: Perform the activity in pairs.

1. Trace the shape of the object on a grid of equal squares with sides of 1 cm.
2. Estimate the perimeter of each shape based on the grid.
3. Measure the perimeter of each shape using a ruler or a thread.
4. Record your estimation and measurement.
5. Compare the estimated value with the measured value to evaluate the accuracy of your estimation.

Guru: Membina Ilmu Menyempurnakan Akhlak

The accuracy of estimated perimeter can be evaluated by comparing the estimated value with the measured value. The smaller the difference between the values of estimated perimeter and measured perimeter, the more precise the estimated value.

Let's Discuss

Besides using grid paper or graph paper, discuss other methods which can be used to estimate the perimeter of a shape.
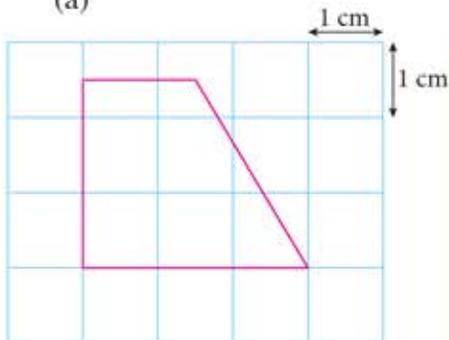
Did You Know

Percentage error

$$= \frac{\text{Difference between estimated value and actual value}}{\text{Actual value}} \times 100\%$$

The smaller the percentage error, the more precise the estimated value.
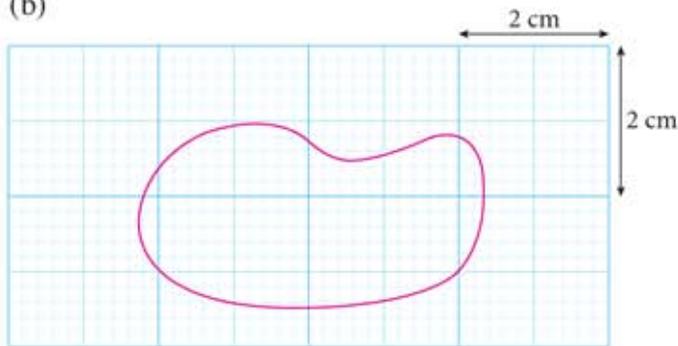
Self Practice 10.1b

1. Estimate the perimeter of each of the following shapes. Hence, measure the perimeter of the shape by using a ruler or a thread to evaluate the accuracy of estimation.

(a)

(b)

▶ How do you solve problems?

MATHEMATICS APPLICATION TASK

LEARNING STANDARDS

Solve problems involving perimeter.

The diagram shows the parking area in front of a shopping mall. The shopping mall management intends to fence up the entire parking area, except the main entrance and another side entrance. If the cost of fencing is RM80 per metre, what will be the cost incurred by the shopping mall?
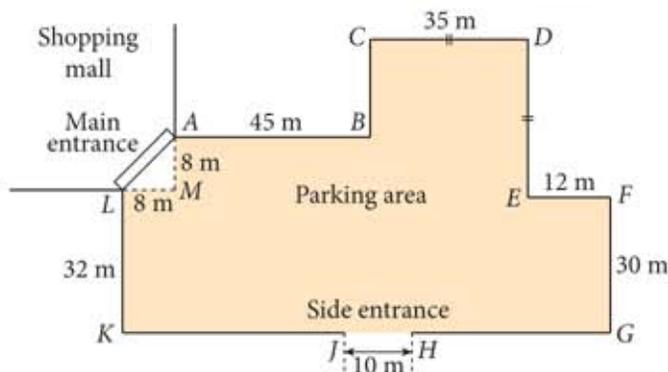
Solution

Total length of the parking area to be fenced up
$= (AB + BC + CD + DE + EF + FG + GK + KL) - HJ$
$= (45 + 25 + 35 + 35 + 12 + 30 + 100 + 32) - 10$
$= 314 - 10$
$= 304$ m

Total cost to fence up the parking area
$= 304 \times$ RM80 ← Total length of fence × RM80
$=$ RM24 320

$BC = DE + FG - (AM + LK)$
$= (35 + 30) - (8 + 32)$
$= 25$ m

$GK = LM + AB + CD + EF$
$= 8 + 45 + 35 + 12$
$= 100$ m
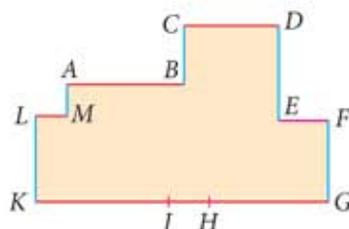
Alternative Method

Perimeter of the enclosed parking area
$= 2 \times [(LM + AB + CD + EF) + (DE + FG)]$
$= 2 \times [(8 + 45 + 35 + 12) + (35 + 30)]$
$= 2 \times (100 + 65)$
$= 2 \times 165$
$= 330$ m

Total length of the parking area to be fenced up
$= 330 - HJ - LM - MA$
$= 330 - 10 - 8 - 8$
$= 304$ m

$KG = LM + AB + CD + EF$
$CB + AM + LK = DE + FG$

Self Practice 10.1c

1. The diagram shows the plan of a swimming pool. What is the perimeter of the swimming pool?

20 m, 5 m, 13 m

2. The diagram shows the plan of Encik Yahya's house. Encik Yahya wants to install colorful LED lights around his house as decorations to celebrate *Hari Raya*. Calculate the installation cost if the cost to install LED lights is RM20 per metre.

