National 5 Portfolio

N5

Relationships 1.4– Pythagoras, 2D Shape and Similarity

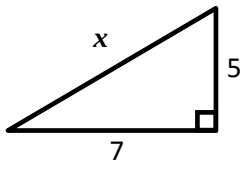
Section A - Revision

This section will help you revise previous learning which is required in this topic.

R1 I can use Pythagoras to calculate the third side of a right angled triangle given the other two.

1. Calculate the length of the side marked *x* in each triangle below

(a)



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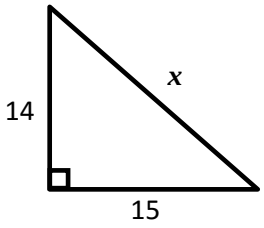

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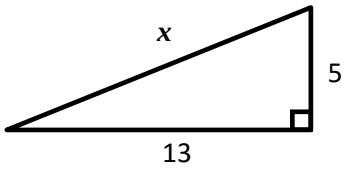

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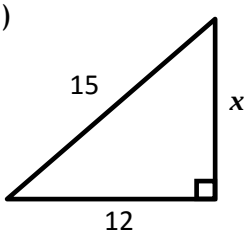

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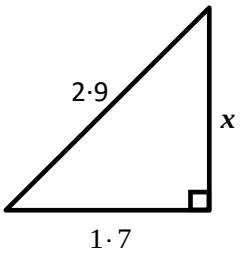

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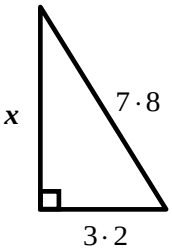

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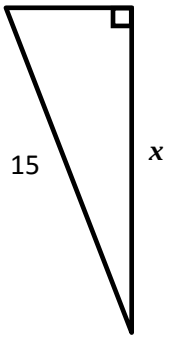

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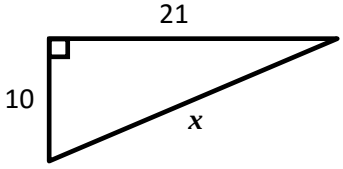
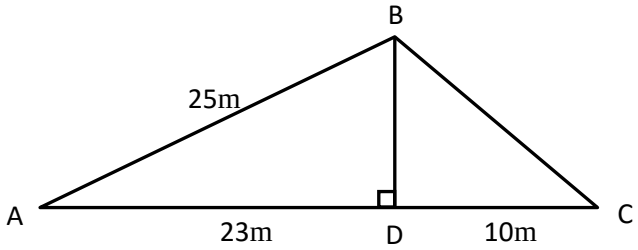
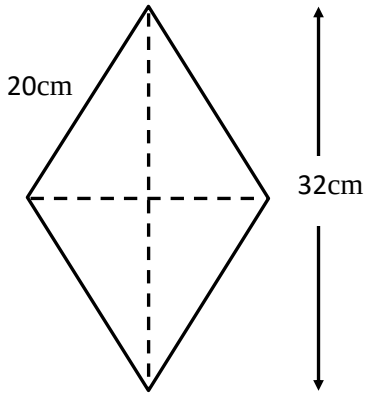


Pythagoras, 2D Shape and Similarity

2. Calculate the length of BC.



3. A rhombus has sides of 20cm and its longest diagonal measuring 32cm.

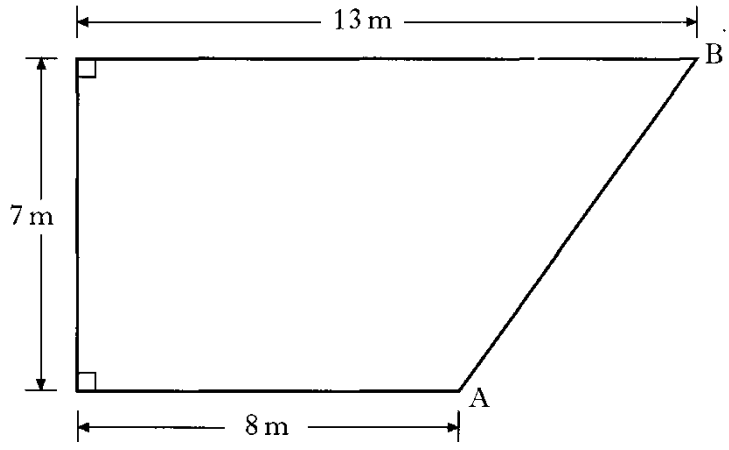


Calculate the length of the shorter diagonal.

4. The diagram shows the shape of a garden.

The gardener decides to plant a hedge along the side AB.

Calculate the length of the hedge.

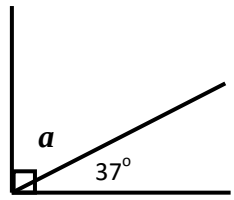


Pythagoras, 2D Shape and Similarity

R2 I can apply a number of angle facts to find unknown angles.

1. Calculate the size of the lettered angles a to m

(a)



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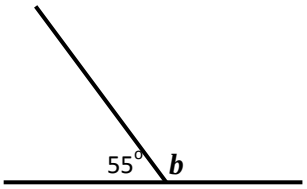

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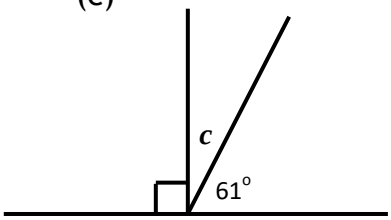

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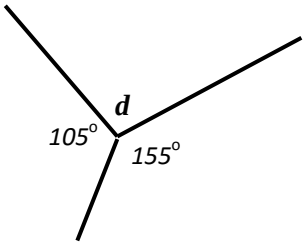

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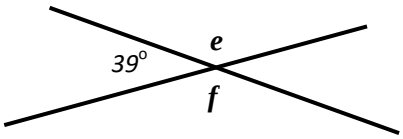

