

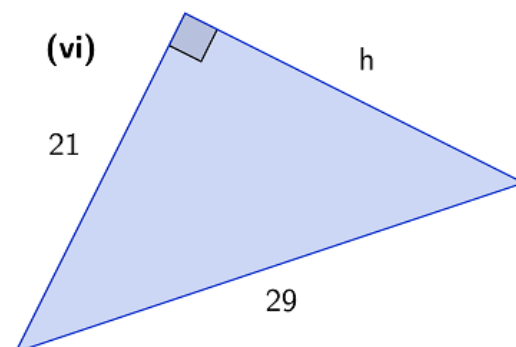
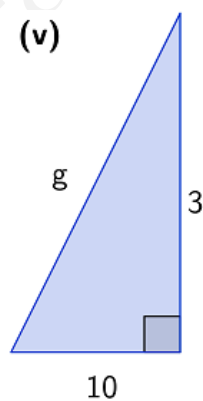
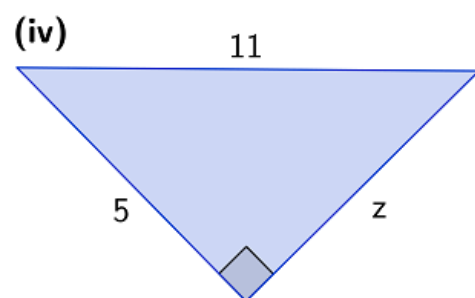
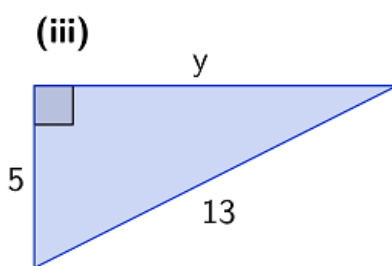
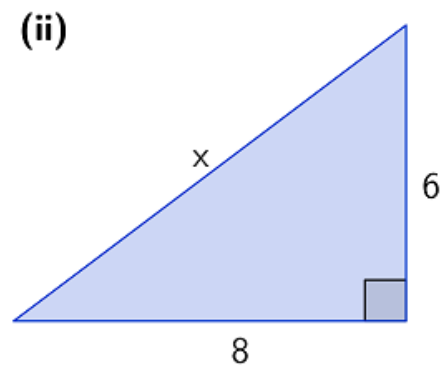
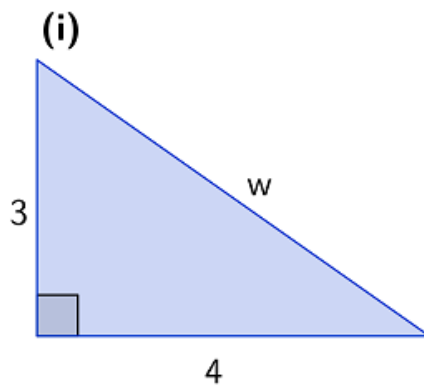
## Paper 2 Revision

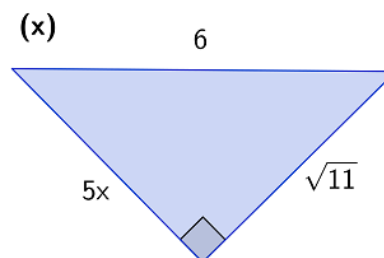
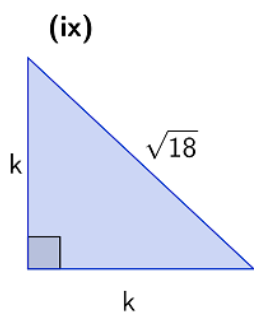


## 1 Trigonometry

## 1.1 Pythagoras Theorem

1. Calculate the unknown length in each of the following right-angle triangles.





2. A television's size is measured along the diagonal, in this case the television is advertised as being 130cm. If the height is given as 50cm, what is the width?

