

Stage 4

Measurement: Length, Perimeter & Area

Booklet 3

Name:

Date Started:

Date Completed:

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Outcomes

By completing this unit, students are working towards achieving the following outcomes.

You have the opportunity to learn to:

- communicate and connect mathematical ideas using appropriate terminology, diagrams and symbols **MA4-1WM**
- apply appropriate mathematical techniques to solve problems **MA4-2WM**
- recognise and explain mathematical relationships using reasoning **MA4-3WM**
- calculate the perimeters of plane shapes and the circumference of circles **MA4-12MG**
- use formulas to calculate the areas of quadrilaterals and circles, and converts between units of area **MA4-13MG**

Knowledge, skills and understanding

Students:

Working Mathematically

- develop understanding and fluency in mathematics through inquiry, exploring and connecting mathematical concepts, choose and apply problem-solving skills and mathematical techniques, communication and reasoning

Measurement and Geometry

- identify, visualise and quantify measures and the attributes of shapes and objects, and explore measurement concepts and geometric relationships, applying formulas, strategies and geometric reasoning in the solution of problems

Measurement: Length, Perimeter & Area

Hi Stage 4,

Hope you are all staying safe and healthy at home 😊

The booklet is a bit different (and longer!) this term because I want you to have an explanation to read before each exercise (just like the notes we would normally write up on the board). It is really important to read and understand the explanation pages before you go ahead and start the exercises (even if you already know how to do it).

If you are feeling confused or need some help either leave a comment on our Stage 4 google classroom or email your question to me at my school email:

brittany.singleton@det.nsw.edu.au

Stage 4 Maths

Class code 6lw2l57 [QR]

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Part A: Perimeter

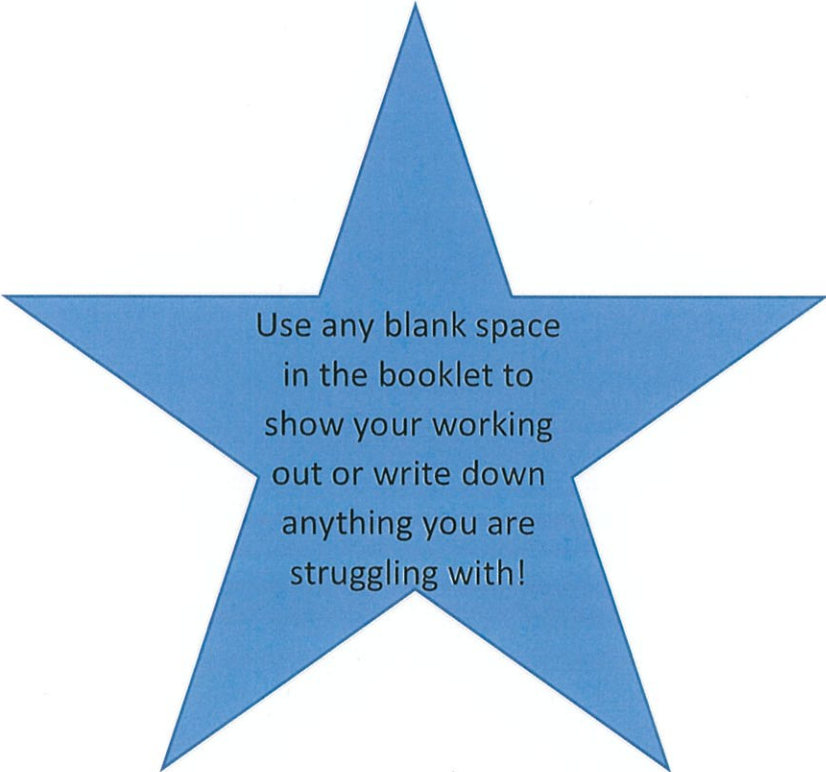
In this booklet you will be solving problems involving perimeters of plane shapes including composite shapes.

The ability to determine the perimeters of two-dimensional shapes is of fundamental importance in many everyday situations, such as framing a picture, furnishing a room, fencing a garden or a yard, and measuring land for farming or building construction.

Indicators

By the end of this booklet, you will have been given the opportunity to work towards aspects of knowledge and skills including:

- finding the perimeters of a range of plane shapes, including parallelograms, trapeziums, rhombuses, kites and simple composite figures
- comparing perimeters of rectangles with the same area
- solving problems involving the perimeters of plane shapes



Use any blank space
in the booklet to
show your working
out or write down
anything you are
struggling with!



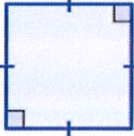
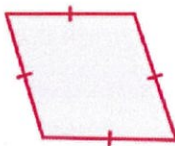
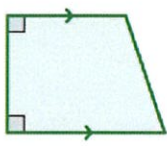
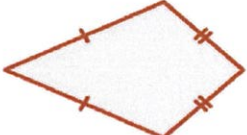
Activity – Preliminary Quiz

Try these.

1. Write out the full words for these abbreviations.

- a) mm _____
- b) cm _____
- c) m _____
- d) km _____

2. Write the best name for these **quadrilaterals**, by using the markings on their sides and in their angles to guide you.

- a)  _____
- b)  _____
- c)  _____
- d)  _____

Exercise A.1

QUESTION 1 Convert the following to centimetres (cm).

- a 1 m = _____ b 4 m = _____ c 2 m = _____ d 4.1 m = _____
e 3 m = _____ f 6 m = _____ g 3.5 m = _____ h 8 m = _____
i 5 m = _____ j 7 m = _____ k 2.25 m = _____ l 5.34 m = _____
m 10 mm = _____ n 80 mm = _____ o 700 mm = _____ p 167 mm = _____

QUESTION 2 Convert the following to metres (m).

- a 200 cm = _____ b 1200 cm = _____ c 90 cm = _____ d 60 cm = _____
e 500 cm = _____ f 2500 cm = _____ g 150 cm = _____ h 20 cm = _____
i 8000 cm = _____ j 4000 cm = _____ k 560 cm = _____ l 1570 cm = _____
m 1 km = _____ n 15 km = _____ o 4.75 km = _____ p 20.07 km = _____

QUESTION 3 Convert each of the following lengths to millimetres (mm).

- a 1 m = _____ b 3.5 m = _____ c 2.25 m = _____ d 10 m = _____
e 6 m = _____ f 12 m = _____ g 6.5 m = _____ h 7.9 m = _____
i 8 m = _____ j 5 m = _____ k 9.52 m = _____ l 5.5 m = _____
m 20 cm = _____ n 80 cm = _____ o 25.5 cm = _____ p 50.1 cm = _____

QUESTION 4 Convert the following measurements to the units shown.

- a 5 m = _____ cm b 4000 mm = _____ m c 4.5 km = _____ m d 640 mm = _____ cm
e 7 m = _____ mm f 463 mm = _____ cm g 6.35 cm = _____ mm h 2.3 km = _____ m
i 9 m = _____ cm j 800 cm = _____ mm k 60 cm = _____ mm l 18 m = _____ cm
m 6 km = _____ m n 5.3 m = _____ cm o 8560 mm = _____ m p 2.31 m = _____ cm

QUESTION 5 Complete the following conversions.

- a 0.8 m = _____ cm b 4 km = _____ cm c 0.3 m = _____ mm d 3.7 m = _____ cm
e 0.006 km = _____ m f 0.04 m = _____ cm g 0.002 m = _____ mm h 12.69 m = _____ mm
i 0.009 m = _____ mm j 0.007 m = _____ cm k 85 m = _____ cm l 58 cm = _____ mm
m 0.02 m = _____ mm n 9 mm = _____ km o 0.05 km = _____ m p 365 mm = _____ cm

Perimeter

A **plane shape** is any flat shape.

The **perimeter** of a plane shape is the sum of the lengths of the sides. In other words, it is the distance around the edge of the shape.

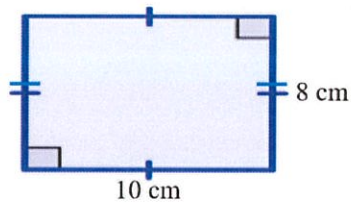
You can find the perimeter of a shape by either adding up the lengths around the outside of the shape or by recognising that because there are some equal sides in your shape, you can group these equal sides together.



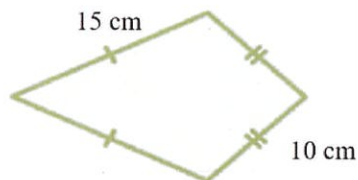
Follow through the steps in this example.

Calculate the perimeter of the following shapes (these shapes are not drawn to scale):

a)



b)



Solution

- a) This is a rectangle, with equal opposite sides. We can calculate the perimeter by either adding each side or multiplying lots of equal sides

$$\begin{aligned}\text{Perimeter} &= 10 + 8 + 10 + 8 \\ &= 36 \text{ cm}\end{aligned}$$

or

$$\begin{aligned}\text{Perimeter} &= 2 \times 8 + 2 \times 10 \\ &= 36 \text{ cm}\end{aligned}$$

- b) A kite has adjacent equal sides.

$$\begin{aligned}\text{Perimeter} &= 2 \times 15 + 2 \times 10 \\ &= 50 \text{ cm}\end{aligned}$$

or

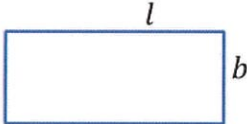
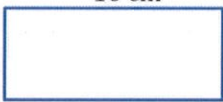
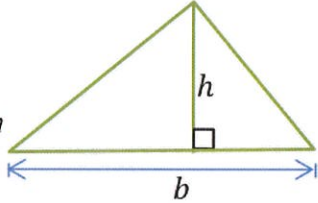
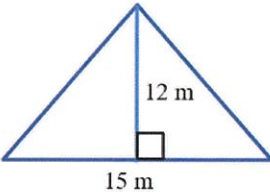
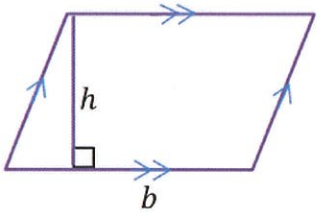
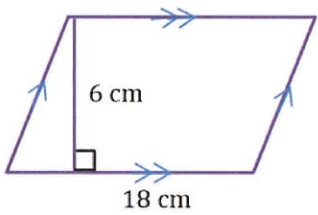
$$\begin{aligned}\text{Perimeter} &= 15 + 10 + 15 + 10 \\ &= 50 \text{ cm}\end{aligned}$$

Perimeter of rectangles with the same area



You can calculate area by either counting the squares inside a shape or you can use the formula for the area of that shape reviewed in the table below.

The area of a shape is the number of square units that it covers. The most common metric units for measuring area are square millimetres (mm^2), square centimetres (cm^2), square meters (m^2) and square kilometres (km^2)

Formula	Examples
Rectangle $area = length \times breadth$ $A = lb$ 	 $A = lb$ $= 10 \times 2.5$ $= 25 cm^2$
Triangle $area = \frac{1}{2} \times base \times height$ $A = \frac{1}{2} \times bh$ 	 $A = \frac{1}{2} \times bh$ $= \frac{1}{2} \times 15 \times 12$ $= 90 m^2$
Parallelogram $area = base \times height$ $A = bh$ 	 $A = bh$ $= 18 \times 6$ $= 108 m^2$

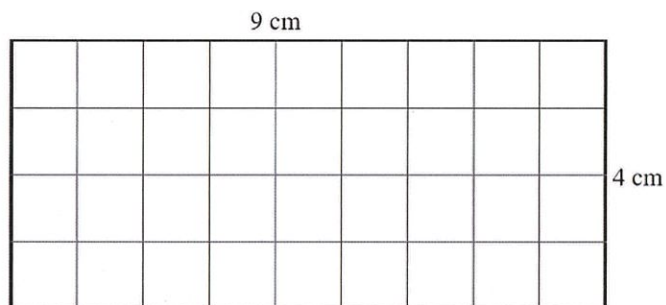


Activity – Perimeter of rectangles

Try these.

Calculate the perimeter and area of the following rectangles. Write the units next to your answer.
The units for area in this activity are square centimetres (or cm^2).

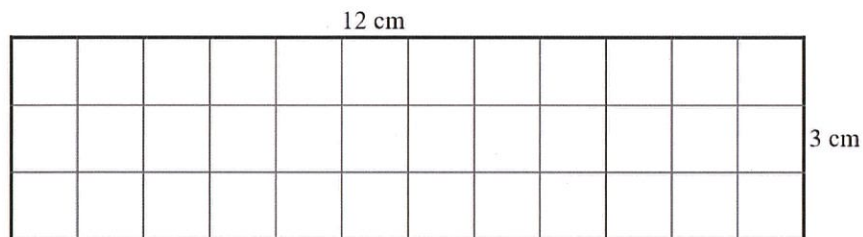
a)



Perimeter = _____

Area = _____

b)



Perimeter = _____

Area = _____

c) Is the perimeter of the first rectangle the same as the perimeter of the second rectangle? _____

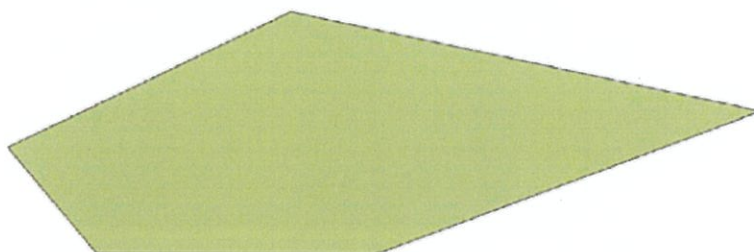
d) Is the area of the first rectangle the same as the area of the second rectangle? _____

Exercise A.2

1. Write True or False if finding the perimeter best suits each of the following situations:

- a) You are painting a wall _____
- b) You wrap some string around some nails _____
- c) Drawing the outline of a shape _____
- d) Fencing a property _____
- e) Planting a crop of wheat _____

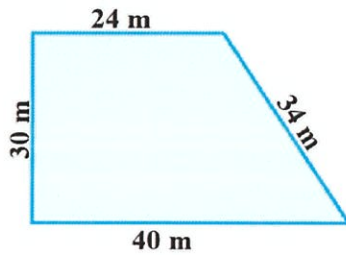
2. Measure the lengths of each side of the following figure in millimetres. Use these lengths to calculate the perimeter.



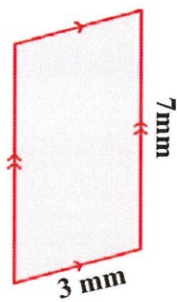
3. The following figures are not drawn to scale.

Use the measurements on them to calculate the perimeters.

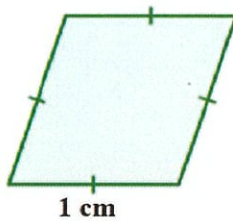
a)



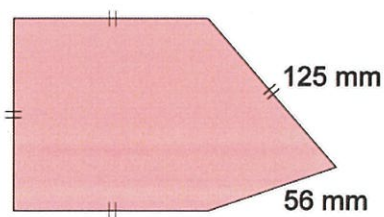
b)



c)



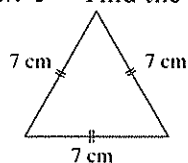
d)



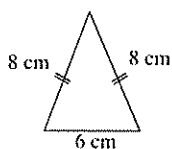
Exercise A.3

QUESTION 1 Find the perimeter of each of the following triangles.

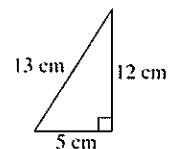
a



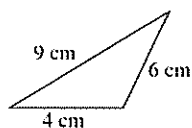
b



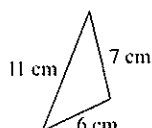
c



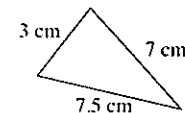
d



e

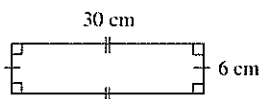


f

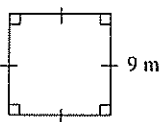


QUESTION 2 Find the perimeter of the following squares and rectangles.

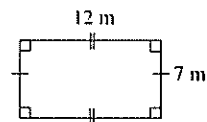
a



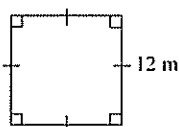
b



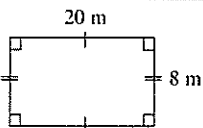
c



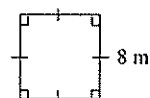
d



e

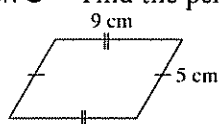


f

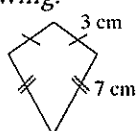


QUESTION 3 Find the perimeter of the following.