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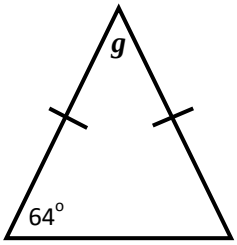

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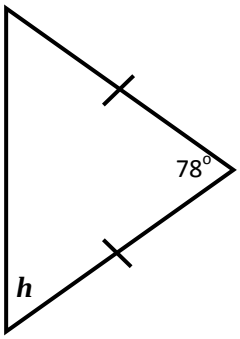

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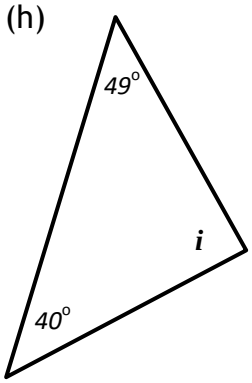

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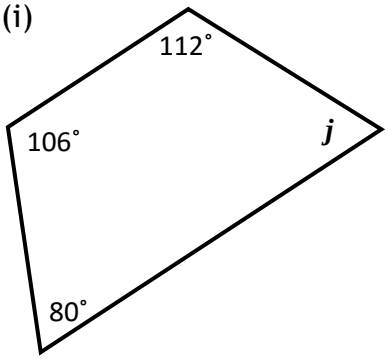

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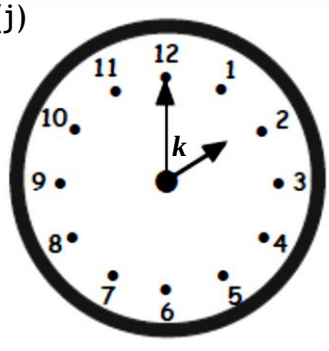
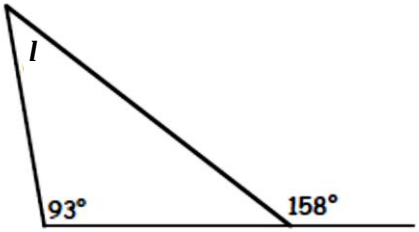


(k)



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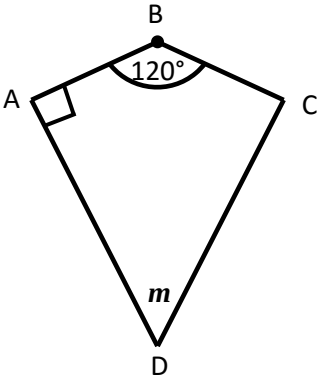
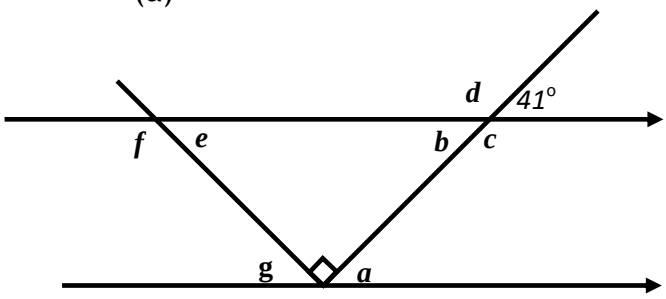


Pythagoras, 2D Shape and Similarity

2. Calculate the size of the lettered angles a to t

(a)



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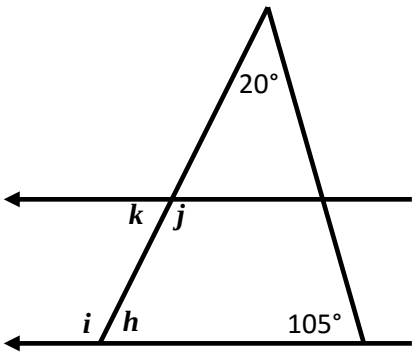

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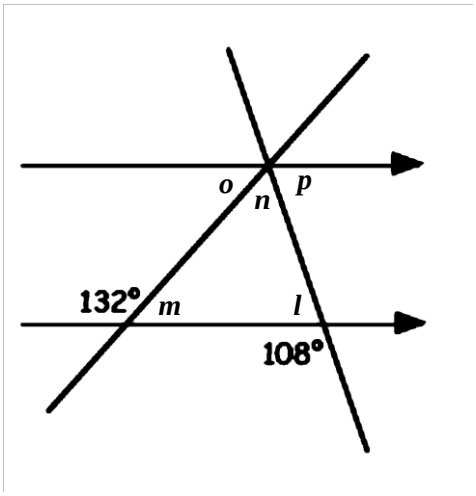

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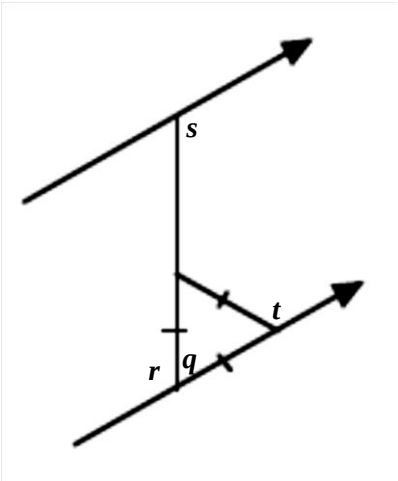


Pythagoras, 2D Shape and Similarity

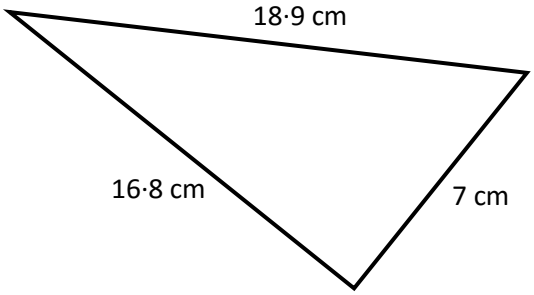
Section B - Assessment Standard Section

This section will help you practise for your Assessment Standard Test for Pythagoras, 2-dimentional shape and Similarity. (Relationships 1.4)

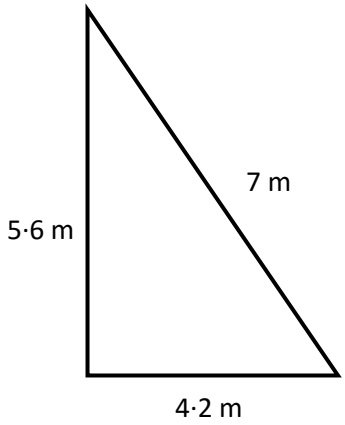
1. Which of the two triangles below are right angled?