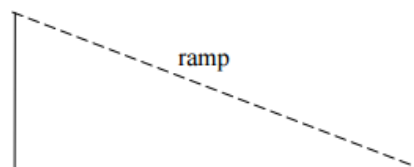
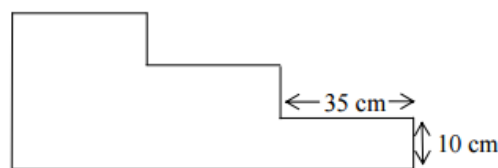


3. (2015 P2 Q12)

- (a) The triangle  $PQR$  has sides of length 8, 11, and  $y$ .  
Write down one value of  $y$  for which the triangle  $PQR$  is an isosceles triangle.
- (b) The triangle  $STU$  has sides of length 4, 7, and  $x$ .  
Find the **two** values of  $x$  for which the triangle  $STU$  is a right angled triangle.  
Give each answer in surd form.

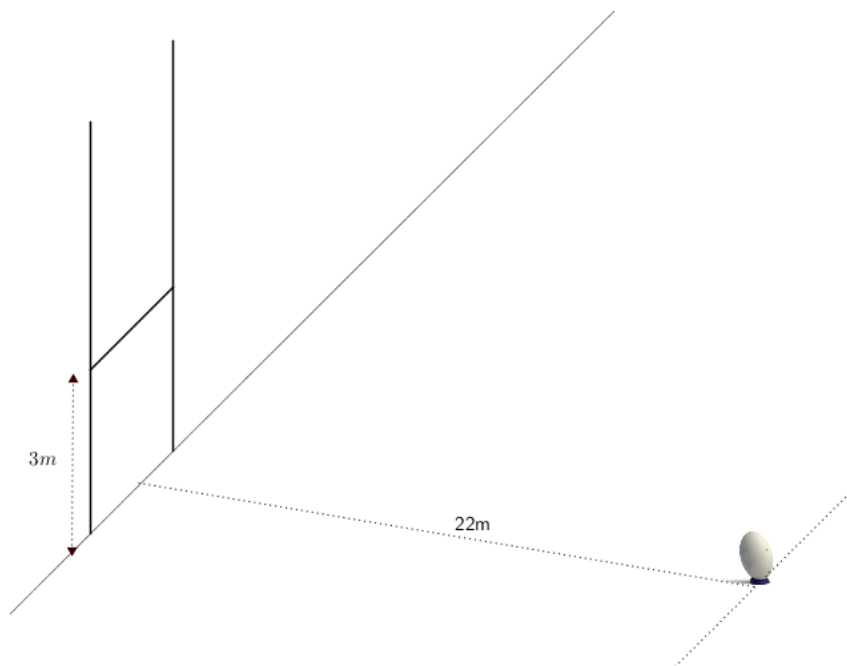
4. (2012 P2 Q12)

A homeowner wishes to replace the three identical steps leading to her front door with a ramp. Each step is 10 cm high and 35 cm long. Find the length of the ramp. Give your answer correct to one decimal place.

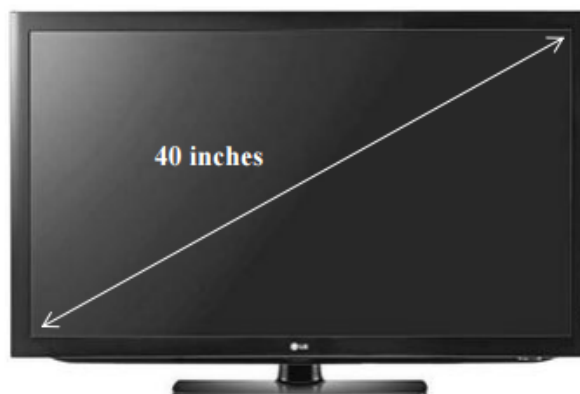




5. Munster's out-half has a kick straight in front of the posts from the 22m line. What is the minimum distance the ball has to travel to get over the 3m cross-bar.