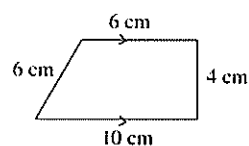
a



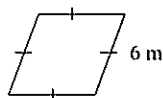
b



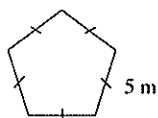
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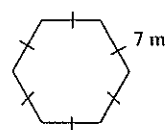
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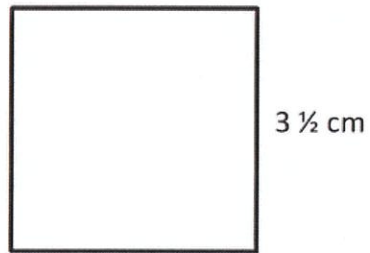
f



Exercise A. 4

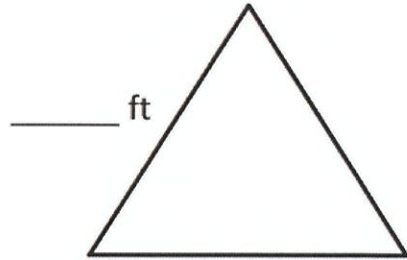
Find the missing side lengths or perimeters of these regular shapes.

1)



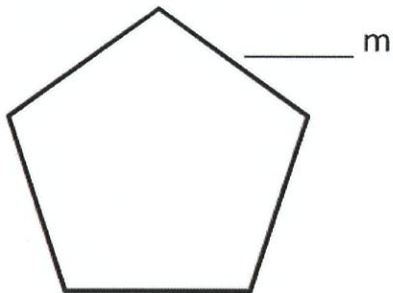
Perimeter = _____

2)



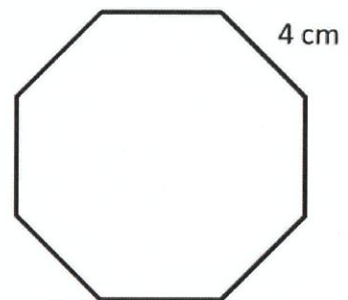
Perimeter = 15 ft

3)



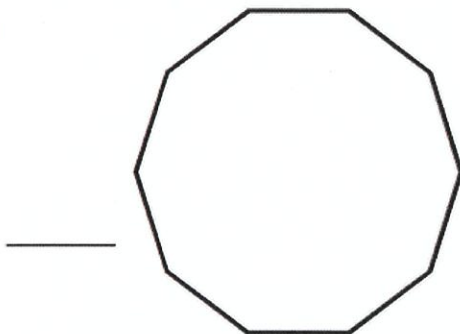
Perimeter = 30 m

4)



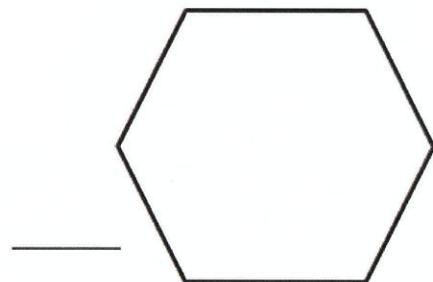
Perimeter = _____

5)



Perimeter = 40cm

6)



Perimeter = 48 in.



Perimeters of Composite Shapes

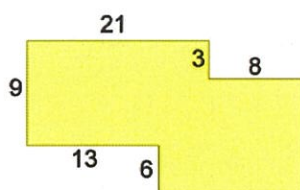
A composite shape is one that is not a simple, one-figure shape. It can be made up of two or more shapes.



The figure below represents the ground plan of a large building. Can you see that this figure is made up of three rectangles?

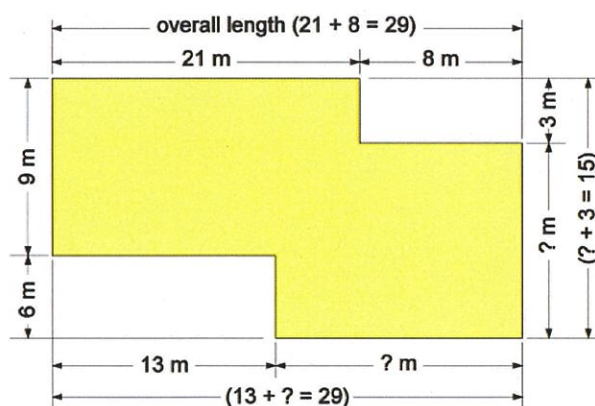


All angles are right angles and all measurements are in metres.



Suppose you needed to calculate its perimeter. You will notice that the lengths of two sections are not given.

To find the perimeter of the figure, you must first find the unmarked sections by using the fact that the opposite sides of a rectangle are equal.



Here is one way to help you find the missing lengths:

$$\begin{aligned}\text{Overall length} &= 21 + 8 \\ &= 29 \text{ m}\end{aligned}$$

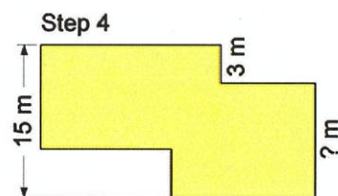
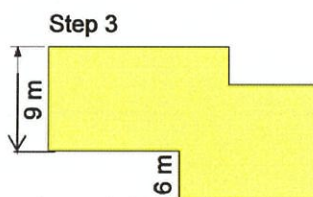
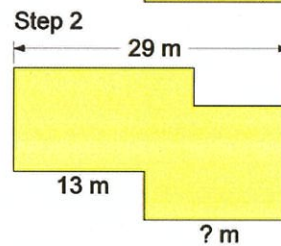
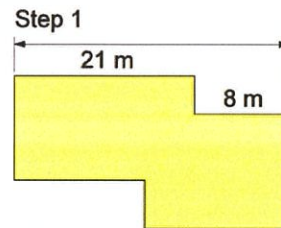
To find the side marked ‘?’

$$\begin{aligned}13 + ? &= 29 \\ 13 + 16 &= 29 \\ \text{Missing length} &= 16 \text{ m}\end{aligned}$$

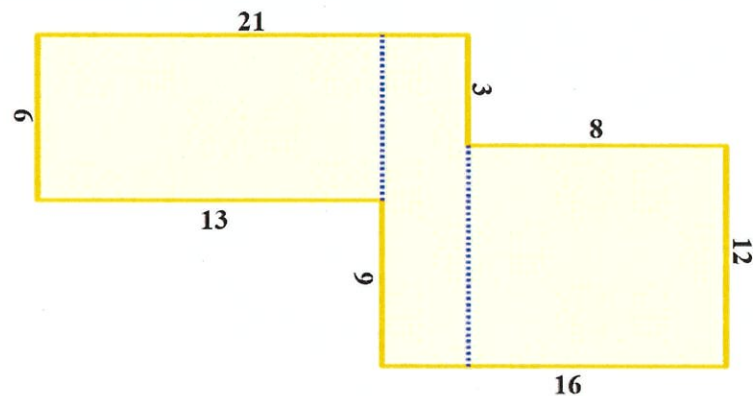
$$\begin{aligned}\text{Overall width} &= 9 + 6 \\ &= 15 \text{ m}\end{aligned}$$

So, to find this right side marked with a ‘?’

$$\begin{aligned}3 + ? &= 15 \\ 3 + 12 &= 15 \\ \text{Missing length} &= 12 \text{ m}\end{aligned}$$



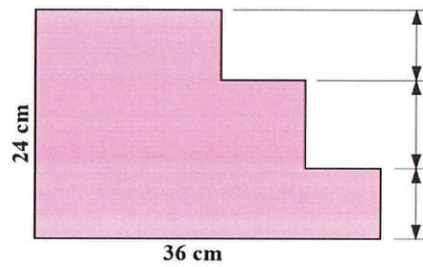
The diagram can now show all measurements.



$$\begin{aligned}\therefore \text{Perimeter} &= 9 + 21 + 3 + 8 + 12 + 16 + 6 + 13 \\ &= 88 \text{ m}\end{aligned}$$



Sometimes it is not necessary to work out the size of every length. In the diagram below, the steps on the right have unequal heights, but the three heights together add to 24 cm.



Similarly, the three top lengths total 36 cm. Can you see why?

This gives a total perimeter for this figure of $2 \times 24 + 2 \times 36 = 120$ cm

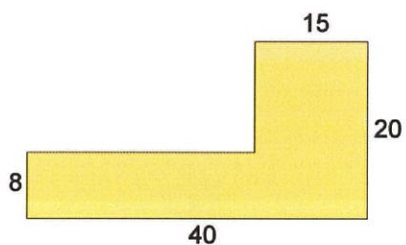


Exercise A.5

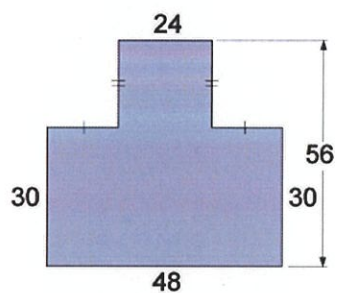
1. Find the perimeter of each of the following composite figures.

All measurements are in centimetres and all angles are right angles.

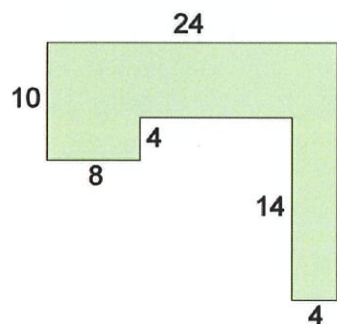
a)



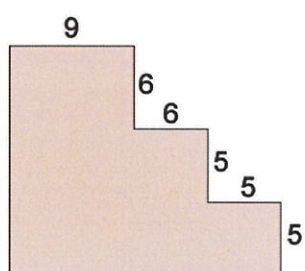
b)



c)

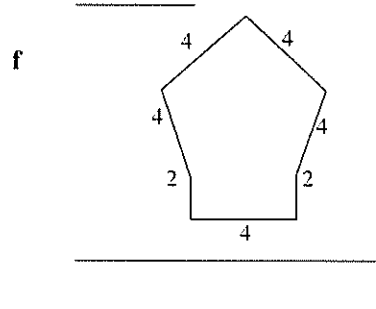
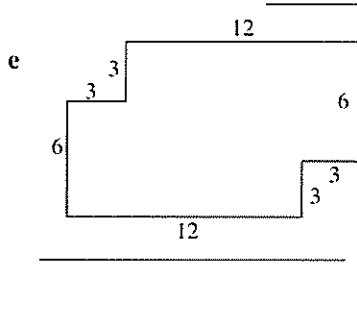
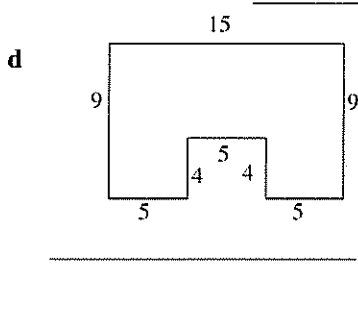
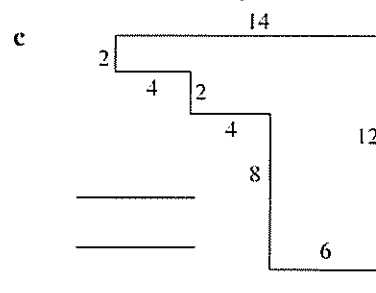
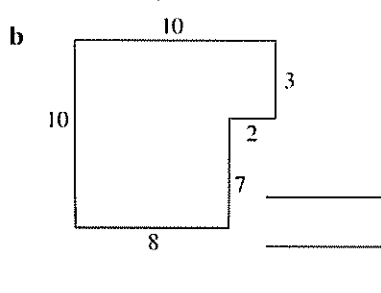
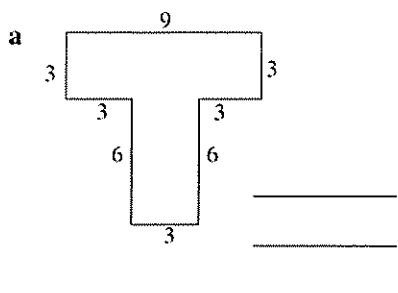


d)

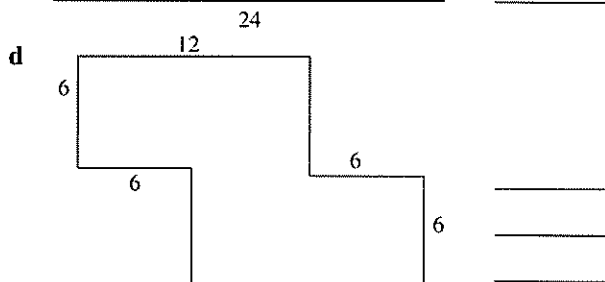
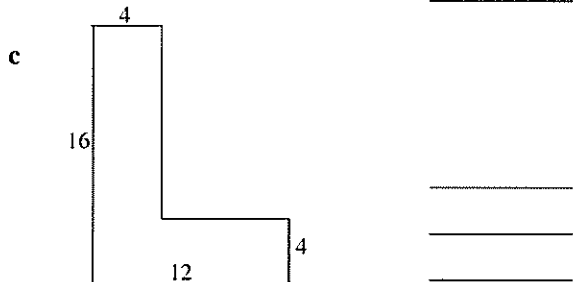
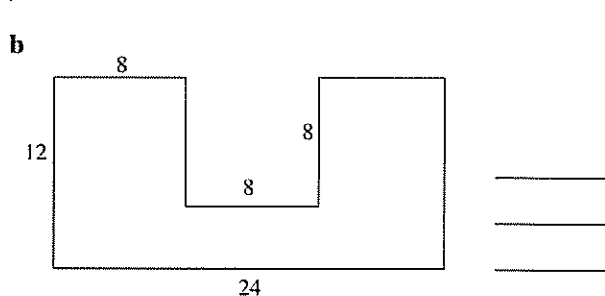
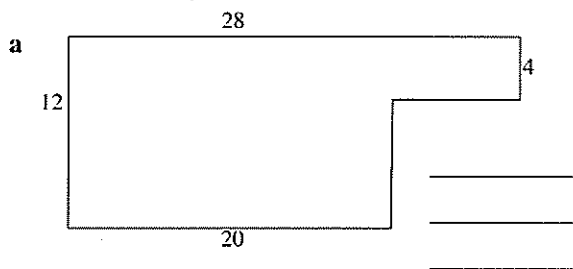


Exercise A.6

QUESTION 1 Find the perimeter of the following. (All measurements are in centimetres.)



QUESTION 2 Find the missing lengths of the following shapes and then find the perimeter of each. (All measurements are in centimetres.)



QUESTION 3

a If the perimeter of a square is 72 metres, find the length of each side.

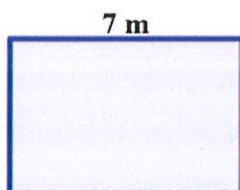
b A room is measured 8.64 metres long and 5.36 metres wide. Find the difference between the length and width in metres.

Problem Solving with Perimeters



Follow through the steps in this example.

- a) The perimeter of a square is 20 m.
How long is each side?
- b) The perimeter of this rectangle is 20 m. What is its width?



Solution

- a) A square has 4 equal sides:

$$4 \text{ equal sides} = 20 \text{ m}$$

$$\text{One side} = 20 \div 4$$

$$= 5 \text{ m}$$

You can also solve this using a simple algebraic equation:

Let s represent each side:

$$s + s + s + s = 20$$

$$4s = 20 \quad (\text{divide both sides by } 4)$$

$$s = 5 \text{ m}$$

- b) A rectangle has opposite sides equal.

As we are given the size of the length (let's call it l) we can calculate the size of the width (let's call it w).

$$\text{Perimeter} = l + l + w + w$$

$$20 = 7 + 7 + w + w$$

$$20 = 14 + 2w$$

$$2w = 6$$

$$w = 3 \text{ m}$$

Therefore, the width of the rectangle is 3 m.

$$\begin{aligned} \text{Let's check: Perimeter} &= 7 + 7 + 3 + 3 \\ &= 20\text{cm} \end{aligned}$$

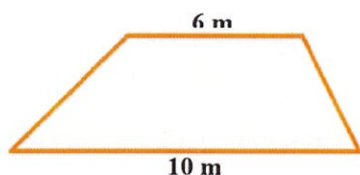


Activity – Problem solving involving perimeters

Try these.

1.

- a) What is the perimeter of the trapezium, below?



- b) This trapezium above has been copied, turned around and joined to the first trapezium to make the parallelogram below.



- i) Write correct lengths against all four sides of the parallelogram above.
ii) What is the perimeter of this parallelogram?

- iii) Explain why the perimeter of the parallelogram is not double the perimeter of the trapezium.