Justify you answer.

(a)



(b)



2. (a) Two boxes are mathematically similar and both have to be wrapped with decorative paper. The large box with a height of 50cm requires $3{\cdot}5m^2$ of paper to cover it.

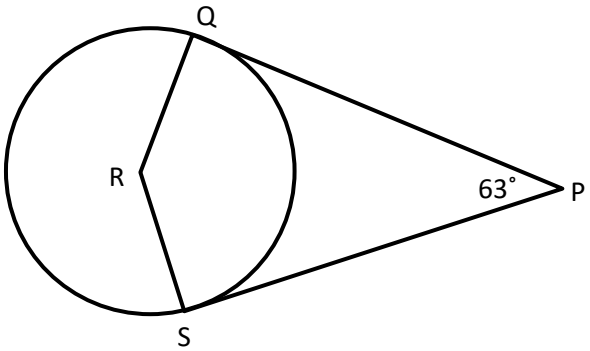
Calculate the amount of paper needed to cover the smaller box which has a height of 40cm.

(b) A fuel tank is 350 mm long. The volume of the fuel tank is 17 150 cm^3.

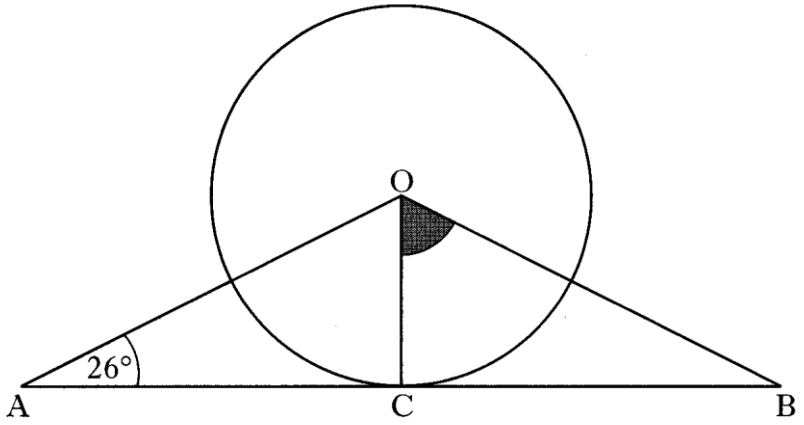
A similar but smaller fuel tank is 200 mm long.

Calculate the volume of the smaller fuel tank.

3. In the kite below PQ is the tangent to the circle at Q and PS is the tangent to the circle at S. If angle QPS is 63°, find angle QRS.



4.

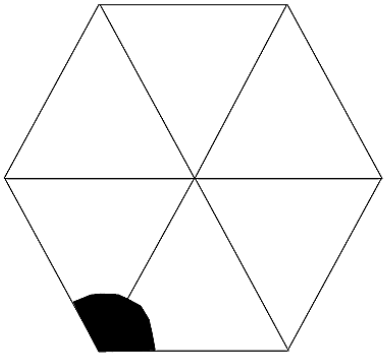


In the above diagram with circle centre O,

- Triangle AOB is isosceles
- AB is a tangent to the circle at C
- Angle CAO is 26˚.

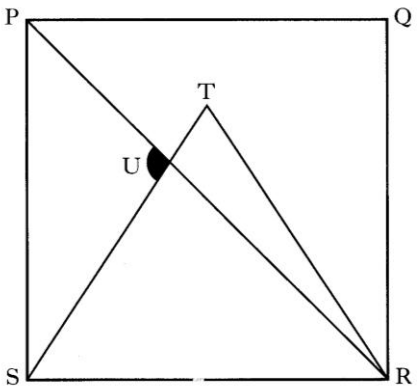
Calculate the size of the shaded angle COB.

5. Here is a regular, 6-sided polygon.



Calculate the size of the shaded angle.

6.



In the diagram shown

- PQRS is a square
- PR is a diagonal of the square
- Triangle RST is equilateral.

Calculate the size of the shaded angle SUP.

Pythagoras, 2D Shape and Similarity

Section C – Operational Skills Section

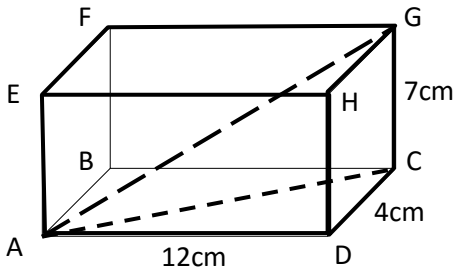
This section provides problems with the operational skills associated with Pythagoras, 2-dimentional shape and Similarity.

O1 I can use Pythagoras in questions involving 3-dimensional figures

1. Consider the cuboid opposite.

(a) Calculate the length of the face diagonal AC.

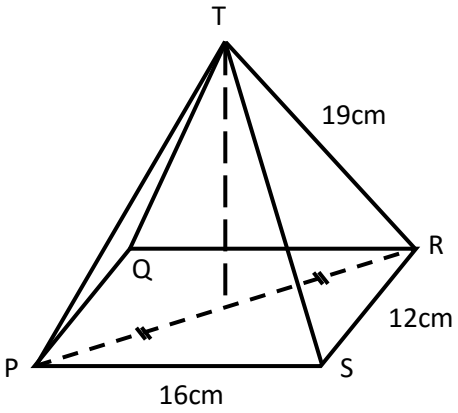
(b) Hence calculate the length of the space diagonal AG.