8 m, 10 m, 25 m

3. In the diagram, *ABC* is an equilateral triangle, *BCFG* is a square and *CDEF* is a rectangle. The perimeter of the whole diagram is 65 cm, find the length of *GE*.

7 cm
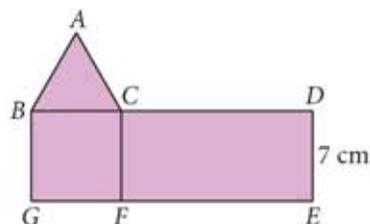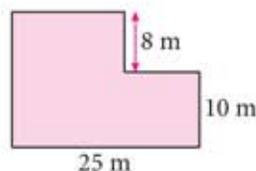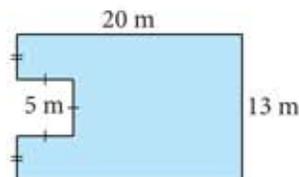
1. The perimeter of a rectangular laboratory is 64 m. If the length of the laboratory is 23 m, find the width of the laboratory.
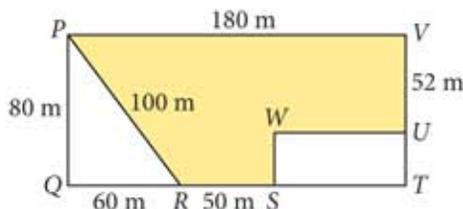
2.
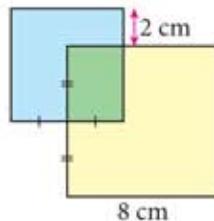
The diagram shows two squares overlapping each other. Calculate the perimeter of the whole diagram.

3.

The diagram shows two shapes, *A* and *B*. Prove that both of the shapes have equal perimeter.

4.

The diagram shows a piece of rectangular land *PQTV* owned by Mr Rhuben. Parts of the land in the shapes of triangle *PQR* and rectangle *STUW* have been given to his brother. Mr Rhuben plans to fence up his land. What is the cost of fencing if each metre of fence costs RM50?

5. A wire with a length of 54 cm is bent to form a shape as shown in the diagram. What is the length of side *AB*?
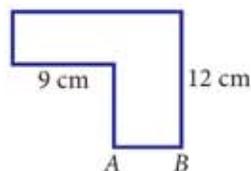
10.2 Area of Triangles, Parallelograms, Kites and Trapeziums

▶ **How do you estimate the area of various shapes?**

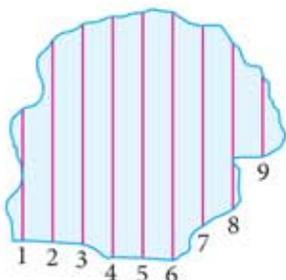Various methods can be used to estimate the area of an irregular shape.

(i) Using a grid with equal squares of sides 1 unit

Number of full 1 unit² squares (✓) = 44
Number of half full or more than
half full squares (✗) = 10
Hence, the area of the shape is about 44 + 10 = 54 unit².

(ii) Drawing lines 1 unit apart

The lines are 1 unit apart from each other. Hence, we can assume one line as a rectangle with a width of 1 unit.

Line	1	2	3	4	5	6	7	8	9
Length (unit)	4.4	6.6	7.2	7.8	8.0	8.0	6.4	5.4	2.6
Area (unit²) = Length × 1 unit	4.4	6.6	7.2	7.8	8.0	8.0	6.4	5.4	2.6

Total area = 4.4 + 6.6 + 7.2 + 7.8 + 8.0 + 8.0 + 6.4 + 5.4 + 2.6
= 56.4 unit²

Hence, the area of the shape is approximately 56.4 unit².

Self Practice **10.2a**

1. Collect some leaves from your school compound. Sketch the shape of each leaf on a piece of paper. Then estimate the area of each leaf in cm², using suitable methods.

Exploration Activity 2 *Group*

Aim: To derive the formula for the area of triangles.
Instruction: Perform the activity in groups of four.

1. Referring to Diagram (a) as shown,
   (a) is the area of △*ABD* the same as the area of △*BCD*?
   (b) state the area of rectangle *ABCD* in terms of *a* and *b*.
   (c) hence, state the area of △*ABD* in terms of *a* and *b*.

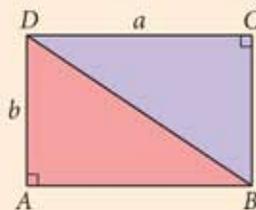*Diagram (a)*

2. Referring to Diagram (b) as shown,
   (a) state the area of △*BFE* in terms of *b* and *c* based on rectangle *BFEC*.
   (b) state the area of △*AFE* in terms of *b* and *d* based on rectangle *AFED*.