6. **(2011 P2 Q14)** Mary is thinking of buying a new television. The television is advertised as having a 40 inch screen. This refers to the diagonal measurement of the screen. The aspect ratio of a television screen is the ratio of its width to its height. For this television, the aspect ratio is 16:9 (sixteen units wide for every nine units in height).



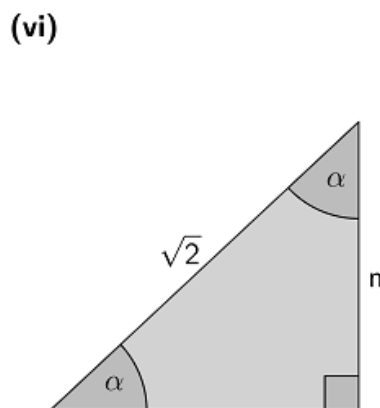
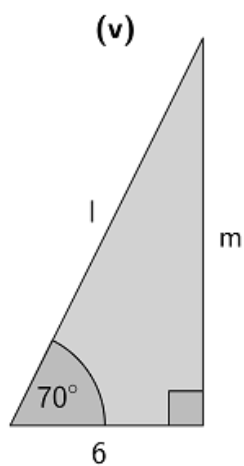
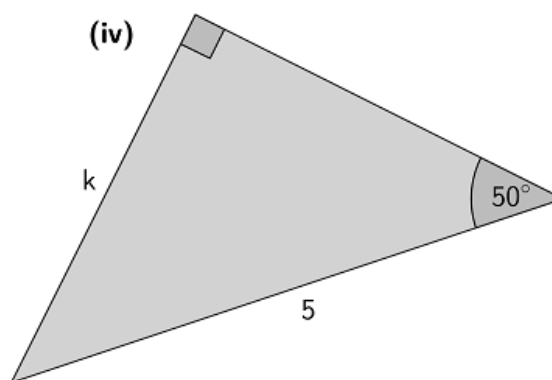
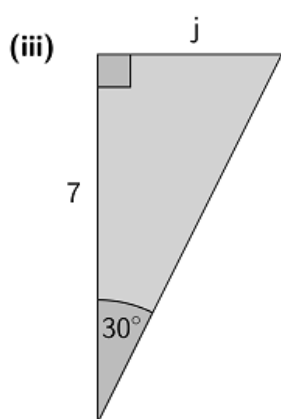
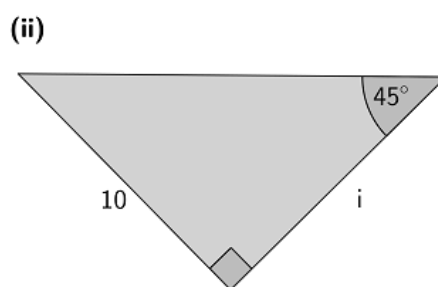
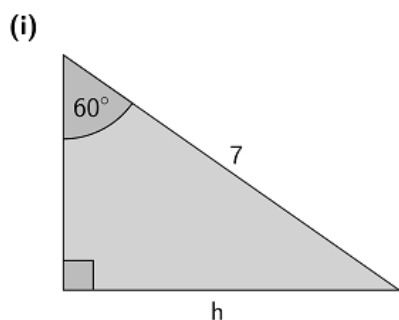
- Convert 40 inches to centimetres if  $1 \text{ inch} = 2.54 \text{ cm}$ .
- Find the width and the height of the screen, in centimetres. Give your answer correct to the nearest cm.
- A different 40 inch television screen has an aspect ratio of 4 : 3. Which of the two television screens has the greatest area, and by how much?





## 1.2 Sine/Cosine/Tangent

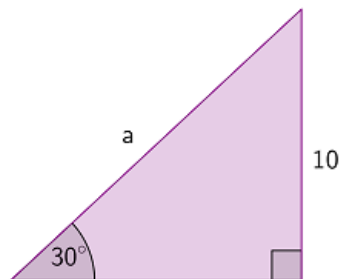
1. Calculate the lengths of the unknown sides in the following triangles, leaving your answer in surd form ( $\sqrt{a}$ ) when necessary.