2. The pyramid opposite has a rectangular base.

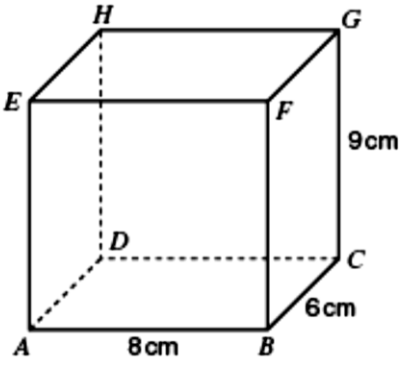
(a) Calculate the length of the base diagonal PR.

(b) Given that edge TR = 19cm, calculate the vertical height of the pyramid.



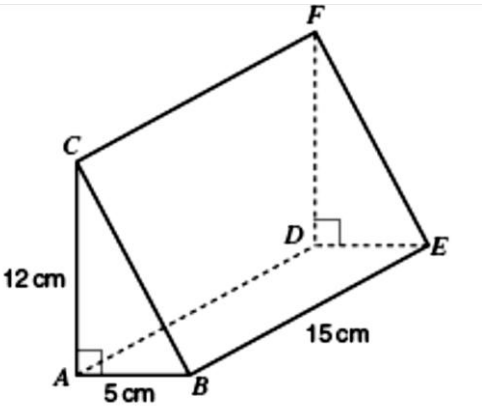
3. Consider the cuboid opposite.

Calculate the length of the space diagonal BH.



Pythagoras, 2D Shape and Similarity

4. The diagram opposite shows a triangular prism.



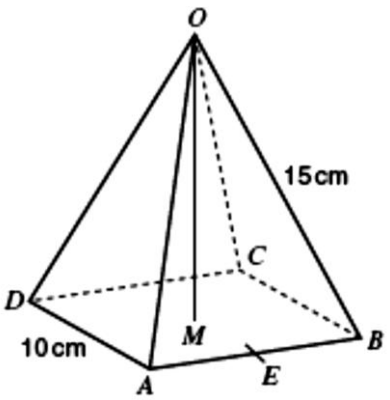
(a) Calculate the length of BC.

(b) Hence calculate the length of CE.

5. The diagram opposite shows a square-based pyramid.

The centre of the base is the point M and the vertex of the pyramid is O, so that OM is vertical.

The point E is the midpoint of the side AB.

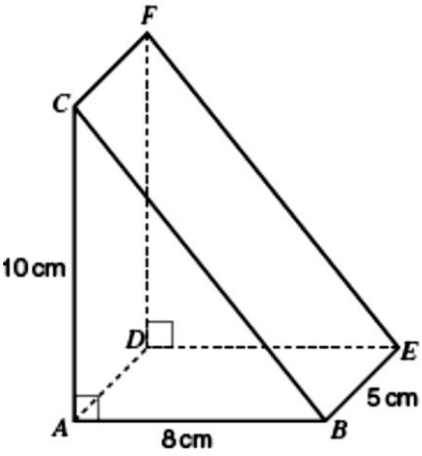


(a) Calculate the length of AM.

(b) Calculate the length of OM.

6. The diagram opposite shows a triangular prism.

Caluclate the length of the space diagonal BF.

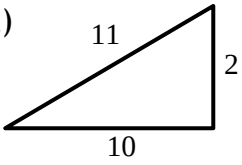


Pythagoras, 2D Shape and Similarity

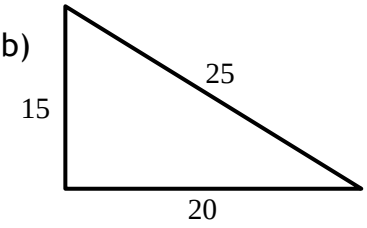
O2 I can use the converse of Pythagoras

1. Use the converse of Pythagoras to determine whether each triangle is right angled.

(a)



(b)



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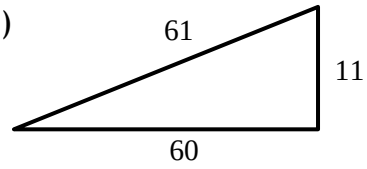

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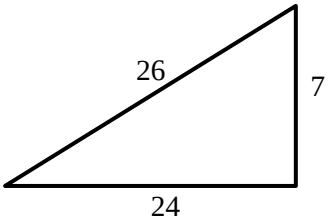

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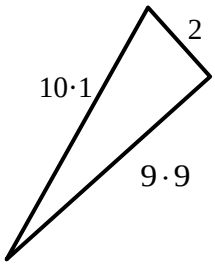
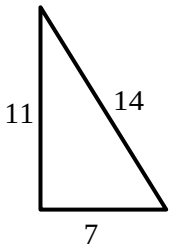
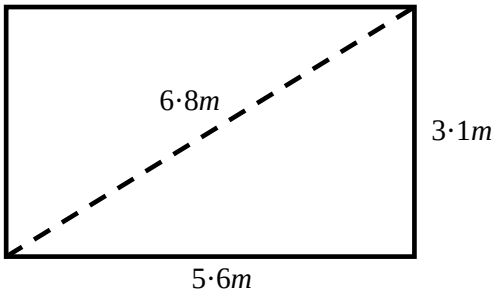


(f)



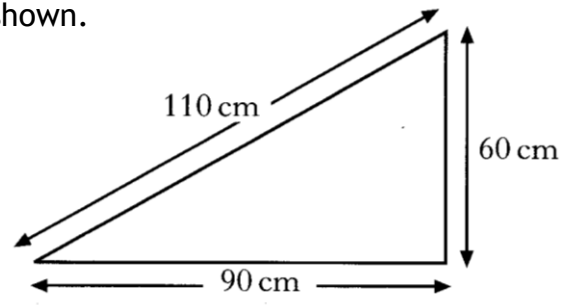
2. To check that a room has perfect right angles, a builder measures two sides of the room and its diagonal. The measurements are shown in this diagram.