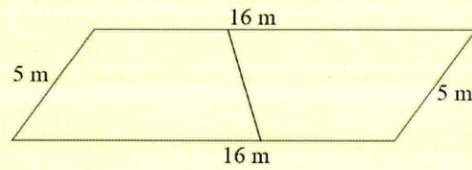
Now correct your answers from the suggested answers given on the next page.

Suggested Answers:

Check your responses against these suggested answers. If your answers are very different or if you do not understand an answer, contact your teacher.

1. a) $\text{Perimeter} = 5 + 6 + 4.1 + 10$
 $= 25.1 \text{ m}$

b) i)

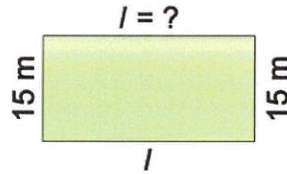


ii) $\text{Perimeter} = 10 + 32$
 $= 42 \text{ m}$

iii) The perimeter of the above shape is not double the perimeter of the trapezium because the joined sides are now not part of the perimeter.

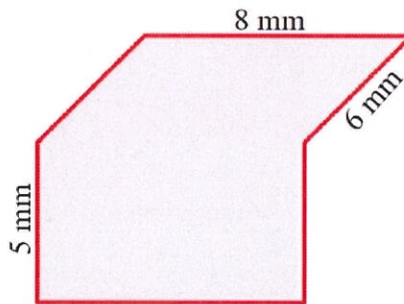
Exercise A.7

1. A rectangle has a perimeter of 80 m. If its width is 15 m, how long is it?



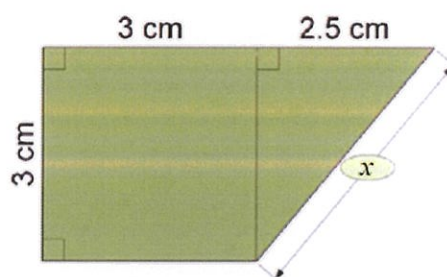
2. A square has a perimeter of 34 cm. How long is each side?

3. This figure has a parallelogram sitting on top of a rectangle.




- a) Write down the missing lengths on the diagram above.
b) Calculate the perimeter

4. Gayle drew the following diagram (not drawn to scale).




She was wondering what measurement the sloping side with x would be. These are some suggestions from Kim, Frank and Mary.

A value between 0 and 3.




Kim

A value between 3 and 5.5.



Frank

A value between 5.5 and 8.5.



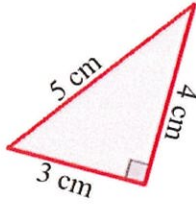
Mary

Who is correct, and why?

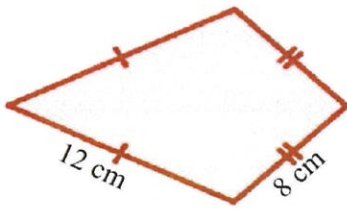
Chapter A Review

1. Calculate the perimeter of the following shapes:

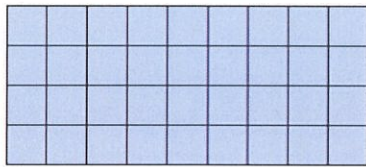
a)



b)

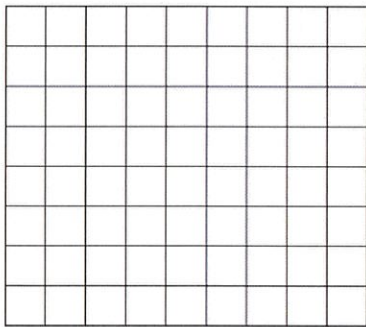


2. a) By counting the squares of the blue rectangle below, find the:



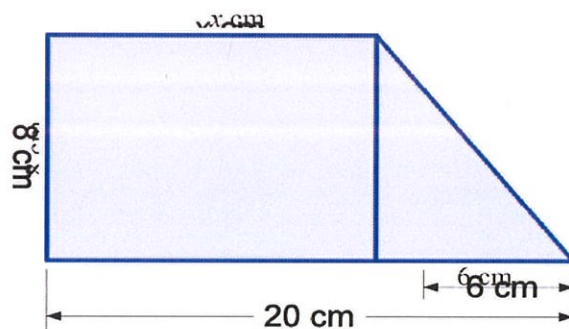
- i. length _____
- ii. breadth _____
- iii. area _____
- _____

b) Use the grid below to draw a square that has the same area as the rectangle above.



c) Name the shape above that has the smallest perimeter. _____

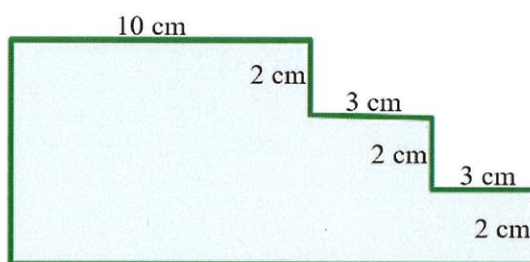
3. This composite figure contains a rectangle and a right-angled triangle.



a) How long is x ? _____

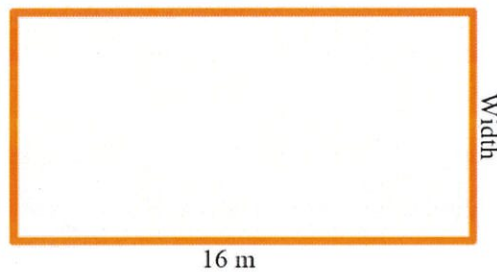
b) Calculate the perimeter of the shape

4. Calculate the perimeter of this composite shape.



5. A square has a perimeter of 18.4 cm. What is the length of one side of the square?

6. The perimeter of this rectangle is 50 m. Calculate its width.



Part B: Circumference

In this booklet you will be finding the circumference of circles and the perimeter of semicircles, quadrants and composite shapes. You will be introduced to the concept of π ('pronounced pie') and investigate its value.

Indicators

By the end of this booklet, you will have been given the opportunity to work towards aspects of knowledge and skills including:

- investigating and defining the number π as the ratio of the circumference to the diameter of any circle
- developing and using the formulas to find the circumferences of circles in terms of the diameter d or radius r
- finding the perimeters of quadrants and semicircles
- finding the perimeters of simple composite figures consisting of two shapes, including quadrants and semicircles
- finding arc lengths and the perimeters of sectors
- solving a variety of practical problems involving circles and parts of circles, giving an exact answer in terms of π and an approximate answer using a calculator's approximation for π

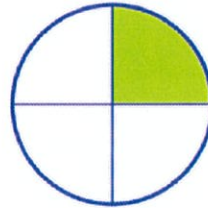


Activity – Preliminary Quiz

Try these.

1. Draw a line from the term to the correct diagram.

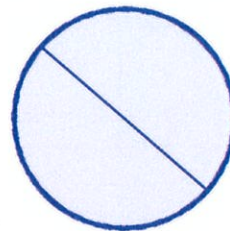
Diameter



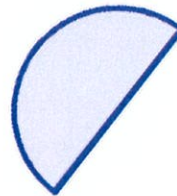
Quadrant



Semicircle



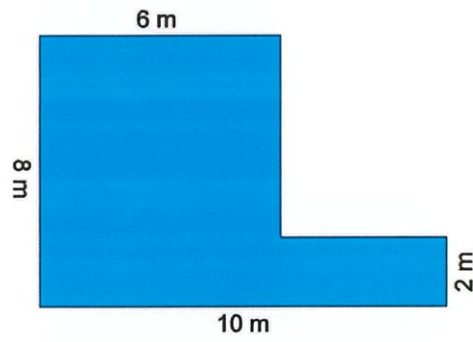
Arc



2. Round off 23.76 to one decimal place. _____
3. Approximate 44.44 correct to one decimal place. _____
4. Approximate 75.398 to two decimal places. _____
5. Rewrite $\frac{1}{2}$ as a decimal _____

6. Rewrite $\frac{1}{4}$ as a decimal _____

7. Calculate the perimeter of the following figure.

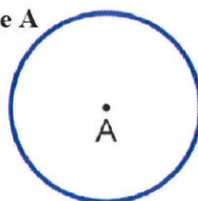


Circumference and Diameter



A circle is a plane shape with all points the same distance from its centre. This circle is called circle A since its centre is at point A.

Circle A

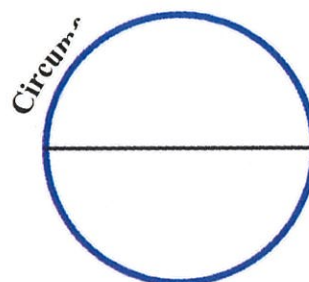


Circumference is the name given to the perimeter of a circle. It is the length of the outside of a whole circle.

The distance across a circle through its centre is called its **diameter**. And the distance from the centre to the edge of the circle is the **radius**.

$$\text{So, radius} = \frac{1}{2} \times \text{diameter}$$

$$\text{or, diameter} = 2 \times \text{radius}$$



A real-life example of a radius is a spoke on a bicycle wheel.



Circumference, diameter and radius are measured in linear units, such as metres and centimetres. A circle has many different radii (plural of radius) and many different diameters, each passing through its centre.



Circumference



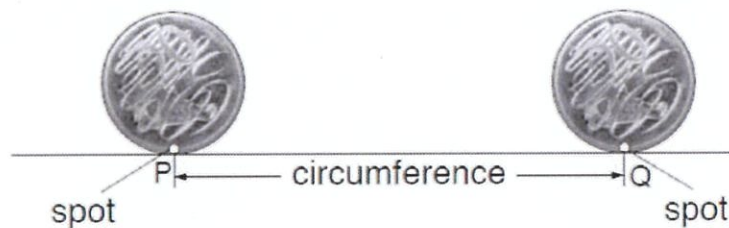
Circumference is the special name given to the **perimeter of a circle**.

The perimeter of a circle cannot be measured with a ruler, however it can be measured in a number of different ways:



Circular objects can be measured with a cloth tape measure or a piece of string which is then measured against a ruler.

The edge of a coin can be covered with ink or paint and then rolled from a marked point across paper to where the point makes contact with the paper again. The line can then be measured with a ruler



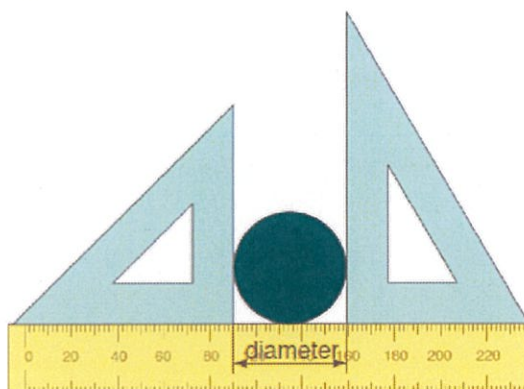
Diameter



The diameter of a circle is the length of the line through the centre of a circle touching two points on its edge.

You can measure the diameter of a circle by;

- Placing a circular object on a flat surface and resting it on a ruler.
- Rest a set square on each side of the object so that each set square is touching the circular object.
- Measure the distance between the two inside edges of the set squares.



This distance gives you the length of the diameter.



Follow through the steps in this example.

Here are the measurements of a drinking mug, to the nearest millimetre:

- circumference = 238 mm;
- diameter = 76 mm

How many times is the circumference bigger than the diameter?

Solution

To answer this question, divide the circumference by the diameter.

$$\frac{238}{76} = 3.131578974$$
$$\approx 3.13 \text{ (correct to 2 decimal places)}$$

(note: the \approx symbol means approximately)

The figure of 3.13 means that the circumference (238 mm) is just over three times as big as the diameter (76 mm).

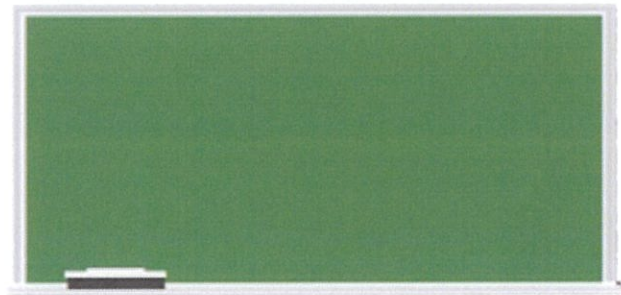
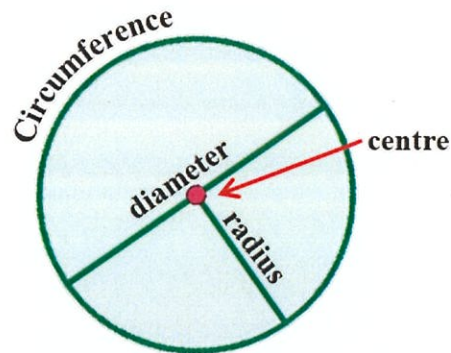
Finding the Circumference

From the previous section we now know that: $\pi = \frac{\text{circumference}}{\text{diameter}}$

We can use this to find the circumference of a circle by rewriting it as:

$$\text{circumference} = \pi \times \text{diameter, or}$$

$$\text{circumference} = \pi \times 2 \times \text{radius} \quad (\text{as diameter} = 2 \times \text{radius})$$



Algebraically, this can be written as:

$$\text{Circumference of circle} = \pi d \quad (\text{for a circle with diameter } d)$$

$$\text{Circumference of circle} = 2\pi r \quad (\text{for a circle with radius } r)$$



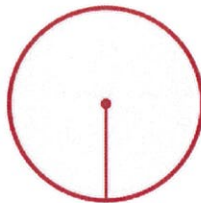
Activity – Finding the circumference

Try these.

1. A circle has a diameter of 7 mm.
 - a) Use the formula $C = \pi d$, and the π value from your calculator, to calculate the length of its circumference.

 - b) What is the approximate length of the circumference if you use $\pi = 3$?

 - c) Was your first answer close to this approximation? _____
2. Find the circumference of the following circle with a given radius correct to one decimal place.



Now correct your answers from the suggested answers given on the next page

Suggested Answers:

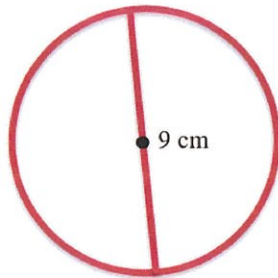
Check your responses against these suggested answers. If your answers are very different or if you do not understand an answer, contact your teacher.

1.
 - a) $C = \pi d$
 $C = \pi \times 7$
 $C \approx 21.9911 \dots \text{ mm}$
 $C \approx 22 \text{ mm}$
 - b) Using $\pi \approx 3$
 $C \approx 3 \times 7$
 $C \approx 21$
 - c) Yes it is a close approximation.
(if your answer in a) is not close to 21, you need to recalculate it. Perhaps you accidentally pressed the wrong keys!)
2. As you are given the radius, you may first calculate the diameter and use
 $C = \pi d$ or you may use $C = 2\pi r$.
 $C = 2\pi r$
 $C \approx 2 \times \pi \times 5$
 $C \approx 31.415 \dots \text{ cm}$
 $C \approx 31.4 \text{ cm}$

Exercise B.1

1. Use your calculator to find the circumference of each of the following circles. Write your answers to 1 decimal place.

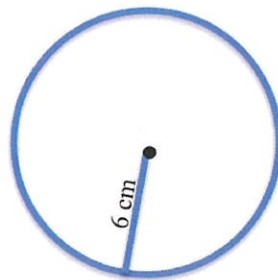
a) a)



b)

2. Wh b)

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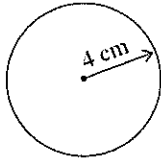
erence of a circle with a radius of 15 m?

3. If a circle has a circumference of approximately 62.8 m, find its diameter to the nearest metre.

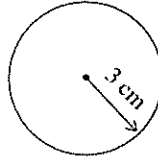
Exercise B.2

QUESTION 1 Calculate the circumference of the following circles correct to one decimal place.

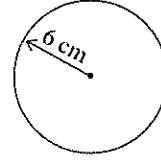
a



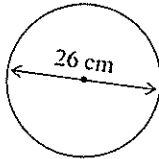
b



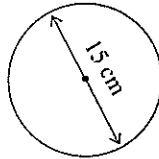
c



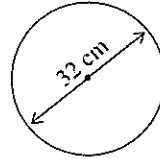
d



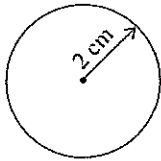
e



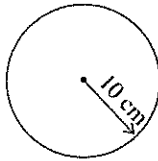
f



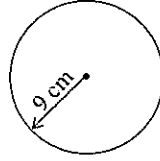
g



h

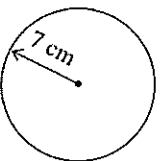


i

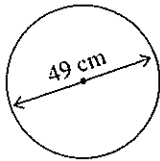


QUESTION 2 By using $\frac{22}{7}$ as the value of π , find the approximate length of the circumference for these circles.