Diagram (b)

   (c) the area of △*ABE* = ⬜ + ⬜

$$= \frac{1}{2}b \left(\boxed{} \right) \leftarrow$$ Distributive law

$$= \boxed{}$$
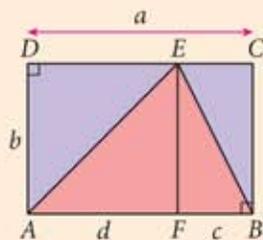
3. Referring to Diagram (c) as shown,
   (a) what is the length of *DE* in terms of *a* and *c*?
   (b) state the area of △*AFE* in terms of *a*, *b* and *c* based on rectangle *AFED*.
   (c) state the area of △*BFE* in terms of *b* and *c* based on rectangle *BFEC*.
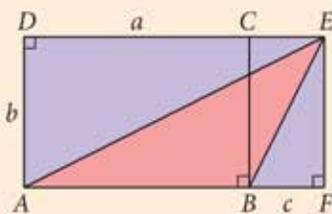
Diagram (c)

   (d) hence the area of △*ABE* = area of △*AFE* − area of △*BFE*

$$= \frac{1}{2}b \left(\boxed{} \right) - \boxed{}$$

$$= \frac{1}{2}ba + \boxed{} - \boxed{}$$

Distributive law

4. Discuss with your friends your findings.
   (a) Compare the results of the area obtained in Steps **1, 2** and **3**. What can you conclude?
   (b) What is the general formula to calculate the area of a triangle?

5. State all the conclusions that can be made.

From the results of Exploration Activity 2, it is found that
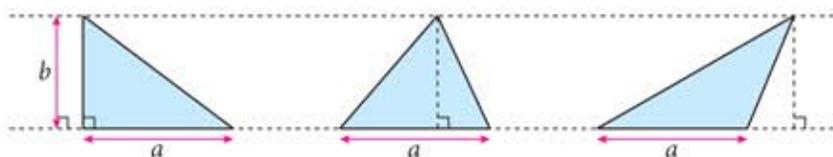
the area of a triangle with the length of base a and height b is calculated by

$$\text{area of triangle} = \frac{1}{2}ab$$

In general, **the area of a triangle** $= \dfrac{1}{2} \times$ **length of base $\times$ height**

> Base and height are always at a right angle.

Exploration Activity 3

Aim: To derive the formula for the area of parallelograms.
Instruction: Perform the activity in groups of four.
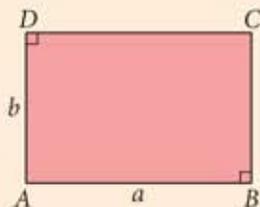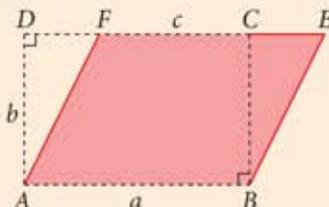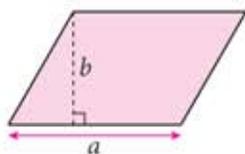

Diagram (a)   Diagram (b)

1. Diagram (a) shows a rectangle $ABCD$ with length of base a and height b. Referring to Diagram (a), state the area of $ABCD$ in terms of a and b.

2. Diagram (b) shows a parallelogram $ABEF$ with the length of base a and height b. Referring to Diagram (b),
   (a) state the length of CE in terms of a and c based on the properties of parallelogram.
   (b) state the length of DF in terms of a and c.
   (c) explain your findings.

3. (a) What can you conclude about the area of triangle *BCE* and triangle *ADF*?
   (b) Is the area of *ABCD* the same as the area of *ABEF*?
   (c) Hence, state the area of the parallelogram *ABEF* in terms of *a* and *b*.

4. Discuss with your friends and state the conclusions that can be made.

From the results of Exploration Activity 3, it is found that the area of a parallelogram with the length of base *a* and height *b* is calculated by


area of parallelogram = *ab*

In general, **the area of a parallelogram = length of base × height**

Exploration Activity 4

Aim: To derive the formula for the area of kites.
**Instruction:** Perform the activity in groups of four.

1. The diagram shows a kite inscribed in a rectangle with measurements *a* and *b*. Referring to the diagram, discuss with your friends and complete the following table.
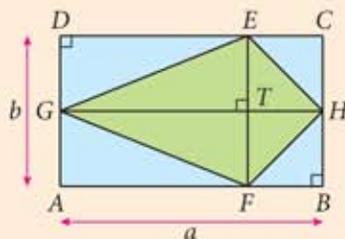
Area of △EHT	$= \frac{1}{2} \times$ area of rectangle *ECHT*
Area of △ETG	$= \frac{1}{2} \times$ area of rectangle ☐
Area of △EHG	$=$ ☐ $\times$ area of rectangle ☐
Area of △FHG	$=$ ☐ $\times$ ☐
Area of kite EHFG	$=$ ☐ $\times$ ☐