Are the corners of the room right-angled?

3. A triangular paving slab has measurements as shown.

Is the slab in the shape of a right angled triangle?

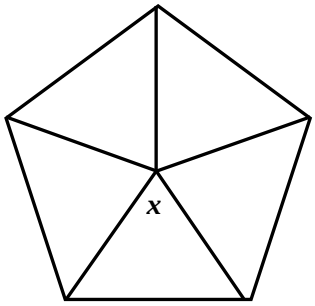


Pythagoras, 2D Shape and Similarity

O3 I can find the size of the interior angle of regular 2-dimentional shapes.

1. Calculate the size of $x°$

(a)



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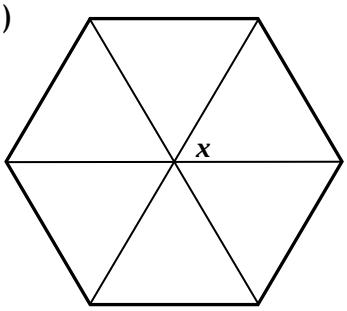

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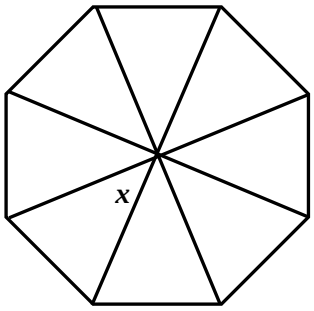
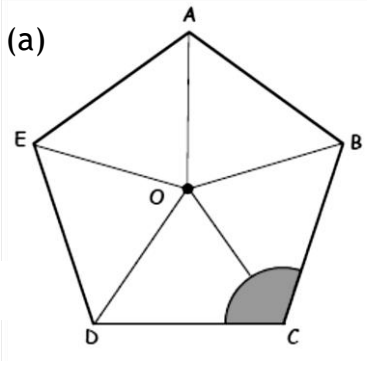
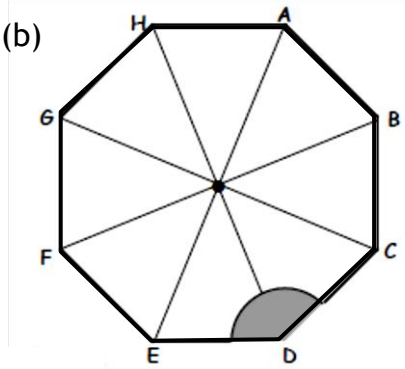


2. Calculate the shaded angles

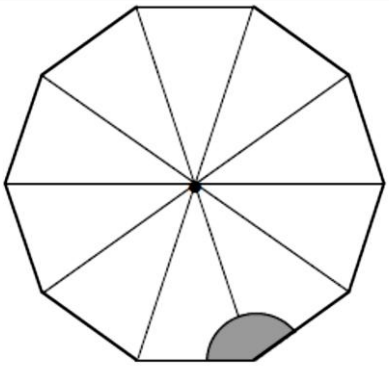
(a)



(b)



(c)

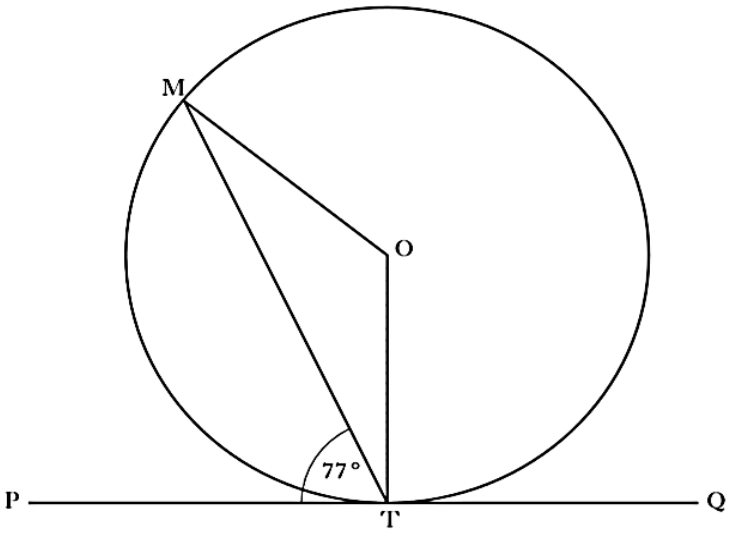


O4 I can apply my knowledge of angle facts in problems involving circles.

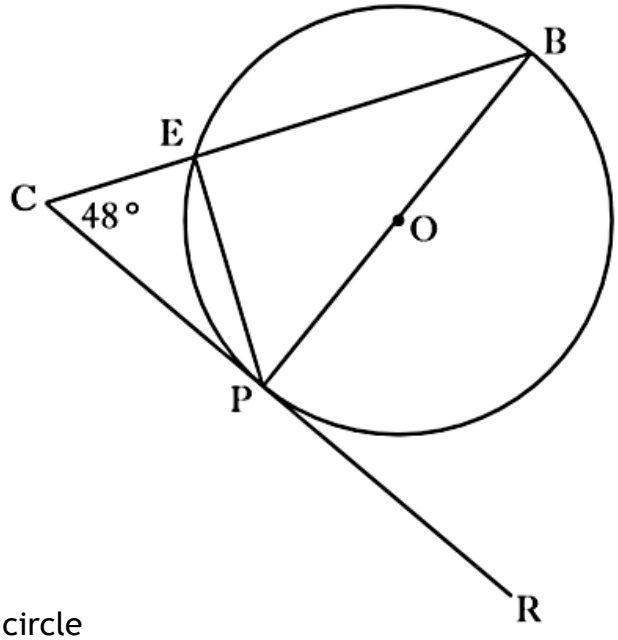
1. The tangent PQ touches the circle, centre O, at T.