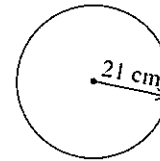
a



b



c



QUESTION 3 Find, to one decimal place, the circumference of a circle with:

a radius 11 km

b diameter 57 m

c radius 23 cm

d diameter 94 cm

e diameter 78 mm

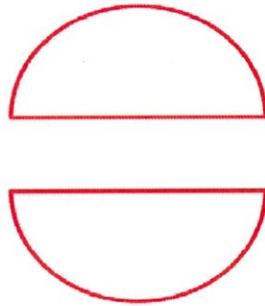
f radius 19 m

Perimeter of Semi Circles and Quadrants

Semicircles

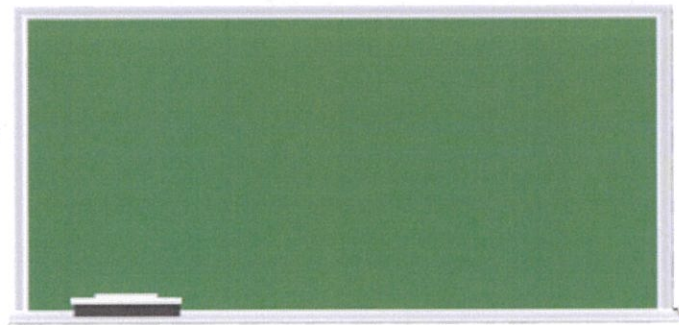


A circle can be divided into two semicircles. You may remember that a semicircle is just another name for half a circle.



semicircular arc

The curved part of the semicircle is half the circumference of the whole circle. So the perimeter of a semicircle is:



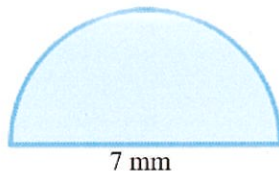
The perimeter of a semicircle includes both the curved portion (semicircular arc) and the length of the diameter.



Activity – Perimeter Semicircles

Try these.

1. The following semicircle has a diameter of 7mm:



- a) Use your calculator to find $C = \pi d$ and **divide your answer by 2**. Write your answer to 1 decimal place.

- b) Explain why this calculation gives the length of the **semicircular arc**.

- c) To calculate the perimeter of this semicircle you must add 7 to your answer above. Explain why.

- d) Complete the statement below:

$$\begin{aligned} \underline{\hspace{2cm}} &= \text{semicircular arc} + \text{diameter} \\ &= \underline{\hspace{2cm}} \\ &= \underline{\hspace{2cm}} \end{aligned}$$

Now correct your answers from the suggested answers given on the next page.

Suggested Answers:

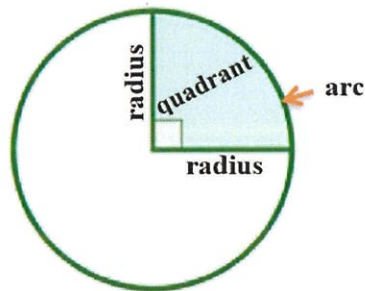
Check your responses against these suggested answers. If your answers are very different or if you do not understand an answer, contact your teacher.

1. a) Semi Circular Arc $= \pi d \div 2$
 $\approx \pi \times 7 \div 2$
 $\approx 10.99557... \text{ mm}$
 $\approx 11 \text{ mm}$
- b) A semicircle is half a circle, so the length of the semicircular arc is half the whole circumference.
Finding half of something is the same as dividing by two.
- c) Perimeter is the total length around the outside of a shape, so you must add the the diameter to the length of the semicircular arc.
- d) perimeter = semicircular arc + diameter
 $\approx 11 + 7$
 $\approx 18 \text{ mm}$

Quadrants



A circle can be divided into four quadrants. The curved part of the quadrant is one quarter the circumference of the whole circle.

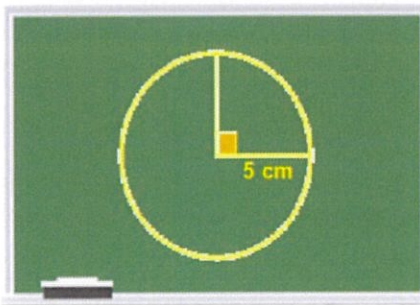


The shaded part of this diagram is called a **quadrant**.

The curved part is called an **arc**.

The little square in the corner means it is a right angle (or 90°), so it is quarter of a circle as a full circle makes a revolution of 360° .

The teacher draws the following diagram on the board, and asked the class to;



Explain how you would calculate the perimeter of this quadrant correct to one decimal place.

To calculate the length of the arc of the quadrant a student suggests dividing the circumference of the circle by 4, as finding a quarter of something is the same as dividing by 4.

The student doubles 5 cm to get the diameter and then writes the following calculation:

$$\begin{aligned}\text{Circumference} &= \pi \times \text{diameter} \\ &= \pi \times 10 \\ \text{Length of arc} &= \pi \times 10 \div 4\end{aligned}$$

He then uses his calculator and gets 7.8539816....



The perimeter is 7.9 cm.

But isn't the perimeter the total of all the sides?



Oh, I forgot. $7.9 + 10$ is 17.9. The perimeter is 17.9cm.

The student added 10 to 7.9 because each radius on the quadrant above is 5 cm long. The perimeter calculation is shown below.

Perimeter = arc length + radius + radius

Or

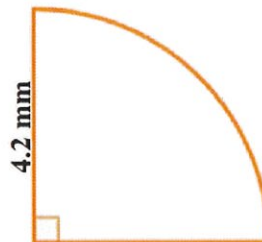
$$\begin{aligned} P &= \text{arc} + 2 \times r \\ &\approx 7.9 + 2 \times 5 \\ &\approx 7.9 + 10 \\ &\approx 17.9 \text{ cm} \end{aligned}$$



Activity – Perimeter of quadrants

Try these.

2. Answer these questions about the following quadrant.



- a) How long is the diameter of the circle that this quadrant came from?

- b) Write the correct numbers in the calculation below.

Circumference = $\pi \times \text{diameter}$

= $\pi \times$ _____

Length of arc = $\pi \times$ _____ \div _____

- c) Use a calculator to find the length of the arc of this quadrant. Write your answer to one decimal place.

- d) You are asked to find the perimeter of the quadrant above.

Write the missing words and numbers below:

$$P \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \text{ length} + \underline{\hspace{2cm}} + \text{radius}$$

$$\approx \underline{\hspace{2cm}} + \underline{\hspace{2cm}} + \underline{\hspace{2cm}}$$

- e) What is the perimeter of the quadrant?

Now correct your answers from the suggested answers given below.

Suggested Answers:

Check your responses against these suggested answers. If your answers are very different or if you do not understand an answer, contact your teacher.

2.

- a) 8.4 mm (the diameter is double the radius)

b) Circumference = $\pi \times \text{diameter}$

$$= \pi \times 8.4$$

Length of arc = $\pi \times 8.4 \div 4$

- c) About 6.6 mm. The number in your display should be 6.597344573. To approximate to one decimal place, you need to look at the nine next to the five. This nine makes the number closer to 6.6, not 6.5.

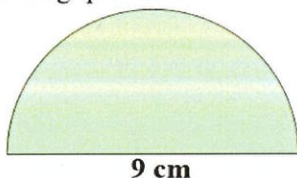
- d) Perimeter = arc length + radius + radius

$$\approx 6.6 + 4.2 + 4.2$$

- e) The perimeter of the quadrant is approximately 15 mm.

Exercise B.3

1. Use this semicircle to answer the following questions.



- a) Calculate the length of the semicircular arc. Write your answer correct to one decimal place.

- b) Calculate the perimeter of the semicircle.

2. Use this quadrant to answer the following questions.



- a) How long is the diameter of the circle that this quadrant came from?

- b) Write the correct numbers in the calculation below.

$$\text{Circumference} = \pi \times \text{diameter}$$

$$= \pi \times \underline{\hspace{2cm}}$$

$$\text{Length of arc} = \pi \times \underline{\hspace{2cm}} \div \underline{\hspace{2cm}}$$

- c) Use your calculator to find the length of the arc. Write your answer correct to one decimal place

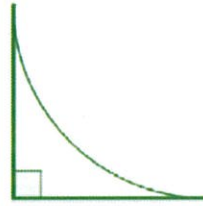
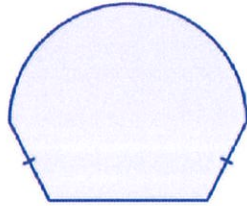
- d) Calculate the perimeter of this quadrant by completing the following:

$$\text{Perimeter} = \text{arc length} + \text{radius} + \text{radius}$$

Perimeter of Composite Shapes Involving Circles



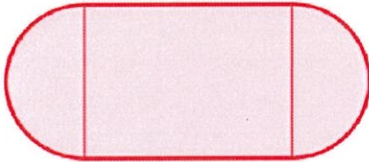
Combining different shapes together in the one diagram produces **composite figures**. Look at the diagrams below. Two figures are used to create each shape. What are they?



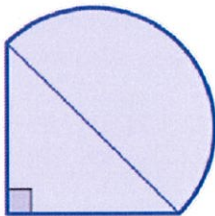
In the first diagram you have a semicircle on top of an **isosceles trapezium** and in the second you have a square with a quadrant (a quarter of a circle) removed from it.

Composite figures are formed by joining two or more shapes together. To find the perimeter of a composite figure add the distances around the enclosed figure.

Can you name all the shapes used in the following composite figures:



This figure is made up of a rectangle and two semicircles.



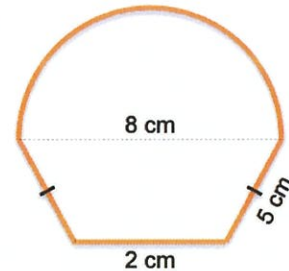
This figure is made up of a right angled triangle and a semicircle.



Activity – Perimeter of composite figures

Try these.

A semicircle and an isosceles trapezium form the following diagram



a) Circle the correct answer. The top section of the diagram is:

- i. a circle with radius 8 cm
- ii. a semicircle with radius 8 cm
- iii. a circle with radius 4 cm
- iv. a semicircle with radius 4 cm

b) Calculate the length of the arc correct to one decimal place.

c) Calculate the perimeter of the figure correct to one decimal place.

Now correct your answers from the suggested answers given below.

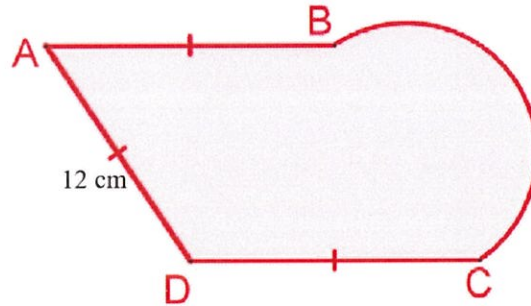
Suggested Answers:

Check your responses against these suggested answers. If your answers are very different or if you do not understand an answer, contact your teacher.

- a) iv. a semicircle with radius 4 cm.
- b) Semicircular arc length = $\pi d \div 2$
 $= \pi \times 8 \div 2$
 $\approx 12.6 \text{ cm}$
- c) Perimeter = semicircular arc + three sides of trapezium
 $\approx 12.6 + 5 + 2 + 5$
 $\approx 24.6 \text{ cm}$

Exercise B. 4

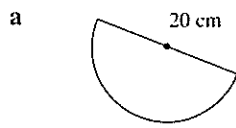
1. Use this composite figure to answer the following questions.

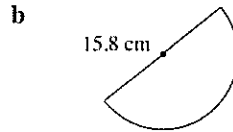


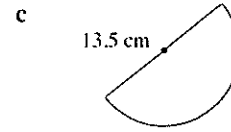
- a) Divide this figure into two shapes by drawing one line. The two shapes must be from this list: triangle, rectangle, square, rhombus, kite, trapezium, circle and semicircle.
- b) Name the two shapes _____
- c) Calculate the perimeter of the shape. Write your answer correct to one decimal place.

Excercise B.5

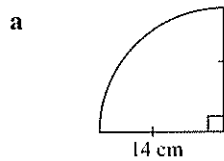
QUESTION 1 Calculate the total perimeter of the following semicircles correct to one decimal place.

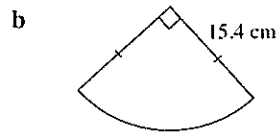


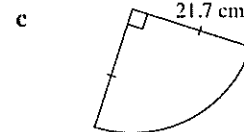




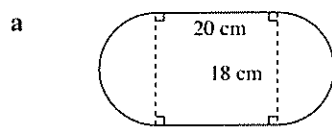
QUESTION 2 Find the total perimeter of these quadrants.

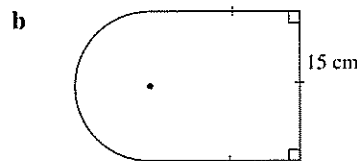


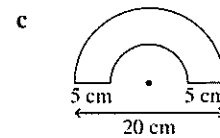


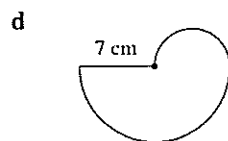


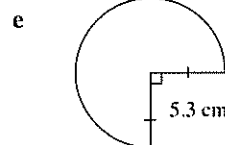
QUESTION 3 Find the perimeter of each of these figures correct to one decimal place.

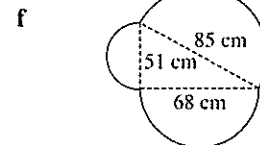


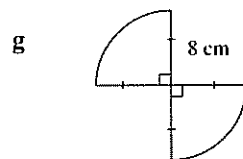


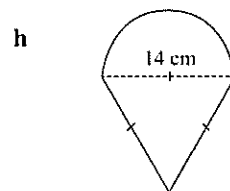


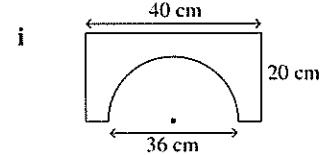












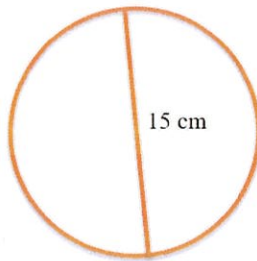
Chapter B Review

1. a) For any circle, what symbol is given to the value of $\frac{\text{circumference}}{\text{diameter}}$?

- b) What is its approximate value correct to four decimal places?

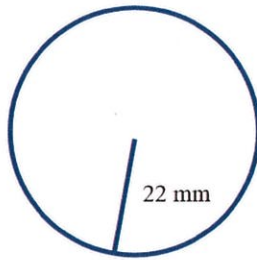
2. Using the π value on your calculator find the circumference for the following circles. Write your answer correct to one decimal place.

a)



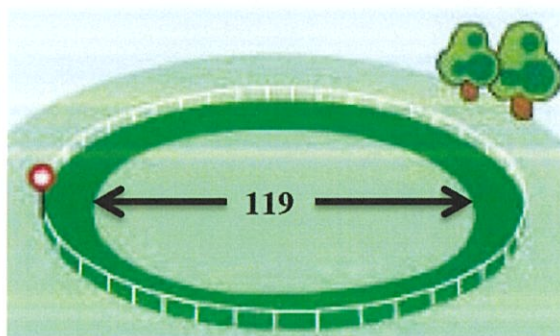
diameter = 15 cm

b)



radius = 22 m

3. A circular running track is 119 m wide at its inner most point. The inner circumference is the smallest distance that you can run if you complete one lap of this track.



- a) The circumference of the inner circle is about 374 m.

Write down the correct working for this answer.

- b) A 1500 m walk is to be organised. Use your answer above to calculate how many laps of this track competitors must walk.

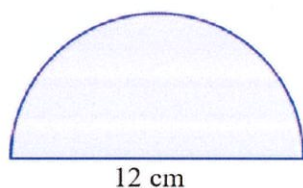
- c) i) If the track is 7 m wide, what is the diameter of the outside edge of the track?
(Remember, the track is on both sides of the inner diameter.)

- ii) Calculate the circumference of the outside edge of the track. Round your answer to the nearest metre.

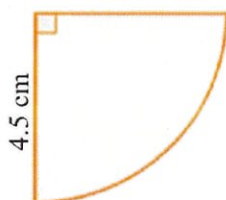
- d) Why do you think competitors in a long race like to crowd along the inner edge of running track?