2. Discuss with your friends and state the conclusions that can be made.

From the results of Exploration Activity 4, it is found that the area of a kite with diagonals of lengths a and b is calculated by
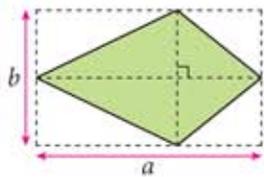
area of kite $= \dfrac{1}{2}ab$

In general,

the area of a kite $= \dfrac{1}{2} \times$ product of the lengths of the two diagonals

Exploration Activity 5 Group

Aim: To derive the formula for the area of trapeziums.
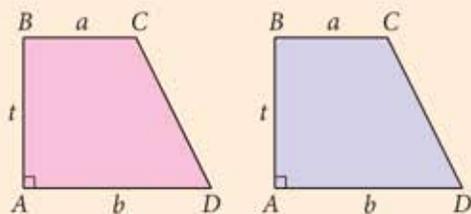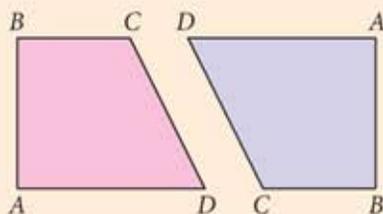**Instruction:** Perform the activity in groups of four.

Diagram (a)

Diagram (b)

1. Draw two identical trapeziums on a piece of manila card and cut out both the trapeziums. Then, record the measurements of the trapeziums as shown in Diagram (a).

2. Rotate one of the trapeziums to a suitable position so that it can be joined to the other trapezium, as shown in Diagram (b).

3. (a) What is the shape obtained when two trapeziums are joined together?
   (b) What is the length of the base of the combined shape?
   (c) State the area of the combined shape in terms of a, b and t.
   (d) Hence, state the area of one trapezium.

4. Discuss with your friends and state the conclusions that can be made.

From the results of Exploration Activity 5, it is found that the area of a trapezium with lengths of two parallel sides a and b respectively and height t is calculated by
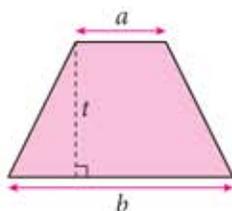
area of trapezium $= \dfrac{1}{2}(a + b)t$

In general,

the area of a trapezium $= \dfrac{1}{2} \times \left(\begin{array}{c} \text{sum of the} \\ \text{lengths of the two} \\ \text{parallel sides} \end{array} \right) \times \text{height}$

Open the file *Area of trapezium.ggb* from the folder downloaded from page vii using *GeoGebra*. Click and drag the slider 'Dissect', the points *A*, *B*, *C* and *D* to do an exploration. Discuss with your friends and explain how you would derive the formula for the area of a trapezium based on your exploration of the *GeoGebra* file. Present your findings during the lesson.
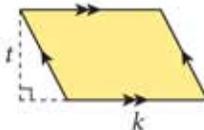
Self Practice   10.2b

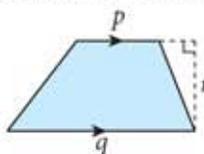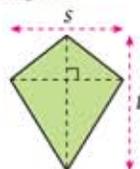1. Write an expression to represent the area of each of the following shapes.
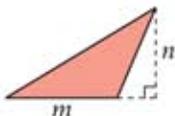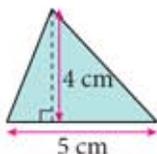
(a)   (b)   (c)   (d)

▶ How do you solve problems involving various shapes?

Example   3
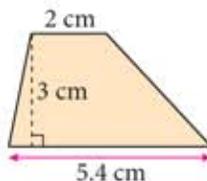
Calculate the area of each of the following shapes.
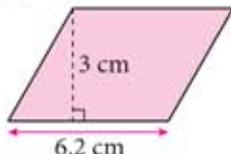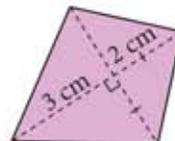
(a)   (b)   (c)   (d)

Solution

(a) Area $= \dfrac{1}{2} \times$ length of base $\times$ height

$\qquad = \dfrac{1}{2} \times 5 \times 4$

$\qquad = 10 \text{ cm}^2$

(b) Area $=$ length of base $\times$ height

$\qquad = 6.2 \times 3$

$\qquad = 18.6 \text{ cm}^2$

(c) Area $= \dfrac{1}{2} \times$ sum of lengths of two parallel sides $\times$ height

$\qquad = \dfrac{1}{2} \times (2 + 5.4) \times 3$

$\qquad = \dfrac{1}{2} \times 7.4 \times 3$

$\qquad = 11.1 \text{ cm}^2$

Career in Mathematics

A housing developer uses the knowledge of perimeter and area to plan a housing project.