Angle MTP is 77°.

Calculate the size of angle MOT.



2. A circle, centre O, is shown below.

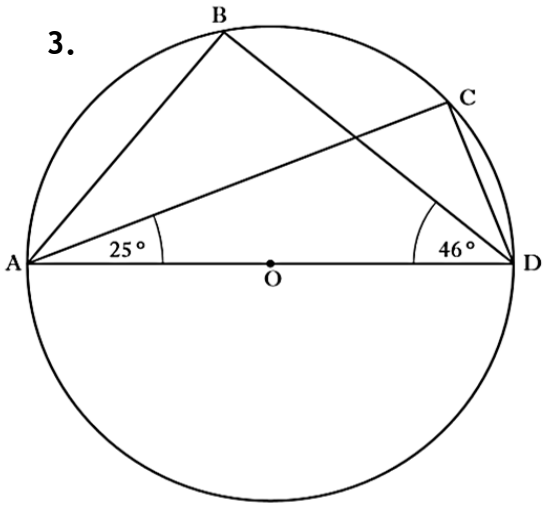


In the circle

- PB is a diameter
- CR is a tangent to the circle at point P
- Angle BCP is 48°.

Calculate the size of angle EPR.

3.



AD is a diameter of a circle, centre O.

B and C are points on the circumference of the circle.

Angle CAD = 25°.

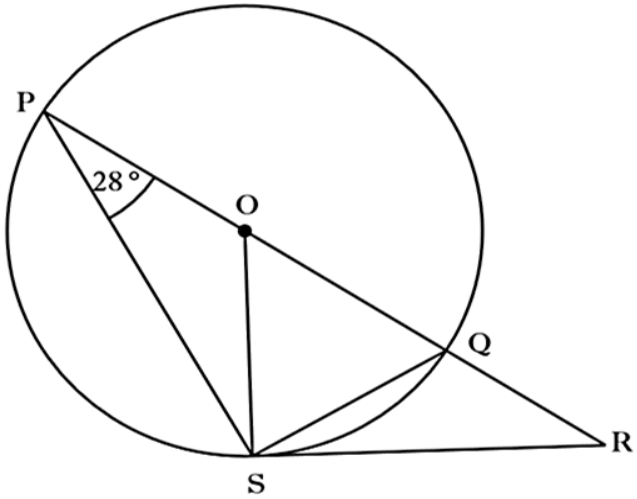
Angle BDA = 46°.

Calculate the size of angle BAC.

4. In the diagram opposite,

- O is the centre of the circle
- PQ is a diameter of the circle
- PQR is a straight line
- RS is a tangent to the circle at S
- Angle OPS is 28°.

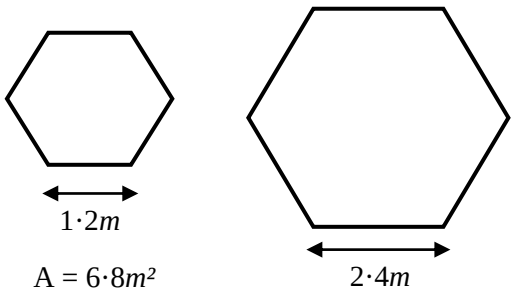
Calculate the size of angle QRS.



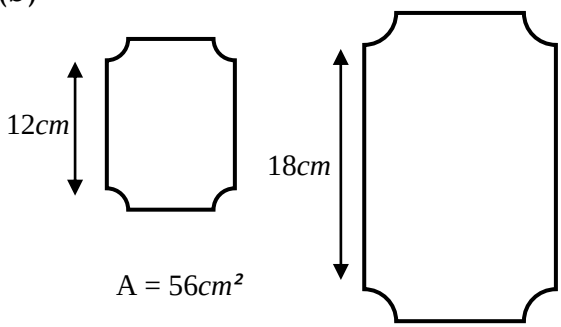
O5 I can calculate areas and volumes of similar shapes.

1. These shapes are mathematically similar. The area of the smaller shape is given calculate the area of the larger shape

(a)

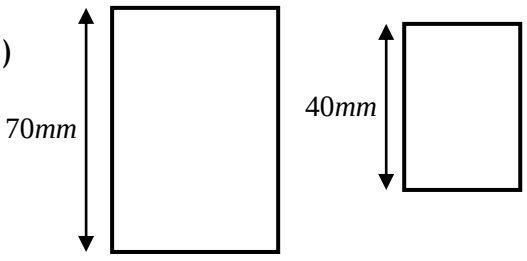


(b)

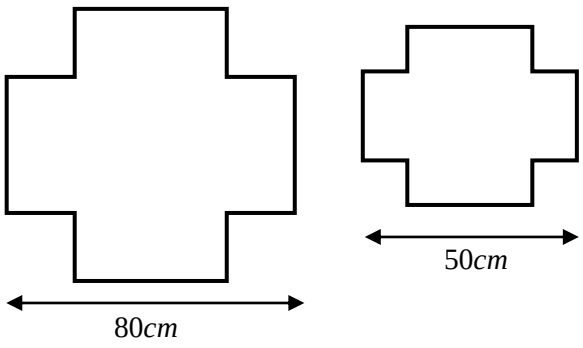


2. These shapes are mathematically similar. The area of the larger shape is given calculate the area of the smaller shape

(a)



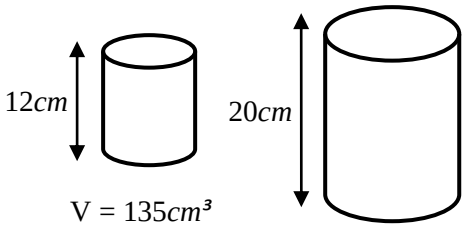
(b)