4. Calculate the perimeter of the following shapes. Remember to add all the sides. Round your answer to one decimal place.

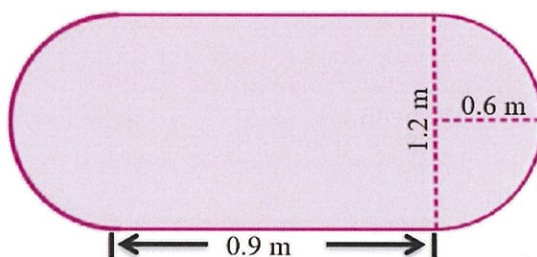
a)



b)



5. A tablecloth is to be made to fit a dining table for a special event. The dimensions of the tablecloth are shown below.



- a) The tablecloth has three shapes inside it. What are the names of the three shapes? (Two of the shapes are the same)

- b) The two same shapes can be combined to form one shape. What is the name of this shape? _____

- c) Draw a diagram of this shape showing its dimensions.

- d) A lace border is to be sewn around the edge of the table cloth. Describe in words, the lengths you need to add together, in order to calculate the amount of lace that will be used.

- e) Calculate the amount of lace needed for the tablecloth edging. Round your answer to 2 decimal places.

Part C: Units of Area

You have previously been introduced to perimeter and area. In this booklet you will further develop your knowledge of area by investigating the units of measurement of area and converting between different metric units.

The ability to determine the areas of two-dimensional shapes and solve related problems is of fundamental importance in many everyday situations, such as carpeting a floor, painting a room, planting a garden, establishing and maintaining a lawn, installing concrete and paving, and measuring land for farming or building construction.

Indicators

By the end of this booklet, you will have been given the opportunity to work towards aspects of knowledge and skills including:

- choosing an appropriate unit to measure the areas of different shapes and surfaces, e.g. floor space, fields
- converting between metric units of area using

$$1 \text{ cm}^2 = 100 \text{ mm}^2$$

$$1 \text{ m}^2 = 1\,000\,000 \text{ mm}^2$$

$$1 \text{ m}^2 = 10\,000 \text{ cm}^2$$

$$1 \text{ ha} = 10\,000 \text{ m}^2$$

$$1 \text{ km}^2 = 1\,000\,000 \text{ m}^2$$

$$1 \text{ km}^2 = 100 \text{ ha.}$$



Before you start this booklet, use this preliminary quiz to revise some skills you will need.



Activity – Preliminary Quiz

Try these.

1. Write the abbreviations for the following lengths.

- a) metres _____
- b) centimetres _____
- c) millimetres _____
- d) kilometres _____

2. Which of these units of length would you use to measure the length of this page?

- A. millimetres
- B. centimetres
- C. metres
- D. kilometres

3. Calculate the following **without** using a calculator:

- a) $32.5 \times 10 =$ _____
- b) $17.1 \times 100 =$ _____
- c) $78.26 \div 10 =$ _____
- d) $65 \div 100 =$ _____

4. Calculate the following **without** using a calculator:

- a) $1^2 =$ _____
- b) $10^2 =$ _____
- c) $1000^2 =$ _____
- d) $5^2 =$ _____

- a) 305 mm to cm _____
- b) 5.1 km to m _____
- c) 25 cm to mm _____
- d) 500 m to km _____

-

Suggested Answers:

1. a) m b) cm c) mm d) km
2. A or B. Either measure will do.
3. a) 325 b) 1710 c) 7.826 d) 0.65
4. a) $1^2 = 1 \times 1$
 $= 1$
 c) $1000^2 = 1000 \times 1000$
 $= 1\,000\,000$
 b) $10^2 = 10 \times 10$
 $= 100$
 d) $5^2 = 5 \times 5$
 $= 25$
5. Using the following conversion:
 1 cm = 10 mm 1 m = 100 cm 1 km = 1000 m
a) 30.5 cm b) 5100 m c) 250 mm d) 0.5 km
6. Perimeter = $6 + 6 + 4 + 2 + 10 + 8$
 $= 36$ m




Area is the amount of surface an object occupies. It is usually measured in square units, such as square centimetres, square millimetres, square metres, and square kilometres.



Activity – Area and perimeter

Try these.

1. a) Count the number of squares,  each of one unit length and one unit of area, that are in the following figures. Enter your result in the table on the next page.
- b) Do the same for the perimeter of each figure. Recording your answers in the table on the next page.

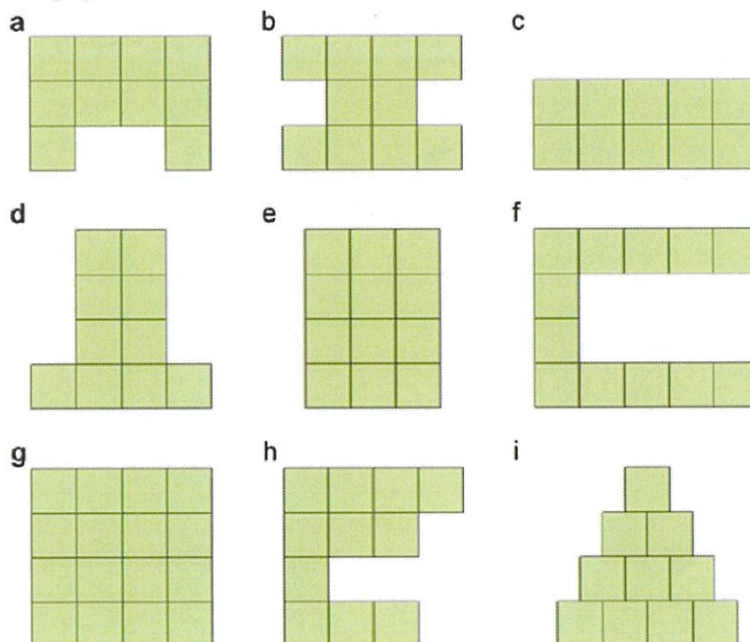


Figure	Area (square units)	Perimeter (units)
a	10	16
b		
c		
d		
e		
f		
g		
h		
i		

- c) Do figures with the same area have the same perimeter? _____
- d) Do figures with the same perimeter have the same area? _____
- e) If the area gets larger, does the perimeter necessarily get larger as well? Comment using examples from your table.

Now correct your answers from the suggested answers given o

Suggested Answers:

Check your responses to the preliminary quiz against these suggested answers. If your answers are very different or if you do not understand an answer, contact your teacher.

1. a) b)

Figure	Area (square units)	Perimeter (units)
a	10	16
b	10	18
c	10	14
d	10	16
e	12	14
f	12	26
g	16	16
h	11	20
i	10	16

c) No

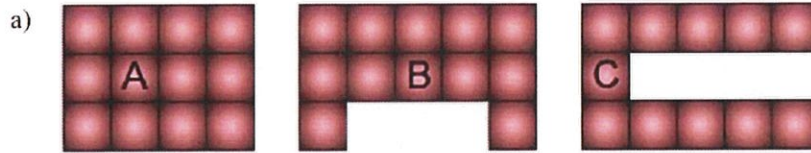
d) No

e) There is no relationship between perimeter and the area enclosed. There are many examples you could use from the table to show this.

Exercise C. 1

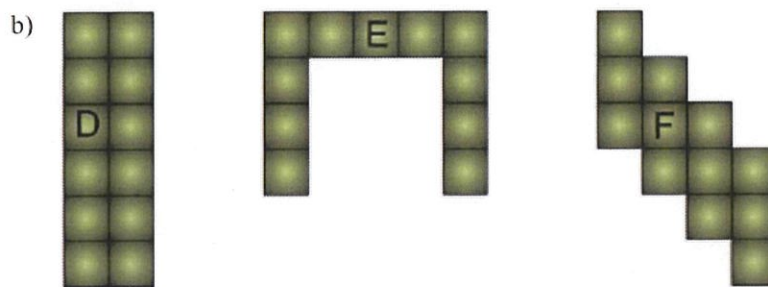
1. For each of the following sets of figures:

- i. which has a different area from the other two?
- ii. which has the largest perimeter?



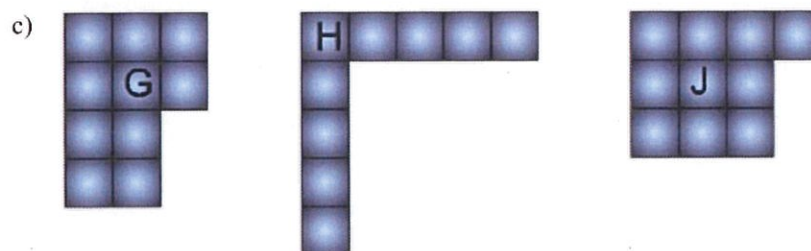
i. _____

ii. _____



i. _____

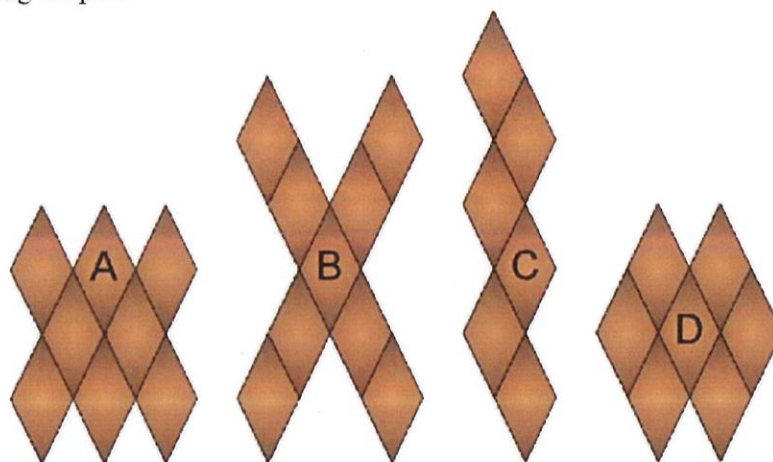
ii. _____



i. _____

ii. _____

2. For the following shapes:

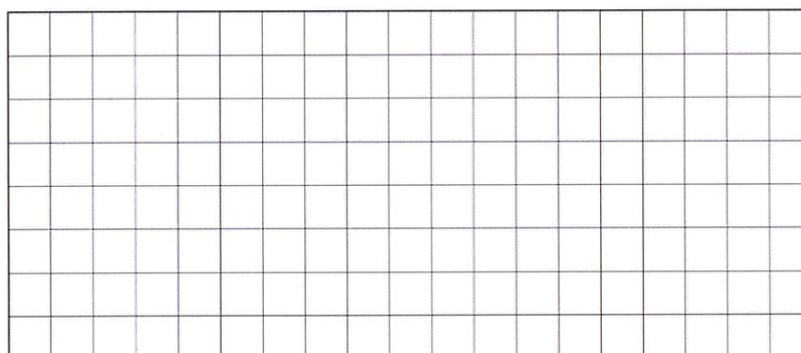


a) List these shapes according to area from smallest to largest.

b) List these shapes according to perimeter from smallest to largest.

c) Are your answers to both a) and b) the same?

3. On the grid below draw three different shapes having area 12 square units, but with different perimeters.





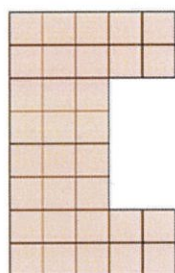
Measurement of area



Area is the amount of surface covered. The whole area of the shape can be divided into small, equal units. Then you can count the number of these units as a measure of area.

You could use a variety of shapes that can fit together without overlap, and with no gaps between them.

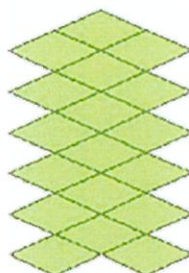
Here are some examples:



squares



triangles

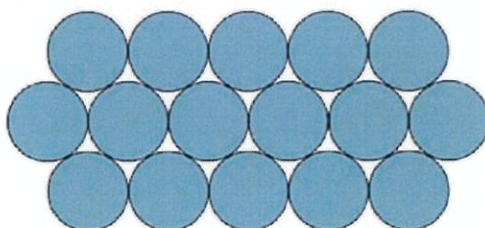


rhombuses



hexagons

It would obviously not be very useful to try and measure areas using circles. Counting circles leaves out part of the area between them.



The unit of area normally used is the square unit.

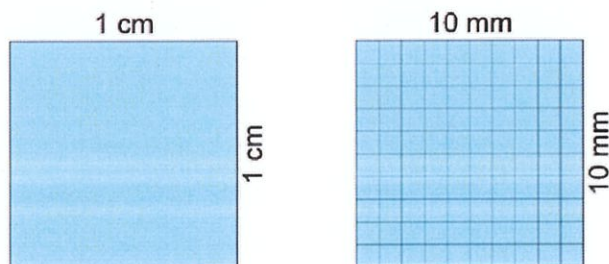




Activity – Measurement of area

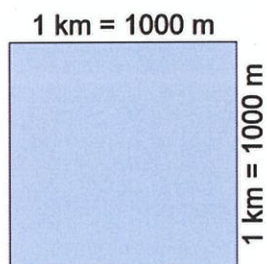
Try these.

1. Use these two diagrams to explain why $1 \text{ cm}^2 = 100 \text{ mm}^2$.



2. $1 \text{ km} = 1000 \text{ m}$. Show how you could use this information to complete:

$$1 \text{ km}^2 = \underline{\hspace{2cm}} \text{ m}^2.$$



Now correct your answers from the suggested answers given on the next page.

Suggested Answers:

Check your responses to the preliminary quiz against these suggested answers. If your answers are very different or if you do not understand an answer, contact your teacher.

1. The square on the left has an area of 1 cm^2 .

The square on the right is divided into millimetres: 10 mm across and 10 mm down.

Each small square has area 1 mm^2 . As there are 100 mm^2 in this square and it has the same area as the square on the left.

$$\therefore 1 \text{ cm}^2 = 100 \text{ mm}^2$$

2. You could explain this answer the same way as in question 1, but here is another method.

$$1 \text{ km} = 1000 \text{ m}$$

$$(1 \text{ km})^2 = (1000 \text{ m})^2$$

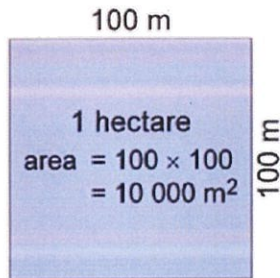
$$1 \text{ km}^2 = 1000 \times 1000 \text{ m}^2$$

$$1 \text{ km}^2 = 1\,000\,000 \text{ m}^2$$



There is one other area unit in common use: the **hectare**.

A hectare (symbol ha) is a metric unit of surface area, equal to $10\,000\text{ m}^2$. It is used for measuring larger areas such as land areas.



One hectare is equivalent to:

10 000 square metres

0.01 square kilometres.

Summary

Here is a summary of some of the different conversions you have worked on in this section.

$$\begin{aligned}1\text{ cm}^2 &= 100\text{ mm}^2 \\1\text{ m}^2 &= 1\,000\,000\text{ mm}^2 \\1\text{ m}^2 &= 10\,000\text{ cm}^2 \\1\text{ ha} &= 10\,000\text{ m}^2 \\1\text{ km}^2 &= 1\,000\,000\text{ m}^2 \\1\text{ km}^2 &= 100\text{ ha}.\end{aligned}$$

You do not need to remember all of these, as long as you know how to work them out.

The unit you use will depend on the size of the area you are measuring.

For large areas, like land areas use km^2 or hectares.

For small areas, such as paper or a mobile phone, use mm^2 or cm^2 .



Exercise C. 2

1. Alex was asked to find how many square millimetres there are in one square metre.



There are 1000 mm in 1m, so there must be 1000 mm² in 1 m².

- a) What is wrong with his explanation?

- b) What should his answer have been?

2. Which of these units: m², km², cm², mm², or ha would be best to use to measure:

- a) the area of a finger nail _____
- b) the area of NSW _____
- c) the area of this page _____
- d) the area of a vineyard _____
- e) the area of the floor in your living room _____

3. One hectare equals $10\,000\text{ m}^2$.

One square kilometre equals $1\,000\,000\text{ m}^2$.

Show how you could use this information to calculate the number of hectares in one square kilometre.