(d) Area $= \dfrac{1}{2} \times$ product of the lengths of the two diagonals

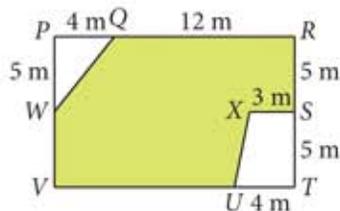$\qquad = \dfrac{1}{2} \times (3+2) \times (2+2) \longleftarrow \boxed{\dfrac{1}{2} \times \text{length of long diagonal} \times \text{length of short diagonal}}$

$\qquad = \dfrac{1}{2} \times 5 \times 4$

$\qquad = 10 \text{ cm}^2$

MATHEMATICS APPLICATION TASK

The diagram shows a rectangular plot of land *PRTV*. The triangular region *PQW* and the trapezium-shaped region *UTSX* are used for planting banana trees and rambutan trees respectively. The remaining shaded region is used to plant papaya trees. Calculate the area of the region used to plant papaya trees.

Solution

Area of *PRTV*	Area of *PQW*	Area of *UTSX*
$= \text{Length} \times \text{width}$	$= \dfrac{1}{2} \times \text{length of base} \times \text{height}$	$= \dfrac{1}{2} \times \left(\begin{array}{c} \text{sum of the} \\ \text{lengths of the two} \\ \text{parallel sides} \end{array} \right) \times \text{height}$
$= (12+4) \times (5+5)$	$= \dfrac{1}{2} \times 4 \times 5$	$= \dfrac{1}{2} \times (3+4) \times 5$
$= 16 \times 10$	$= 10 \text{ m}^2$	$= \dfrac{1}{2} \times 7 \times 5$
$= 160 \text{ m}^2$		$= 17.5 \text{ m}^2$

Thus, the area of the shaded region $= 160 - 10 - 17.5 \longleftarrow \boxed{\text{Area of } PRTV - \text{Area of } PQW - \text{Area of } UTSX}$
$\qquad\qquad\qquad\qquad\qquad\qquad = 132.5 \text{ m}^2$

Self Practice 10.2c

1. Calculate the area of each of the following shapes.

(a)   (b)   (c)   (d)
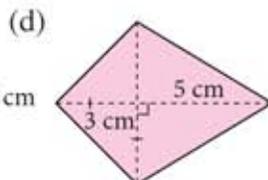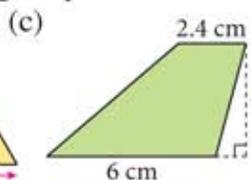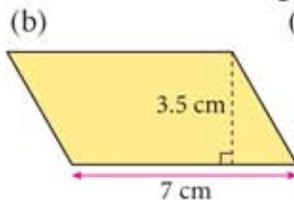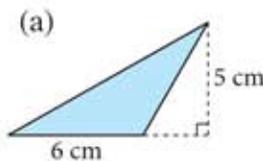
2. A square-shaped exhibition site *PQRS* is divided into three regions *A*, *B* and *C* with *A* being trapezium-shaped and *B* being rectangular. Find the area of the shaded region *C*.
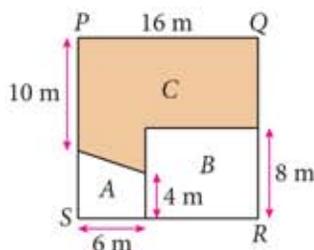
Mastery Q 10.2

Open the folder downloaded from page vii for extra questions of Mastery Q 10.2.

1. By using a suitable computer program or a pencil, draw an irregular shape. Then, estimate the area of the shape in cm², using a suitable method.

2. The diagram shows a playground which is a combination of three different shapes. *TSVU* is a square, *SRQV* is a trapezium and *PQVU* is a parallelogram. Calculate the total area of the playground.

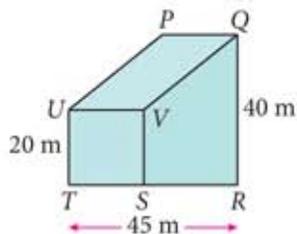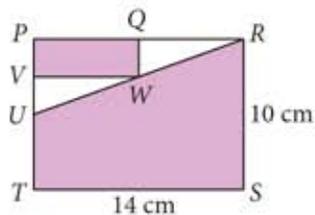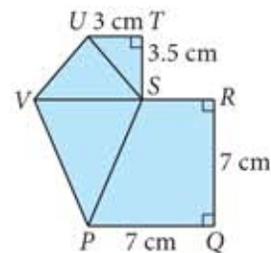3. In the diagram, *PRST* and *PQWV* are rectangles. *Q*, *V* and *U* are midpoints of *PR*, *PU* and *PT* respectively. Find the area of the shaded region.

4. In the diagram, *VSR* is a straight line and *PSUV* is a kite. Calculate the area of the whole diagram.

10.3 Relationship between Perimeter and Area

▶ What is the relationship between perimeter and area?

Kassim has a plot of empty land. He wants to fence up a region of the land to plant some vegetables. He has a 20 m length of fence. How should he construct the fencing such that he can have a region with the largest area?

State your conjectures for each of the following.
• How does the area of a rectangle change when its perimeter is fixed?
• How does the perimeter of a rectangle change when its area is fixed?
Then, perform the following activity to verify your conjectures.

Exploration Activity 6

Aim: To explore the relationship between the perimeter and the area of a rectangle.

Instruction: Explore by yourself before the lesson begins and discuss in groups of four during the lesson.