Pythagoras, 2D Shape and Similarity

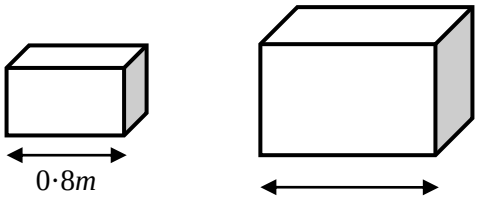
3. These shapes are mathematically similar. The volume of the smaller shape is given calculate the volume of the larger shape

(a)



V = 135cm^3

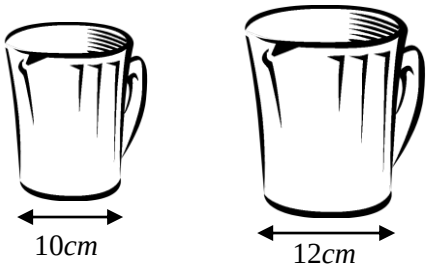
(b)



V = 2·4m^3

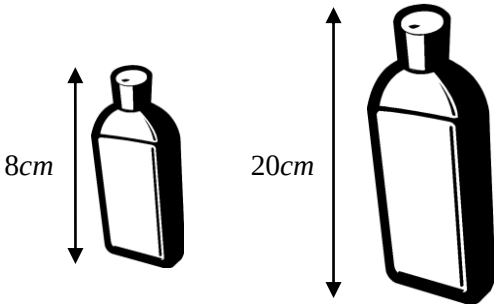
4. These shapes are mathematically similar. The volume of the larger shape is given calculate the volume of the smaller shape

(a)



V = 864ml

(b)



V = 2000cm^3

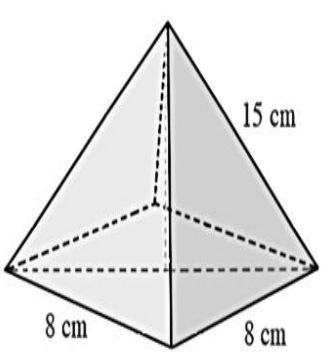
Pythagoras, 2D Shape and Similarity

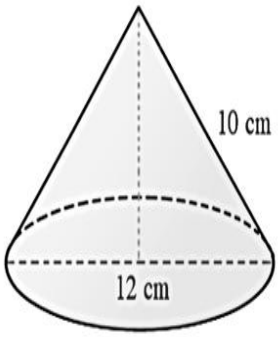
Section D - Reasoning Skills Section

This section provides problems with Reasoning Skills in the context of Pythagoras, 2-dimentional shape and Similarity.

1. Shown are a square based pyramid and a cone.

By calculating the height of both, decide which has the greater **volume** and by how much.

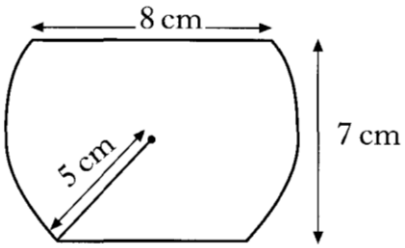




2. A badge is made from a circle of radius 5 centimetres.

Segments are taken off the top and the bottom of the circle as shown.

The straight edges are parallel.



The badge measures 7 centimetres from the top to the bottom.

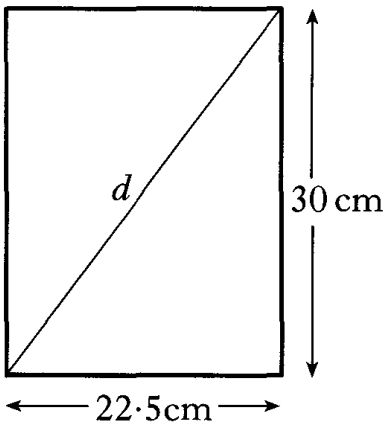
The top is 8 centimetres wide.

Calculate the width of the base.

Pythagoras, 2D Shape and Similarity

3. A **rectangular** picture frame is to be made.

It is 30 centimetres high and 22·5 centimetres wide, as shown.



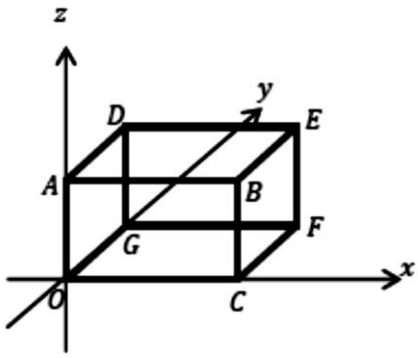
To check that the frame is rectangular, the diagonal, d, is measured.

It is 37·3 centimetres long.

Is the frame rectangular?

4. Look at the cuboid shown on the coordinate diagram.

The coordinates of point E are $(5, 3, 1)$



(a) State the coordinates of F

(b) State the coordinates of G

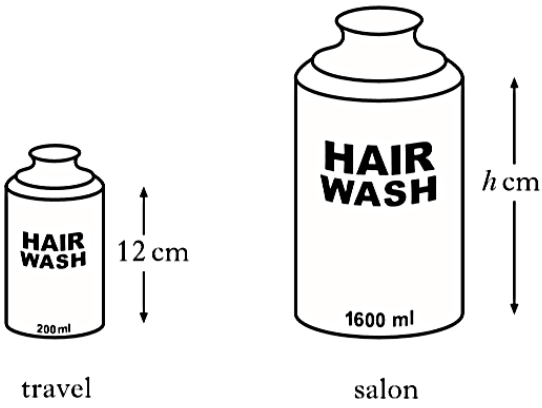
(c) What is the shortest distance between points D and C?

5. Shampoo is available in travel size and salon size bottles.

The bottles are mathematically similar.

The travel size contains 200 millilitres and is 12 centimetres in height.

The salon size contains 1600 millilitres.