Exercise C.3

QUESTION 1 Complete the following.

a $1 \text{ cm}^2 = \underline{\hspace{2cm}} \text{ mm}^2$

b $1 \text{ m}^2 = \underline{\hspace{2cm}} \text{ cm}^2$

c $1 \text{ ha} = \underline{\hspace{2cm}} \text{ m}^2$

d $1 \text{ km}^2 = \underline{\hspace{2cm}} \text{ m}^2$

e $1 \text{ km}^2 = \underline{\hspace{2cm}} \text{ ha}$

f $1 \text{ cm}^3 = \underline{\hspace{2cm}} \text{ mm}^3$

g $1 \text{ m}^3 = \underline{\hspace{2cm}} \text{ cm}^3$

h $1 \text{ L} = \underline{\hspace{2cm}} \text{ mL}$

i $1 \text{ kL} = \underline{\hspace{2cm}} \text{ L}$

j $1 \text{ cm}^3 = \underline{\hspace{2cm}} \text{ mL}$

k $1 \text{ m}^3 = \underline{\hspace{2cm}} \text{ L}$

l $1 \text{ m}^3 = \underline{\hspace{2cm}} \text{ kL}$

QUESTION 2 Complete the following table.

	Capacity/water	Volume	Mass
a	1 mL		1 g
b	10 mL	10 cm ³	
c	100 mL		100 g
d		500 cm ³	500 g
e	600 mL	600 cm ³	
f	800 mL		800 g
g	1 L	1 000 cm ³	

QUESTION 3 Complete the following.

a $7 \text{ cm}^2 = \underline{\hspace{2cm}} \text{ mm}^2$

b $80\,000 \text{ m}^2 = \underline{\hspace{2cm}} \text{ ha}$

c $9 \text{ m}^2 = \underline{\hspace{2cm}} \text{ cm}^2$

d $350 \text{ ha} = \underline{\hspace{2cm}} \text{ km}^2$

e $5 \text{ ha} = \underline{\hspace{2cm}} \text{ m}^2$

f $230 \text{ m}^2 = \underline{\hspace{2cm}} \text{ cm}^2$

g $6 \text{ cm}^3 = \underline{\hspace{2cm}} \text{ mm}^3$

h $5\,000\,000 \text{ cm}^3 = \underline{\hspace{2cm}} \text{ m}^3$

i $15\,000 \text{ mm}^3 = \underline{\hspace{2cm}} \text{ cm}^3$

j $49 \text{ cm}^3 = \underline{\hspace{2cm}} \text{ mm}^3$

k $8 \text{ m}^3 = \underline{\hspace{2cm}} \text{ kL}$

l $50\,000 \text{ L} = \underline{\hspace{2cm}} \text{ m}^3$

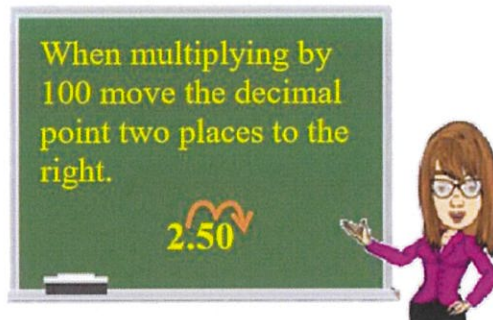
Converting areas



You will need to be able to convert, or change, from one unit to another.

For example, you know that $1 \text{ cm}^2 = 100 \text{ mm}^2$. So if you need to convert 2.5 cm^2 to mm^2 , all you need do is multiply by 100.

$$\begin{aligned} 2.5 \text{ cm}^2 &= 2.5 \times 100 \text{ mm}^2 \\ &= 250 \text{ mm}^2 \end{aligned}$$



Here are the area conversions you will use in this lesson:

$$1 \text{ cm}^2 = 100 \text{ mm}^2$$

$$1 \text{ m}^2 = 1\,000\,000 \text{ mm}^2$$

$$1 \text{ m}^2 = 10\,000 \text{ cm}^2$$

$$1 \text{ ha} = 10\,000 \text{ m}^2$$

$$1 \text{ km}^2 = 1\,000\,000 \text{ m}^2$$

$$1 \text{ km}^2 = 100 \text{ ha.}$$



Follow through the steps in this example.

The area of an A4 sheet of paper is given as $62\,580\text{ mm}^2$. Convert this to an area given in cm^2 .

Solution

You need the conversion $1\text{ cm}^2 = (10\text{ mm})^2$
 $= 100\text{ mm}^2$

Every 100 mm^2 equals 1 cm^2 .

So to change to cm^2 , you need to divide this number by 100:

$$\begin{aligned} 62\,580\text{ mm}^2 &= \frac{62\,580}{100} \\ &= 625.8\text{ cm}^2 \end{aligned}$$



Before you do a problem, write down the appropriate conversion factor and then decide whether you will need to divide or multiply by it.

It might be easier to remember:

- when changing from a larger unit to a smaller unit, multiply by the conversion factor
- when changing from a smaller unit to larger a unit, divide by the conversion factor.



Activity – Converting areas

Try these.

1. A desktop has an area of $16\,600\text{ cm}^2$. Convert this area to m^2 .

2. A vineyard has an area of 23.4 ha . What is this area in m^2 ?

Now correct your answers from the suggested answers given on the next page.

Suggested Answers:

Check your responses to the preliminary quiz against these suggested answers. If your answers are very different or if you do not understand an answer, contact your teacher.

1. You need the conversion $1 \text{ m}^2 = (100 \text{ cm})^2$.
 $= 10\,000 \text{ cm}^2$

As you changing from a smaller unit to a larger unit, divide by the conversion factor:

$$\begin{aligned}\text{Area} &= \frac{16\,600}{10\,000} \\ &= 1.66 \text{ m}^2\end{aligned}$$

2. You need the conversion $1 \text{ ha} = (100 \text{ m})^2$.
 $= 10\,000 \text{ m}^2$

As you changing from a larger unit to a smaller unit, multiply by the conversion factor:

$$\begin{aligned}\text{Area} &= 23.4 \times 10\,000 \\ &= 234\,000 \text{ m}^2\end{aligned}$$

Exercise C.4

1. Convert the following areas to the units given:

a) 75 cm^2 to mm^2 _____

b) 0.023 m^2 to mm^2 _____

c) $95\,000 \text{ ha}$ to km^2 _____

d) $2\,450\,000 \text{ m}^2$ to km^2 _____

2. Sometimes you may need to use two steps to obtain an answer.

For example, change $732\,000\,000 \text{ cm}^2$ to ha.

First change to m^2 :

$$\begin{aligned} 732\,000\,000 \text{ cm}^2 &= \frac{732\,000\,000}{10\,000} \\ &= 73\,200 \text{ m}^2 \end{aligned}$$

Then change this to ha:

$$\begin{aligned} 73\,200 \text{ m}^2 &= \frac{73\,200}{10\,000} \\ &= 7.32 \text{ ha} \end{aligned}$$

a) Convert 84 million cm^2 to ha

b) Convert 0.25 ha to mm^2

3. A garden bed has an area of 0.45 ha. How many m^2 is this?

4. The land area of New South Wales is approximately 800 600 km^2 .

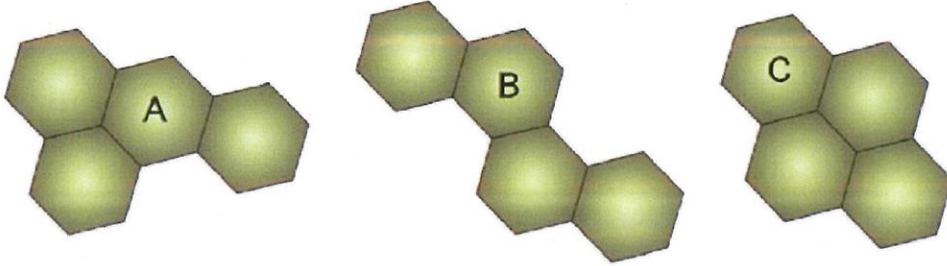
- a) Convert this area to hectares.

- b) Why isn't the area of NSW usually expressed in hectares?

- c) Would it be practical to express the area of NSW in square metres? Explain.

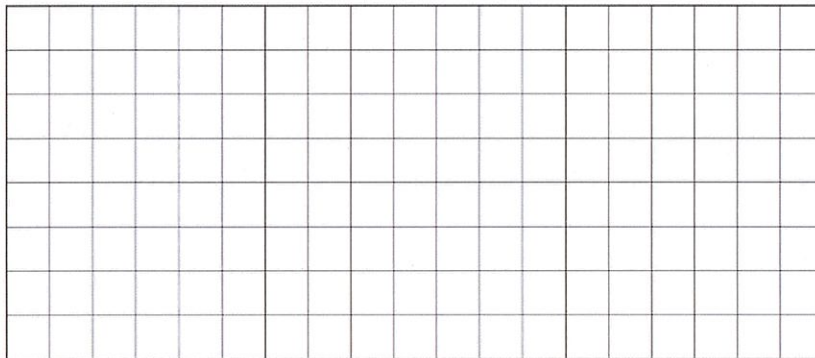
Chapter C Review

1. Hexagons are joined together to make three different shapes.



- a) Do all shapes have the same area? _____
- b) Which shape has the
- i. greatest perimeter? _____
- ii. least perimeter? _____

2. On this grid draw two shapes having the same perimeter, but different areas.



3. Convert the following areas to the units shown in parentheses.

a) 84 cm^2 (mm^2) _____

b) 7.6 ha (m^2) _____

4. If $1 \text{ m} = 100 \text{ cm}$, explain how you can show that $1 \text{ m}^2 = 10\,000 \text{ cm}^2$.

5. The Australian Government bought 1770 hectares of land at Badgery's Creek for a new Sydney airport. Convert this area to km^2 .



Image source: <http://www.manmonthly.com.au/news/badgerys-creek-airport-long-overdue-ai-group>

Part D: Area of Quadrilaterals and Triangles

You have previously been introduced to perimeter and area. In this booklet you will further develop your knowledge of area by investigating the area of rectangles, triangles, parallelograms and composite shapes.

The ability to determine the area of two-dimensional shapes and solve related problems is of fundamental importance in many everyday situations, such as carpeting a floor, painting a room, planting a garden, establishing and maintaining a lawn, installing concrete and paving, and measuring land for farming or building construction.

Indicators

By the end of this booklet, you will have been given the opportunity to work towards aspects of knowledge and skills including:

- developing and using the formulas to find the areas of rectangles and squares
- developing and using the formulas to find the areas of parallelograms and triangles, including triangles for which the perpendicular height needs to be shown outside the shape
- identifying the perpendicular heights of parallelograms and triangles in different orientations
- finding the areas of simple composite figures that may be dissected into rectangles, squares, parallelograms and triangles



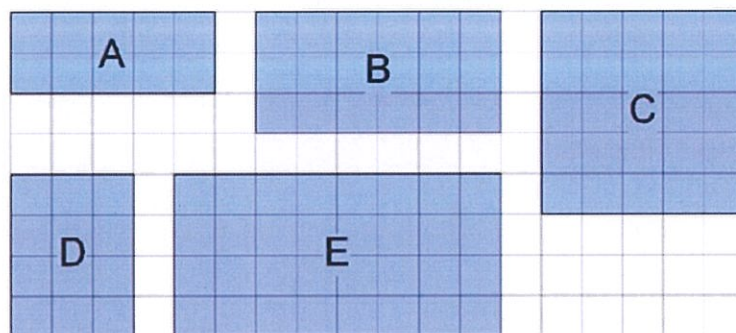
In Stage 3 you learned how to calculate the area of rectangles and squares. Here you will review and extend this knowledge.



Activity – Area of rectangles

Try these.

- Each of the squares on the background grid covers one square centimetre.



Complete the details for each rectangle.

Rectangle A

length = ____ cm

breadth = ____ cm

area = ____ cm²

Rectangle D

length = ____ cm

breadth = ____ cm

area = ____ cm²

Rectangle B

length = ____ cm

breadth = ____ cm

area = ____ cm²

Rectangle E

length = ____ cm

breadth = ____ cm

area = ____ cm²

Rectangle C

length = ____ cm

breadth = ____ cm

area = ____ cm²

Area of Rectangles and Squares



You can write a formula for this rule. A formula is just a rule expressed in algebraic symbols.

If the number of units of length is represented by l , and the number of units of breadth (or breadth) is represented by b , then the area, A , can be written:

$$\text{Area of rectangle} = l \times b$$

You must always make sure that both the length and breadth are measured in the same units, so that the area will be calculated in the same sort of square units.



The area for a square is found in the same way as for a rectangle. Remember, a square is a special rectangle where all four sides are equal in length.

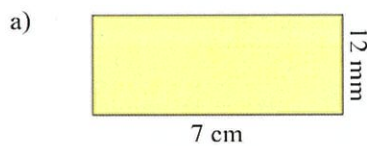
You can write a formula for the area of a square with side length s units as:

$$\text{Area of square} = s^2$$



Follow through the steps in this example.

Calculate the area of these plane shapes, giving your answers in square centimetres. (All corners are at right angles.)



Hint: this is a composite figure. You can find the area of this shape by dividing it into two rectangles.

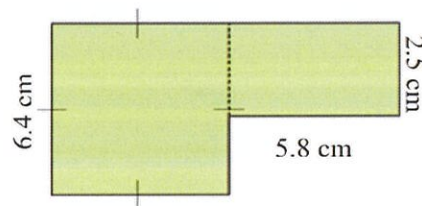
Solution

- a) The measurements are not in the same units.

Since area is required in cm^2 , change 12 mm to 1.2 cm.

$$\begin{aligned} A &= l \times b \\ &= 7 \times 1.2 \\ &= 8.4 \text{ cm}^2 \end{aligned}$$

- b) Divide this composite shape into a square and rectangle.



The area of the square is:

$$\begin{aligned} A &= s^2 \\ &= 6.4^2 \\ &= 40.96 \text{ cm}^2 \end{aligned}$$

The area of the rectangle is

$$\begin{aligned} A &= l \times b \\ &= 5.8 \times 2.5 \\ &= 14.5 \text{ cm}^2 \end{aligned}$$

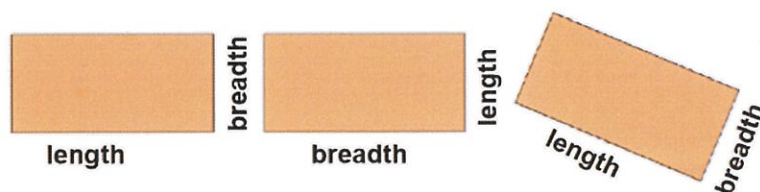
So the total area of the composite figure is:

$$\begin{aligned} \text{Total area} &= 40.96 + 14.5 \\ &= 55.46 \text{ cm}^2 \end{aligned}$$



There are different ways you could have divided the composite shape. Choose one that will give you the answer most conveniently.

It doesn't matter which side is designated the length and which the breadth. The answer will still be the same.




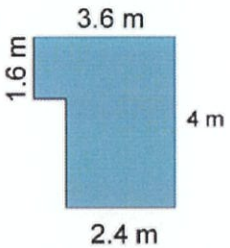


Activity – Area of rectangles

Try these.

3. Calculate the areas of these shapes. (All corners are at right angles.)

a)  _____

b)  _____

Now correct your answers from the suggested answers given below

Suggested Answers:

Check your responses to the activity against these suggested answers. If your answers are very different or if you do not understand an answer, contact your teacher.

3. a) $A = l \times b$
 $= 6.1 \times 3.5$
 $= 21.35 \text{ cm}^2$

- b) You can divide this shape lengthwise into a rectangle and square.

$$\begin{aligned}\text{Area of rectangle} &= 1.6 \times 3.6 \\ &= 5.76 \text{ m}^2\end{aligned}$$

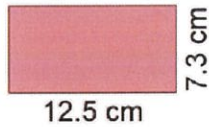
$$\begin{aligned}\text{Area of square} &= 2.4^2 \\ &= 5.76 \text{ m}^2\end{aligned}$$

$$\begin{aligned}\text{Total area} &= 5.76 + 5.76 \\ &= 11.52 \text{ m}^2\end{aligned}$$

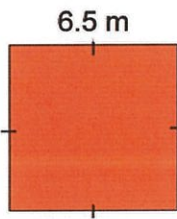
Exercise D. 1

1. Calculate the areas of each of the following rectangles, giving your answers in the correct units.

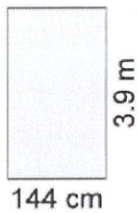
a)



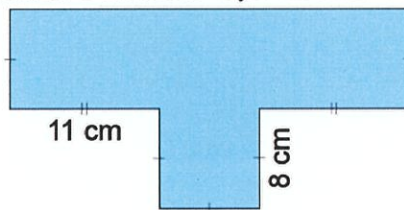
b)



2. Calculate the area of the following rectangle, giving your answers in square centimetres (write all units in centimetres first).