A 1. Copy and complete Table (a) by stating the values for the length and width of a rectangle which has a perimeter of 36 cm.

Table (a)

Length (cm)	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Width (cm)	1.0	2.0															
Area (cm²)	17.0	32.0															
Difference between length and width (cm)	16.0	14.0															

2. Construct a similar table for a rectangle having each of the following fixed values of perimeter, beginning with a length equivalent to $\left(\dfrac{\text{Perimeter}}{2} - 1\right)$ cm until 1 cm.

   (a) 40 cm   (b) 48 cm   (c) 56 cm

   Open the file Rectangle fixed perimeter.ggb or the file Perimeter and area.xls from the folder downloaded from page vii for help.

3. Study the number patterns obtained in Table (a).
   (a) How does the area of a rectangle change in relation to a fixed perimeter?
   (b) When will the area of the rectangle be the biggest?

B 4. Copy and complete Table (b) by stating the values for the length and width of a rectangle which has an area of 49 cm².

Table (b)

Length (cm)	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Width (cm)	3.500	3.769												
Perimeter (cm)	35.000	33.538												
Difference between length and width (cm)	10.500	9.231												

5. Construct a similar table for a rectangle having each of the following fixed values of area, beginning with a length equivalent to an approximate integer of $2 \times \sqrt{\text{Area}}$ until 1 cm.

   (a) 81 cm²   (b) 144 cm²   (c) 225 cm²

   Open the file Rectangle fixed area.ggb or the file Perimeter and area.xls from the folder downloaded from page vii for help.

6. Study the number patterns obtained in Table (b).
   (a) How does the perimeter of a rectangle change in relation to a fixed area?
   (b) When will the perimeter of the rectangle be the smallest?

7. Discuss with your friends your findings and state all the conclusions that can be made.

From the results of Exploration Activity 6, it is found that for rectangles with;

(a) the same perimeter,
   - the area will decrease if the difference between the length and the width increase.
   - the area will be the largest when the rectangle is a square.

(b) the same area,
   - the perimeter will increase if the difference between the length and the width decrease.
   - the perimeter will be the smallest when the rectangle is a square.

Let's Discuss

Open the file *Triangle fixed perimeter.ggb* and *Triangle fixed area. ggb* from the folder downloaded from page vii using *GeoGebra*. Explore the relationship between the perimeter and the area of a triangle like what was done in Exploration Activity 6 for rectangles. Discuss with your friends and explain your findings.
(a) How does the area of a triangle change when its perimeter is fixed?
(b) How does the perimeter of a triangle change when its area is fixed?
(c) Does a triangle show the same pattern of change as a rectangle?

Present your findings in class during the lesson.
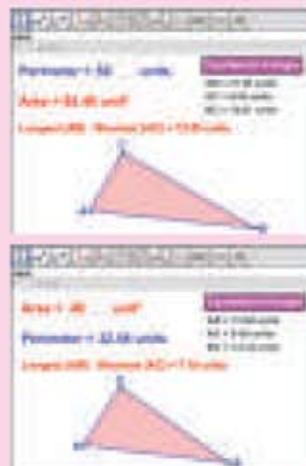
Self Practice 10.3a

1. The rectangles P, Q, R, S and T as shown below have the same perimeter. Arrange the areas of the rectangles in ascending order. Explain your answer.

   P   Q   R   S   T
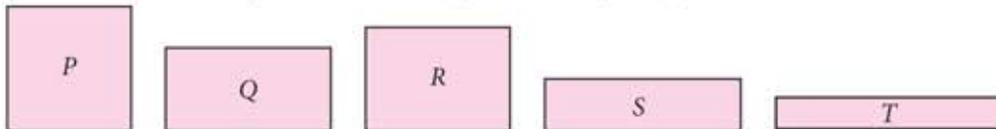
2. The rectangles P, Q, R, S and T as shown below have the same area. Arrange the perimeters of the rectangles in descending order. Explain your answer.

   P   Q   R   S   T

▶ How do you solve problems?

Example **4**

Given the area of a square garden is 500 m^2, find the perimeter of the garden.

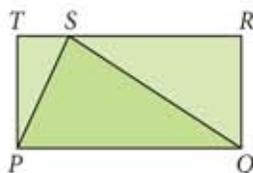*Solution*

Let the length of the side of the garden = x m

Then, $x^2 = 500$ ← Area of the square is 500 m^2.

Thus, $x = \sqrt{500}$

$\qquad = 22.36$ ← 2 decimal places

Hence, the perimeter of the garden = 22.36×4

$\qquad\qquad\qquad\qquad\qquad\qquad = 89.44$ m

Example **5**

The diagram shows a triangle *PQS* inscribed in a rectangle *PQRT*. The perimeter of the rectangle is 42 cm and the length of the rectangle is twice its width. Find the area of triangle *PQS*.

Solution

Let the length of the rectangle = y cm and the width of the rectangle = x cm

$\qquad$ Perimeter = 42 cm

Thus, $2x + 2y = 42$ ...... ①

$\qquad\qquad y = 2x$ ...... ② ← The length is twice its width.