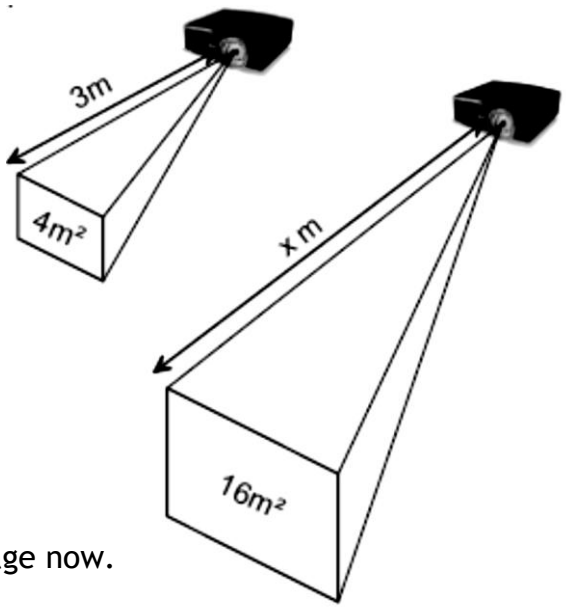


Calculate the height of the salon size bottle.

Pythagoras, 2D Shape and Similarity

6. A projector positioned 3 metres from a screen produces a rectangular image of 4 square metres.

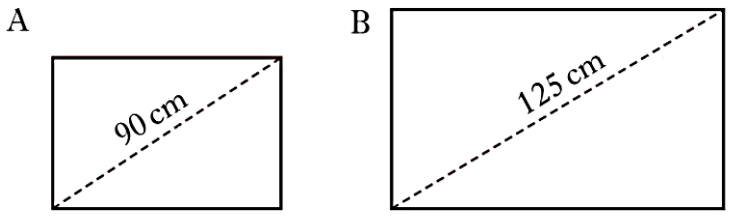
The projector is moved further back, as shown opposite, and the rectangular image now produced is 16 square metres.



Calculate how far the projector is from the image now.

7. Two rectangular solar panels, A and B, are mathematically similar.

Panel A has a diagonal of 90 centimetres and an area of 4020 square centimetres.



A salesman claims that panel B, with a diagonal of 125 centimetres, will be double the area of panel A.

Is this claim justified?

Show all your working.

Pythagoras, 2D Shape and Similarity

Answers

Section A – Revision

R1

Q1 (a) $x = 8 \cdot 6$ (b) $x = 20 \cdot 5$ (c) $x = 13 \cdot 9$ (d) $x = 9$

(e) $x = 2 \cdot 3$ (f) $x = 7 \cdot 1$ (g) $x = 14 \cdot 5$ (h) $x = 23 \cdot 3$

Q2 $BC = 14$ m Q3 $24cm$ Q4 $8 \cdot 6m$

R2

Q1 (a) $a = 53°$ (b) $b = 125°$ (c) $c = 29°$ (d) $d = 100°$

(e) $e = f = 141°$ (f) $g = 52°$ (g) $h = 51°$ (h) $i = 91°$

(i) $j = 62°$ (j) $k = 60°$ (k) $l = 65°$ (l) $m = 60°$

Q2 (a) $a = 41°$ $b = 41°$ $c = 139°$ $d = 139°$ $e = 49°$ $f = 131°$ $g = 49°$

(b) $h = 55°$ $i = 125°$ $j = 125°$ $k = 55°$

(c) $l = 72°$ $m = 48°$ $n = 60°$ $o = 48°$ $p = 72°$

(d) $q = 60°$ $r = 120°$ $s = 120°$ $t = 120°$

Section B – Practice Assessment Standard Questions

Q1 Triangle (b) Q2 (a) 2·24 m² (b)3200 cm³ Q3 117°

Q4 64° Q5 120° Q6 105°

Section C – Operational Skills

O1

Q1 (a) $AC = 12 \cdot 6cm$ (b) $AG = 14 \cdot 4cm$

Q2 (a) $PR = 20cm$ (b) $16 \cdot 2cm$

Q3 $BH = 13 \cdot 5cm$

Q4 (a) $BC = 13cm$ (b) $CE = 19 \cdot 8cm$

Q5 (a) $AM = 7 \cdot 1cm$ (b) $OM = 13 \cdot 2cm$

Q6 $BF = 13 \cdot 7cm$

Pythagoras, 2D Shape and Similarity

O2

Q1 (a) $Not\ right\ angled$ (b) $Right\ angled$

(c) $Right\ angled$ (d) $Not\ right\ angled$

(e) $Right\ angled$ (f) $Not\ right\ angled$

Q2 $Corners\ are\ not\ right\ angled$

Q3 $The\ slab\ is\ not\ right\ angled$

O3

Q1 (a) $x = 72°$ (b) $x = 60°$ (c) $x = 45°$

Q2 (a) $108°$ (b) $135°$ (c) $144°$

O4

Q1 $MOT = 154°$

Q2 $EPR = 138°$

Q3 $BAC = 19°$

Q4 $QRS = 34°$

O5

Q1 (a) $27 \cdot 2m^2$ (b) $126cm^2$

Q2 (a) $2400mm^2$ (b) $3000cm^2$

Q3 (a) $625cm^3$ (b) $8 \cdot 1m^3$

Q4 (a) $500ml$ (b) $128cm^3$

Section D - Reasoning Skills Section

Q1 $Volume\ of\ cone\ is\ greater\ by\ (301 \cdot 59 - 296 \cdot 53) = 5 \cdot 06cm^3$

Q2 $width = 6cm$

Q3 $The\ frame\ is\ not\ rectangular\ as\ 22 \cdot 5^2 + 30^2 \neq 37 \cdot 3^2$

Q4 (a) $F(5, 3, 0)$ (b) $G(0, 3, 0)$ (c) $5 \cdot 9\ or\ \sqrt{35}$

Q5 $salon\ height = 24cm$

Q6 $x = 6m$ Q7 $No\ as\ 7754 \cdot 6 \neq 8040$