3. Calculate the area of this shape in two different ways. In each case describe your method.



Method 1

Method 2

4. A vineyard is in the shape of a rectangle 430 m long and 410 m wide.

a) Calculate its area in square metres and in hectares.

b) This white grape vineyard has 3800 vines planted in each hectare. How many vines will the wine grower plant in this vineyard? (Answer to the nearest hundred vines.)



Area of triangles

The following activity looks at the relationship between rectangles and triangles.

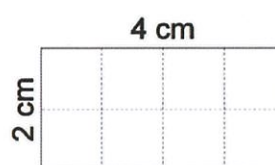


Activity – Area of triangles

Try these.

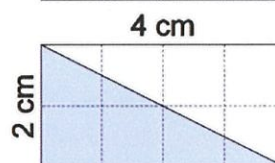
1. a) The rectangle shown is 4 cm long and 2 cm wide.

Calculate its area. _____



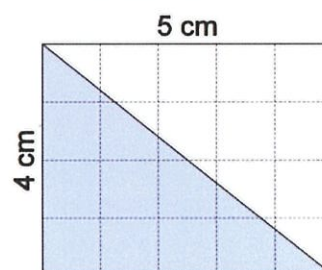
- b) What fraction of the rectangle has been shaded? _____

- c) What is the area of this triangle? _____

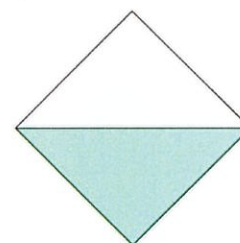


2. a) What is the area of the rectangle shown?

- b) What is the area of the shaded triangle?



3. The area of the square is 9 cm^2 . What is the area of the shaded triangle?



4. What relationship is there between the area of the triangle and the area of the rectangle?

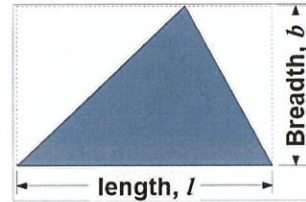


Did you see that the area of the triangle is half the area of the rectangle enclosing it? It doesn't matter where the apex of the triangle is. It could lie at the vertex of the rectangle, or along the edge of the rectangle.

You can write a formula for this rule.

If the number of units of length is represented by l , and the number of units of width is represented by b , then the area, A , of the triangle can be written as:

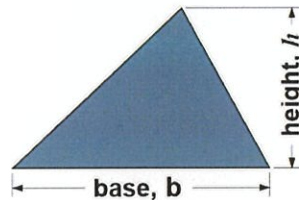
$$A = \frac{1}{2} \times l \times b$$



With triangles the base length is referred to as the base. The breadth is the perpendicular height. So the area of the triangle can be written as:

$$A = \frac{1}{2} \times \text{base} \times \text{perpendicular height}$$

$$\text{Area of triangle} = \frac{1}{2}bh$$



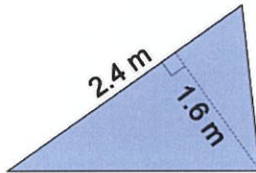
You must always make sure that both the base and perpendicular height are measured in the same units, so that the area will be calculated in the same square units.



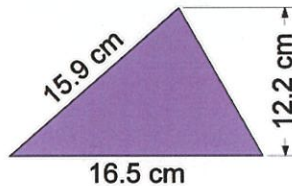
Follow through the steps in this example.

Calculate the areas of these triangles.

a)



b)



Solution

- a) It doesn't matter how you position the triangle.

Can you see that the base of this triangle is 2.4 m long, and the perpendicular to this base is 1.6 m long?

$$\begin{aligned}A &= \frac{1}{2}bh \\&= \frac{1}{2} \times 2.4 \times 1.6 \\&= 1.92 \text{ m}^2\end{aligned}$$

- b) The base length is 16.5 cm, and the perpendicular height of the triangle is 12.2 cm.

You do not use the slant height, 15.9 cm, given on this triangle.

Remember, the formula for the area of a triangle requires the perpendicular height.

$$\begin{aligned}A &= \frac{1}{2}bh \\&= \frac{1}{2} \times 16.5 \times 12.2 \\&= 100.65 \text{ cm}^2\end{aligned}$$

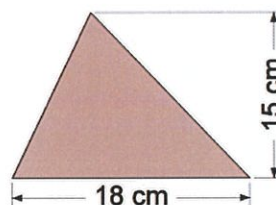
To calculate the area of a triangle look for the length of a base, and the perpendicular height from this base to the apex.



Activity – Area of triangles

Try these.

5. Calculate the area of this triangle.



Now correct your answers from the suggested answers given o

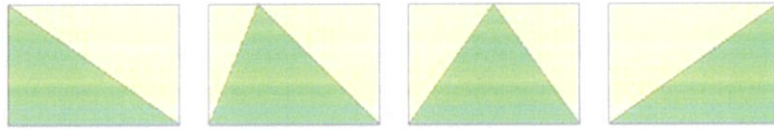
Suggested Answers:

Check your responses to the activity against these suggested answers. If your answers are very different or if you do not understand an answer, contact your teacher.

$$\begin{aligned}5. \quad A &= \frac{1}{2}bh \\&= \frac{1}{2} \times 18 \times 15 \\&= 135 \text{ cm}^2\end{aligned}$$

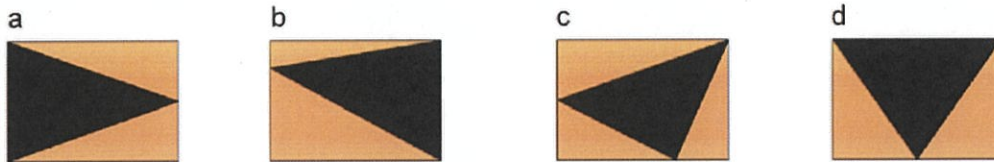
Exercise D.2

1. Four different triangles are drawn inside four identical rectangles.

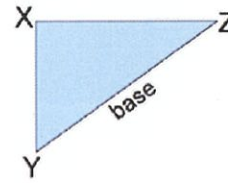
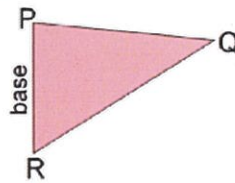
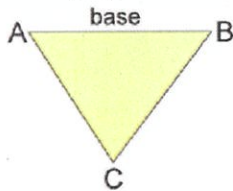


Explain why each of these triangles has the same area as the others.

2. Circle the diagram which shows a black triangle that does not have the same area as the others.

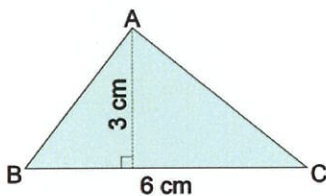


3. When calculating the area of a triangle you can choose any side of the triangle to be the base as long as you use the perpendicular drawn from the other vertex as the perpendicular height. Draw the perpendicular height of the triangle given the base marked.

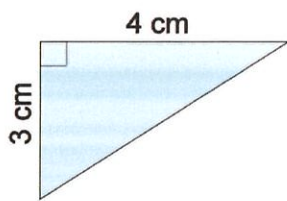


4. Calculate the areas of these triangles:

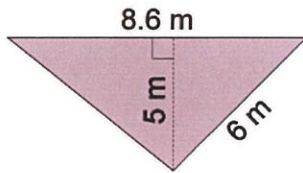
a)



b)

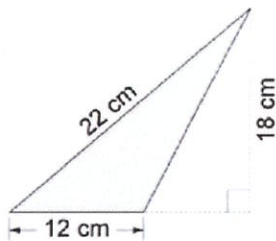


c)



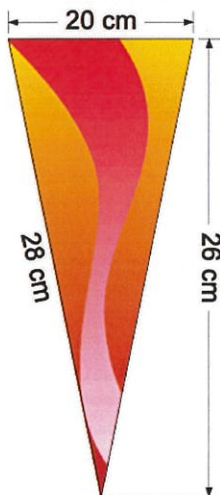
5. The area of a triangle formula can also be used for obtuse-angled triangles.

a) Calculate the area of this triangle.



b) Which value was not used? Why?

6. Ric and Ester were asked to calculate the area of felt needed to make this triangular pennant.



This is what they said.

$$\text{Area} = \frac{1}{2} \times 20 \times 28$$

$$= 280 \text{ cm}^2$$



$$\text{Area} = \frac{1}{2} \times 20 \times 26$$

$$= 260 \text{ cm}^2$$

Comment on who is correct and explain why.

Area of composite shapes

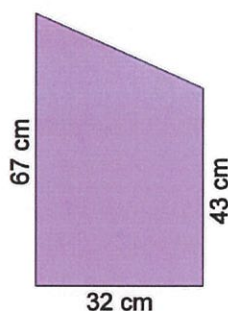


Many shapes are not simple triangles, rectangles, squares or parallelograms but can be constructed from them. **Composite shapes** are made up of simpler shapes joined together. To find their area you will need to identify the simpler shapes, such as rectangles, squares, and triangles.



Follow through the steps in this example.

Calculate the area of this shape.



Solution

This shape consists of a rectangle and a triangle.

Can you see that the height of the triangle is $67 - 43 = 24$ cm?

The area of the triangle is:

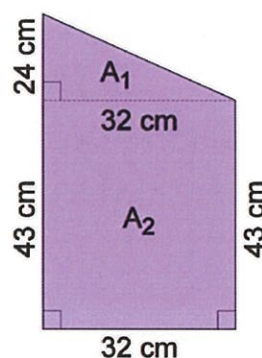
$$\begin{aligned} A &= \frac{1}{2} \times b \times h \\ &= \frac{1}{2} \times 32 \times 24 \\ &= 384 \text{ cm}^2 \end{aligned}$$

The area of the rectangle is:

$$\begin{aligned} A &= l \times w \\ &= 43 \times 32 \\ &= 1376 \text{ cm}^2 \end{aligned}$$

The total area is:

$$384 + 1376 = 1760 \text{ cm}^2$$

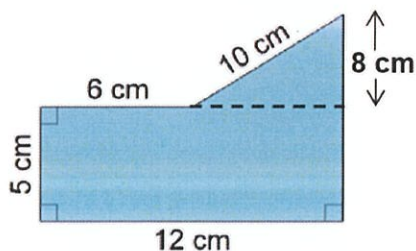




Activity – Areas of composite shapes

Try these.

1. Calculate the areas of the following composite shape.



Now correct your answers from the suggested answers given below

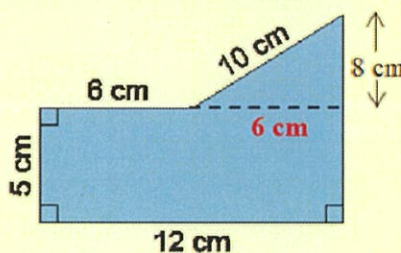
Suggested Answers:

Check your responses to the activity against these suggested answers. If your answers are very different or if you do not understand an answer, contact your teacher.

1. Area of rectangle = 12×5
= 60 cm^2

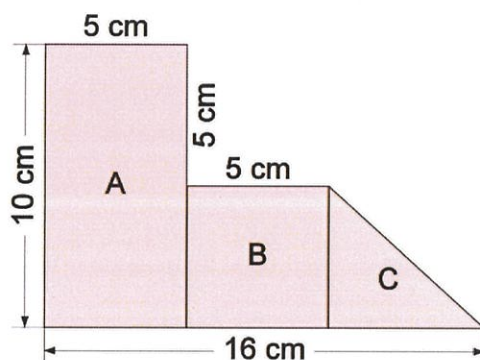
Area of triangle = $\frac{1}{2} \times 6 \times 8$
= 24 cm^2

Total area = $24 + 60$
= 84 cm^2



Exercise D.3

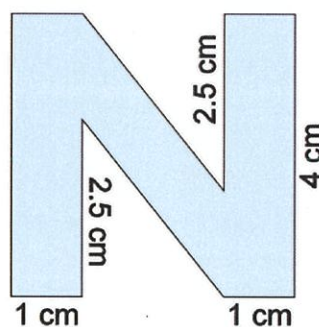
1. Calculate the area of each simple shape labelled A, B, and C. Hence determine the total area of the figure.



2. This letter N is made by cutting two equal triangular areas from a square of side 4 cm. Calculate:

a) the area of the original square:

b) the area of each triangle:



c) the area of the letter N.

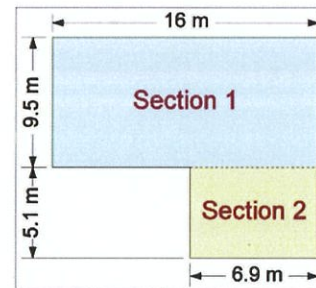
Chapter D Review

1. Calculate the area of this mat.



2. The floor area shown is to be covered with wooden tiles.

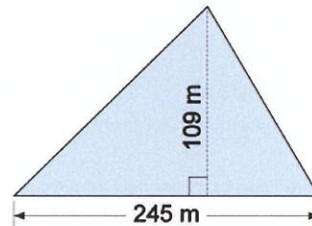
- a) Calculate the total area of floor.



- b) If floor tiles cost \$38.70 for each square metre, what is the cost of floor tiles for this area.

3. A small triangular park is to be seeded with grass.

- a) Calculate the area of the park in square metres and also in hectares.



- b) It costs \$94.25 per hectare for the grass seed. Calculate the cost of seed for this park to the nearest dollar.

Part E: Area of Circles

In this booklet you will investigate and apply the area of a circle. This will enable you to develop formulas to find areas of semicircles, quadrants and sectors.

The ability to determine the areas of two-dimensional shapes and solve related problems is of fundamental importance in many everyday situations, such as carpeting a floor, painting a room, planting a garden, establishing and maintaining a lawn, installing concrete and paving, and measuring land for farming or building construction.

Indicators

By the end of this booklet, you will have been given the opportunity to work towards aspects of knowledge and skills including:

- developing and using the formulas to find the areas of circles
- finding the areas of quadrants, semicircles and sectors
- solving a variety of practical problems involving circles and parts of circles, giving an exact answer in terms of π and an approximate answer using a calculator's approximation for π

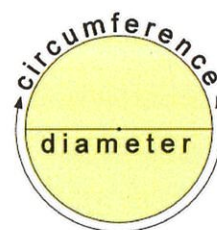
Estimating the area of a circle



From our previous study of the circle we found that the value of $\frac{\text{circumference}}{\text{diameter}}$ (or circumference \div diameter) of a circle produces a value a little over 3.

Mathematicians call this number π (pronounced 'pie') and it does not have an exact value.

From your calculator you can see that $\pi \approx 3.141592654$, and for most calculations this is all the accuracy you need.



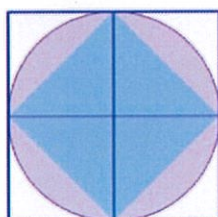
In this session you will estimate an approximate value for the area of a circle. You will see that π again appears here.



Consider a square drawn inside a larger square with its corners touching the midpoints of the sides of the larger square.



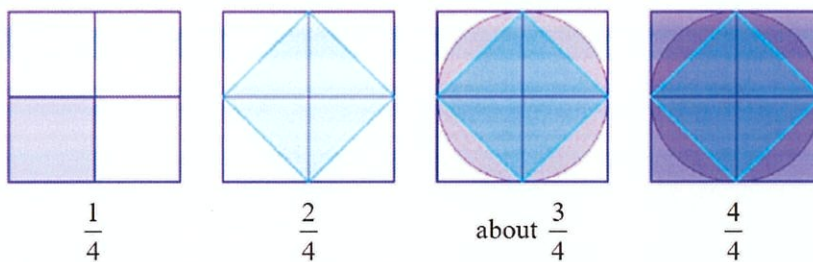
Can you see that the area of the smaller square is half the area of the larger square?



Now suppose you drew a circle inside the larger square, but outside the smaller square, as shown.

The area of the circle lies between the area of the smaller square and the area of the larger square

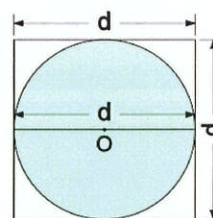
Overall, comparing the shaded areas to the area of the large square:



Can you see that the area of a circle will always be about $\frac{3}{4}$ of the area of the square around it?

If the diameter of the circle is d , then the area of the square is d^2 .

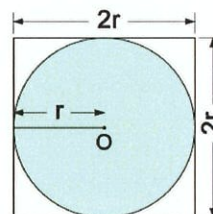
So the area of the circle is about $\frac{3}{4}$ of d^2 .



Now if the radius of the circle is r , the area of the square is $2r \times 2r = 4r^2$.

So the area of the circle is about $\frac{3}{4}$ of $4r^2$.