Substitute ② into ①, $2x + 2(2x) = 42$

$\qquad\qquad\qquad\qquad\qquad 6x = 42$

$\qquad\qquad\qquad\qquad\qquad x = \dfrac{42}{6}$

$\qquad\qquad\qquad\qquad\qquad = 7$

$\qquad\qquad\qquad\qquad\qquad y = 2(7)$

$\qquad\qquad\qquad\qquad\qquad = 14$

Hence, the area of triangle $PQS = \dfrac{1}{2} \times 14 \times 7$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad = 49$ cm^2

Check●

Perimeter of the rectangle *PQRT*

$= 2(7) + 2(14)$

$= 14 + 28$

$= 42$ cm

Self Practice 10.3b

1. Given the perimeter of the square floor of a hall is 82 m, find the area of the floor of the hall.

2. The length of a rectangle is 5 cm more than its width. If the perimeter of the rectangle is 40 cm, find the area of the rectangle.

3. In the diagram, *PQTU* is a parallelogram with a perimeter of 24 cm and an area of 28 cm^2. Given that *UTS* and *PQR* are straight lines, find the area of the whole diagram.
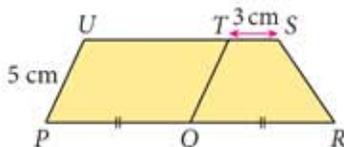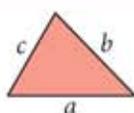

CHAPTER

10

1. The width of a rectangular cardboard is 24 cm and its area is 960 cm². Find the perimeter of the cardboard.

2. The perimeter of a rectangle is 48 cm. Explain how you should draw the rectangle so that the area is the largest. What is the largest area?

3. The diagram shows a piece of rectangular tile *PQRS*. A kite shape *TUVW* is inscribed in the rectangle. Given that the perimeter of *PQRS* is 120 cm, find the area of *TUVW*.

4. A plot of rectangular land is divided into 3 sections, *P*, *Q* and *R* to plant three types of vegetables. The perimeter of the land is 170 m and the length of the land is 15 m more than its width. Find the area of the largest plot for planting the vegetables.
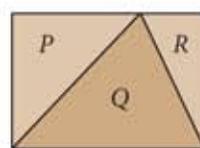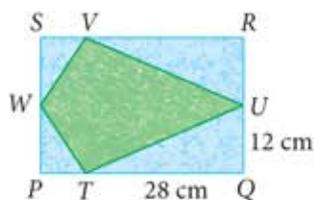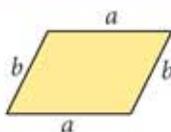

SUMMARY

PERIMETER

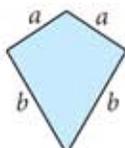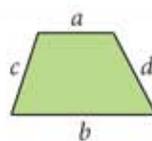| Triangles	Parallelograms	Kites	Trapeziums
$P = a + b + c$	$P = 2a + 2b$	$P = 2a + 2b$	$P = a + b + c + d$

AREA
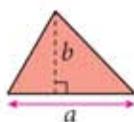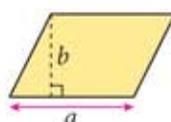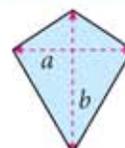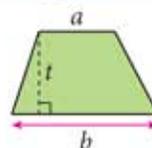
Triangles	Parallelograms	Kites	Trapeziums
$A = \dfrac{1}{2}ab$	$A = ab$	$A = \dfrac{1}{2}ab$	$A = \dfrac{1}{2}(a + b)t$

| At the end of this chapter, I can...	😃 Very good	😓 Work harder
determine the perimeter of various shapes when the side lengths are given or need to be measured.		
estimate the perimeter of various shapes and then evaluate the accuracy of estimation.		
solve problems involving perimeter.		
estimate the area of various shapes using various methods.		
derive the formulae of the area of triangles, parallelograms, kites and trapeziums based on the area of rectangles.		
solve problems involving areas of various shapes and the combinations of these shapes.		
make and verify the conjecture about the relationship between perimeter and area.		
solve problems involving perimeter and area of various shapes and the combinations of these shapes.		

Let's PRACTISE

Test Yourself

1. In the diagram, the perimeter of the shaded region is 25 cm. Find the perimeter of the region which is not shaded.
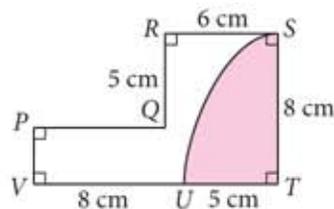
2. The diagram shows a square *PQST*, a triangle *QRS* and a trapezium *PTUV*. Find the perimeter of the whole diagram.
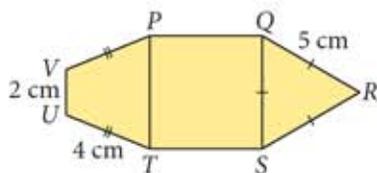
3. The diagram shows a triangle *SRT* and a trapezium *PQRT*. The perimeter of the triangle *SRT* is 24 cm. Find the area of the whole diagram.
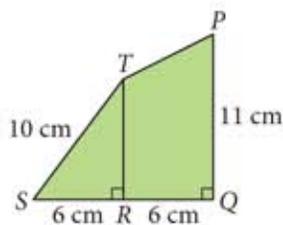
4. Based on the information given in the diagram,
   (a) find the area of the triangle.
   (b) find the value of t.