Area of a circle $\approx \frac{3}{4} \times 4r^2 = 3r^2$



This is just a quick method for finding an approximate value for the area of a circle.





Activity – Estimating the area of a circle

Try these.

1. A circle is drawn on a grid below. Take each small square on the grid as a unit square.

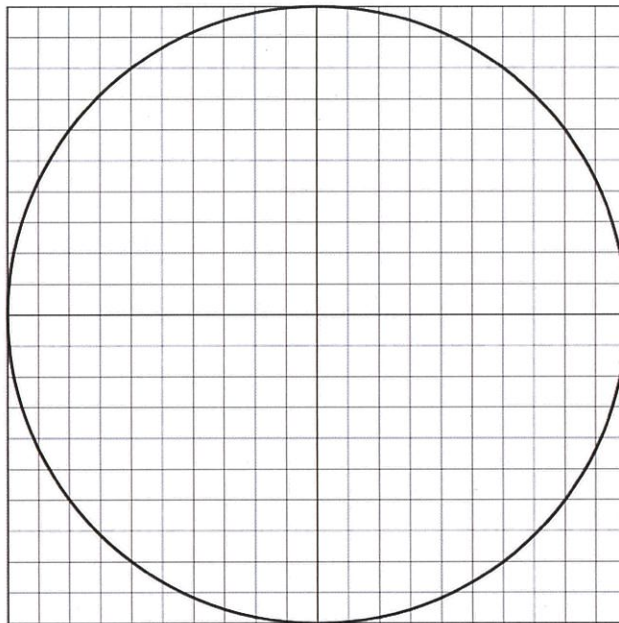
a) How many unit squares are there in the large square around the circle?

b) Tick each small square that has at least half of it inside the circle. This is the approximate area of the circle. Count the number of ticks.

Approximately how many unit squares make up the area of the circle?

c) The area of the circle is about $\frac{\quad}{400}$ the area of the large square.

d) If the radius of the circle is r , its area is $\frac{\quad}{400} \times 4r^2 = \quad r^2$



Suggested Answers:

Check your responses to the activity against these suggested answers. If your answers are very different or if you do not understand an answer, contact your teacher.

1. a) $20 \times 20 = 400$ square units
b) About 316 square units (your answer may vary slightly)
c) $\frac{316}{400}$
d) $\frac{316}{400} \times 4r^2 = 3.16r^2$

Area of a Circle Formula



The value you found is an improvement on the area of the circle, $A \approx 3r^2$, estimated before this activity.

You should notice that your value should be closer to π than to 3.

In fact the area of a circle is exactly π times the area of the square of the radius of a circle, therefore:

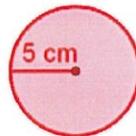
$$\text{Area of a circle} = \pi r^2$$



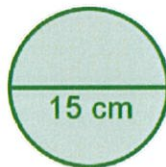
Follow through the steps in this example.

Calculate the area of the following circles.

- a) Write your answer correct to 1 decimal place



- b) Find the exact area of the following circle.



Solution

- a) radius (r) = 5 cm

$$\begin{aligned} A &= \pi r^2 \\ &= \pi \times 5^2 \\ &= 78.5 \text{ cm}^2 \end{aligned}$$

Note: you may have entered the following on your calculator:
qK05d=

$$\text{b) radius } (r) = \text{diameter} \div 2$$

$$\text{radius } (r) = 15 \div 2$$

$$\text{radius } (r) = 7.5 \text{ cm}$$

$$A = \pi r^2$$

$$= \pi \times 7.5^2$$

$$= 56.25\pi \text{ cm}^2$$

Note: When writing the exact area you must leave it in terms of π (the calculator value of π is only an approximation):



Activity – Estimating the area of a circle

Try these.

2. A circle has a radius of 20 mm.

- a) Calculate the exact area of the circle:(hint: leave your answer in terms of π)

- b) What is the area of the circle correct to one decimal place:

Now correct your answers from the suggested answers given below.

Suggested Answers:

Check your responses to the activity against these suggested answers. If your answers are very different or if you do not understand an answer, contact your teacher.

$$\begin{aligned} 2. \quad \text{a) Area of a circle} &= \pi r^2 \\ &= \pi \times 20^2 \\ &= \pi \times 400 \text{ mm}^2 \\ &= 400\pi \text{ mm}^2 \end{aligned}$$

Note: When writing the exact answer you must leave it in terms of π (the calculator

value of π is only an approximation).

$$\begin{aligned} \text{b) Area of a circle} &= \pi r^2 \\ &= \pi \times 20^2 \\ &= 1256.6 \text{ mm}^2 \end{aligned}$$

Exercise E. 1

1. a) Calculate the exact area of a circle that has a radius of 12 m.

- b) Another circle has a **diameter of 12 m**.

- i) Tick (✓) the answer you think is correct:

The area of a circle is:

- ☐ the same as the area of the circle above.
- ☐ half as big as the area of the circle above.
- ☐ a quarter of the area of the circle above.

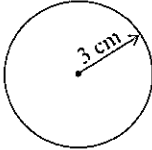
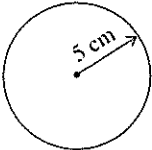
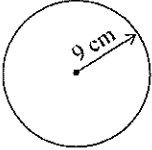
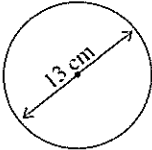
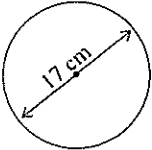
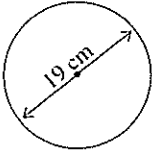
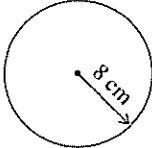
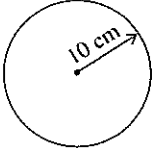
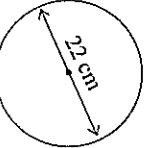
- ii) Check your answer above by calculating the exact area of this circle.

Did you tick the correct statement? _____

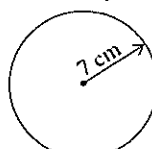
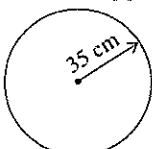
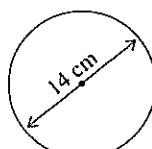
(You may change your tick above, if you wish)

Exercise E.2

QUESTION 1 Calculate the area of the following circles correct to one decimal place using the calculator value of π .

<p>a</p>  <p>_____</p> <p>_____</p>	<p>b</p>  <p>_____</p> <p>_____</p>	<p>c</p>  <p>_____</p> <p>_____</p>
<p>d</p>  <p>_____</p> <p>_____</p>	<p>e</p>  <p>_____</p> <p>_____</p>	<p>f</p>  <p>_____</p> <p>_____</p>
<p>g</p>  <p>_____</p> <p>_____</p>	<p>h</p>  <p>_____</p> <p>_____</p>	<p>i</p>  <p>_____</p> <p>_____</p>

QUESTION 2 By using $\frac{22}{7}$ as the value of π , find the approximate area of these circles.

<p>a</p>  <p>_____</p> <p>_____</p>	<p>b</p>  <p>_____</p> <p>_____</p>	<p>c</p>  <p>_____</p> <p>_____</p>
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QUESTION 3 Find the area, to one decimal place, of a circle with:

<p>a radius 25 km</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>b radius 1.8 m</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>c diameter 37 mm</p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>d radius 73 cm</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>e diameter 400 km</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>f diameter 13.9 cm</p> <p>_____</p> <p>_____</p> <p>_____</p>



Area of semicircles and quadrants

Semicircles



How can you calculate the area of a semicircle?



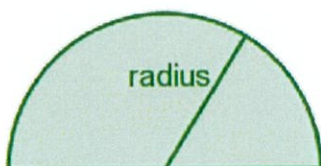
First you have to find the area of the whole circle and then divide it by two.

Or you could halve it.



Isn't that the same thing

Yeah. You could multiply the whole circle area by zero point five. That's the same thing as well.



$$\begin{aligned}\text{Area of a semicircle} &= \frac{1}{2} \times \text{area of a whole circle} \\ &= \frac{1}{2} \times \pi r^2 \quad (\text{or } \pi r^2 \div 2 \quad \text{or } 0.5 \times \pi r^2)\end{aligned}$$



Activity – Area of semicircles and quadrants

Try these.

1. Calculate the area of a semicircle that has a radius of 20 mm. Write your answer correct to one decimal place.

Now correct your answers from the suggested answers given o

Suggested Answers:

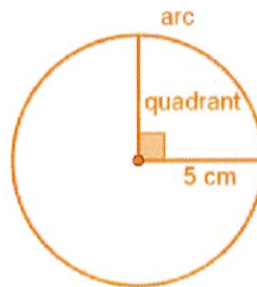
Check your responses to the activity against these suggested answers. If your answers are very different or if you do not understand an answer, contact your teacher.

$$\begin{aligned} 1. \quad \text{Area of a semicircle} &= \frac{1}{2} \times \text{area of a whole circle} \\ &= \frac{1}{2} \times \pi r^2 \\ &= \frac{1}{2} \times \pi \times 20^2 \\ &= 628.3 \text{ mm}^2 \end{aligned}$$

Quadrants



Remember, a **quadrant** is just another name for a quarter of a circle.



So, for a quadrant, you could first find the area of the whole circle and then divide by four ... or multiply by one quarter ... or multiply by zero point two five.



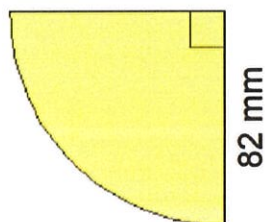
$$\begin{aligned}\text{Area of a quadrant} &= \frac{1}{4} \times \text{area of a whole circle} \\ &= \frac{1}{4} \times \pi r^2 \quad (\text{or } \pi r^2 \div 4 \quad \text{or } 0.25 \times \pi r^2)\end{aligned}$$



Activity – Area of semicircles and quadrants

Try these.

2. Answer the following questions about the quadrant below.



- a) Use your calculator to find the area of the quadrant using the following expressions, correct to the nearest whole number:

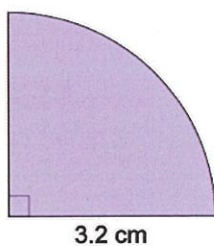
i) $A = \frac{1}{4} \times \pi \times 82^2$
= _____

ii) $A = \pi \times 82^2 \div 4$
= _____

iii) $A = 0.25 \times \pi \times 82^2$
= _____

- b) Do they all give the same answer? _____

3. Calculate the area of the quadrant below. Write your answer correct to 2 decimal places.



Now correct your answers from the suggested answers given on the next page.

Suggested Answers:

Check your responses to the activity against these suggested answers. If your answers are very different or if you do not understand an answer, contact your teacher.

2. a) i) $A \approx 5281 \text{ mm}^2$
ii) $A \approx 5281 \text{ mm}^2$
iii) $A \approx 5281 \text{ mm}^2$
b) All answers are the same.

It doesn't really matter which method you use as they all give the same answer. The important thing to remember is to divide the area of the whole circle by four or to multiply it by $\frac{1}{4}$ or 0.25. If you forget to do this you will get the wrong answer.

3. 8.04 cm^2

You could have calculated:

$$A = \frac{1}{4} \times \pi \times 3.2^2 \text{ or}$$

$$A = \pi \times 3.2^2 \div 4 \text{ or}$$

$$A = 0.25 \times \pi \times 3.2^2$$

Exercise E.3

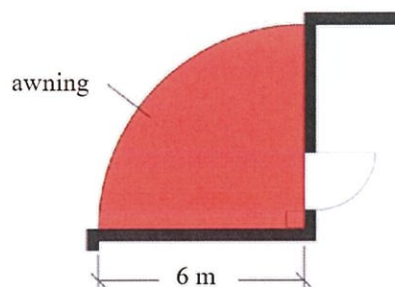
1. The fan below is semicircular. It has a diameter of 0.3 m and it is made out of a beautiful ivory-coloured lace.



- a) What is the radius of the fan? _____
- b) Ignoring the extra material needed to anchor the fan to its arms, how much material, in square metres is needed to make:
- i) one fan (write your answer correct to three decimal places)
- _____
- _____
- _____
- ii) 500 fans
- _____
- _____
- c) If this special lace costs \$150 per square metre, how much would it cost to buy the material for all 500 fans?
- _____
- _____

(Note: this calculation represents the minimum amount of material needed. You would always need to buy more to allow for wastage.)

2. The dimensions of a colourful awning for an entrance to a building are shown below.



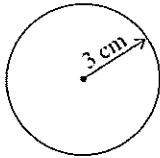
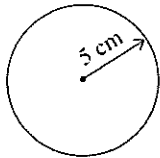
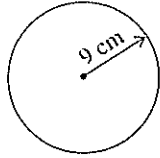
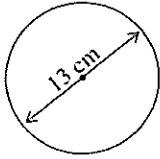
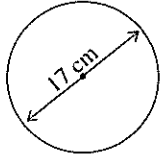
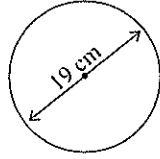
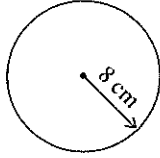
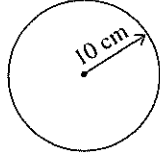
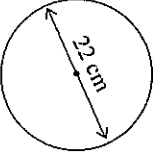
Complete the calculation for the amount of material needed to make this awning (write your answer to one decimal place).

Area of a whole circle = πr^2

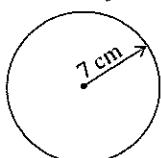
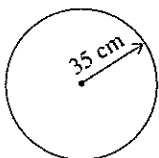
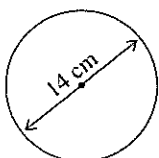
Area of quadrant = _____

Exercise E.4

QUESTION 1 Calculate the area of the following circles correct to one decimal place using the calculator value of π .

<p>a</p>  <p>_____</p> <p>_____</p>	<p>b</p>  <p>_____</p> <p>_____</p>	<p>c</p>  <p>_____</p> <p>_____</p>
<p>d</p>  <p>_____</p> <p>_____</p>	<p>e</p>  <p>_____</p> <p>_____</p>	<p>f</p>  <p>_____</p> <p>_____</p>
<p>g</p>  <p>_____</p> <p>_____</p>	<p>h</p>  <p>_____</p> <p>_____</p>	<p>i</p>  <p>_____</p> <p>_____</p>

QUESTION 2 By using $\frac{22}{7}$ as the value of π , find the approximate area of these circles.

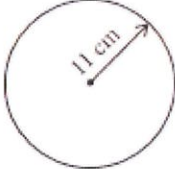
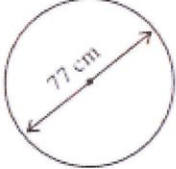
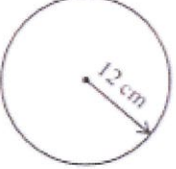
<p>a</p>  <p>_____</p> <p>_____</p>	<p>b</p>  <p>_____</p> <p>_____</p>	<p>c</p>  <p>_____</p> <p>_____</p>
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QUESTION 3 Find the area, to one decimal place, of a circle with:

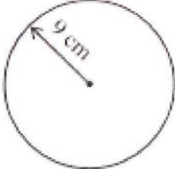
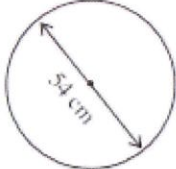
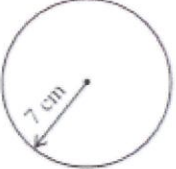
<p>a radius 25 km</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>b radius 1.8 m</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>c diameter 37 mm</p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>d radius 73 cm</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>e diameter 400 km</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>f diameter 13.9 cm</p> <p>_____</p> <p>_____</p> <p>_____</p>

Chapter E Review

QUESTION 1 Calculate the circumference of each circle correct to one decimal place.

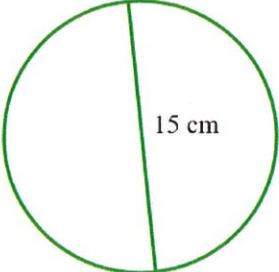
a		b		c	
<hr/> <hr/>		<hr/> <hr/>		<hr/> <hr/>	

QUESTION 2 Calculate the area of each circle correct to two decimal places.

a		b		c	
<hr/> <hr/>		<hr/> <hr/>		<hr/> <hr/>	

Calculate the area of the following figures correct to one decimal place.

a)



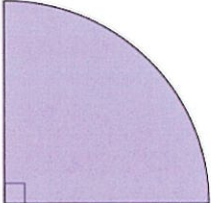
diameter = 15 cm

b)



7 mm

c)



20 cm