5. In the diagram, $PQRW$ is a square, RST is a triangle and $TWVU$ is a trapezium. Find the area of the whole diagram.

6. In the diagram, QRU is an equilateral triangle, $PQUV$ and $RSTU$ are two squares. Given the area of $PQUV$ is 36 cm², find the perimeter of the whole diagram.
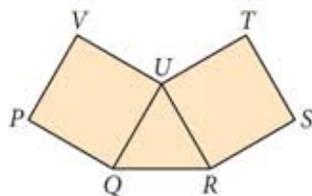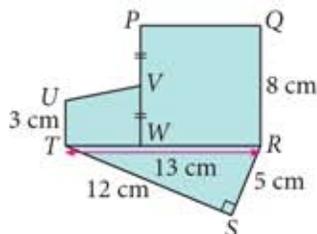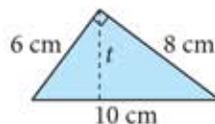
7. The diagram shows a rhombus $PQTU$ and a trapezium $QRST$. PQR and UTS are straight lines. Given that the area of the whole diagram is 46 cm²,
   (a) find the height of the rhombus $PQTU$.
   (b) hence, find the perimeter of the whole diagram.

8. In the diagram, $PQRS$ is a parallelogram with an area of 100 cm². Find the area of triangle TQR.
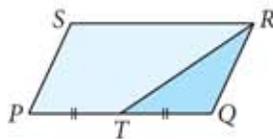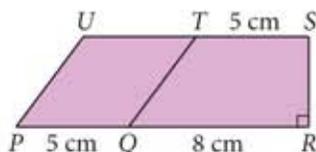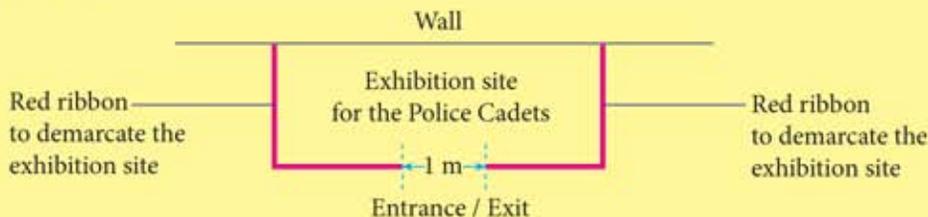
9. You are given a piece of string of length 30 cm. Explain how you would form a rectangle with the biggest area.

10. The diagram shows a rectangular plot of land with a length of 40 m and a width of 20 m. You are required to fence up a region on the land with an area of 450 m². Explain how you would fence the land such that you use the shortest fence. What would be the shortest length of the fence required?
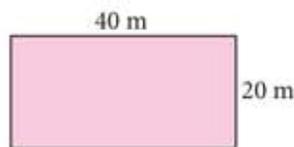
ASSIGNMENT

Your school is going to have an exhibition in conjunction with *Hari Wawasan*. The Police Cadets will be taking part in the exhibition. You have been assigned to plan the exhibition site.

Wall

Red ribbon to demarcate the exhibition site — Exhibition site for the Police Cadets — Red ribbon to demarcate the exhibition site

←1 m→

Entrance / Exit

The Police Cadets are given a space beside the wall as their exhibition site. The exhibition site is demarcated with red ribbon except for a 1 m space as the entrance and exit for the exhibition site, as shown in the diagram.

You are supplied with a piece of 20 m long red ribbon. Explain how you would demarcate the exhibition site with the red ribbon so that the exhibition site has the largest area. Write a report and present it to your teacher who is the advisor of the Police Cadets.

⟫ *Open the file Assignment.ggb from the folder downloaded from page vii using GeoGebra to help you.*

Exploring MATHEMATICS

1. Open the file *Mystery area.ggb* from the folder downloaded from page vii using GeoGebra.
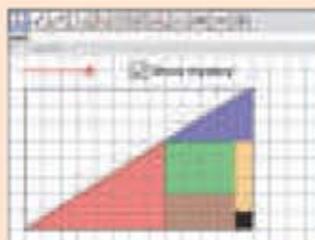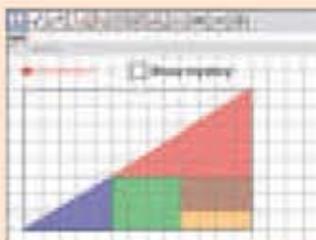
2. Click and drag the slider to the end, towards the right.
3. Observe the movements of the shapes on display.
4. Explain why there is a difference of 1 unit² of area when the shapes are rearranged although all the shapes maintain their respective areas.
5. Click and drag the slider towards left and right a few times or click at 'Show mystery' for help.
6. Present the result of your exploration in class during the lesson.