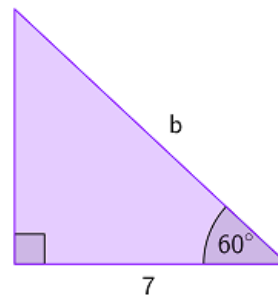


2. Calculate the lengths of the unknown sides in the following triangles, leaving your answer in surd form ( $\sqrt{a}$ ) when necessary.

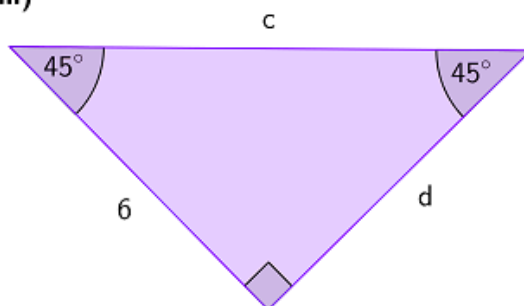
(i)



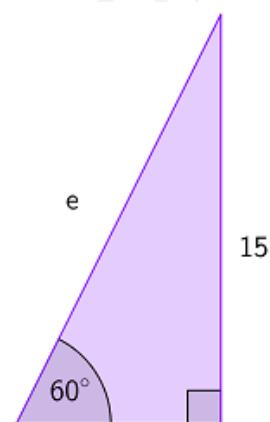
(ii)



(iii)



(iv)



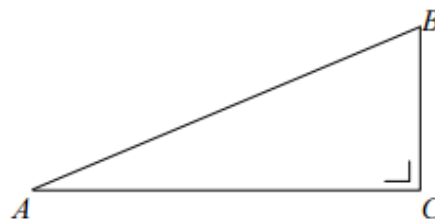
3. (2012 P2 Q11)

- (a) Construct a right angles triangle containing an angle  $A$  such that  $\sin A = 0.4$   
 (b) Find, from your triangle,  $\cos A$  in surd form.

4. (2013 P2 Q 10)

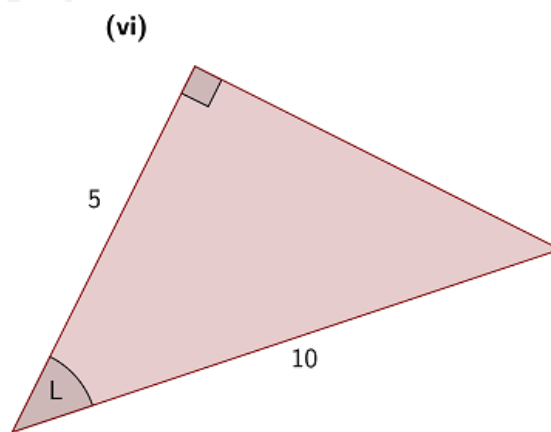
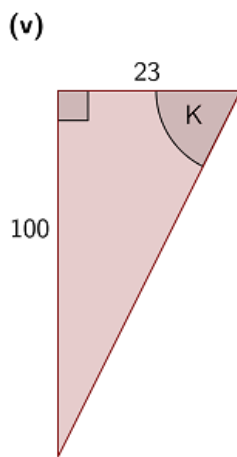
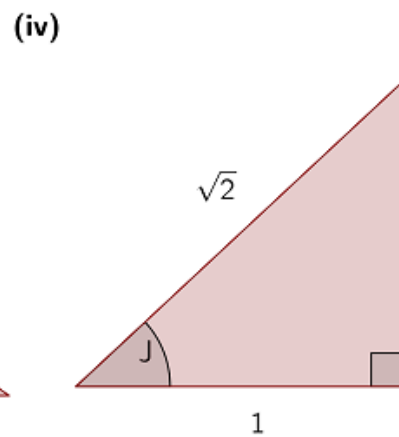
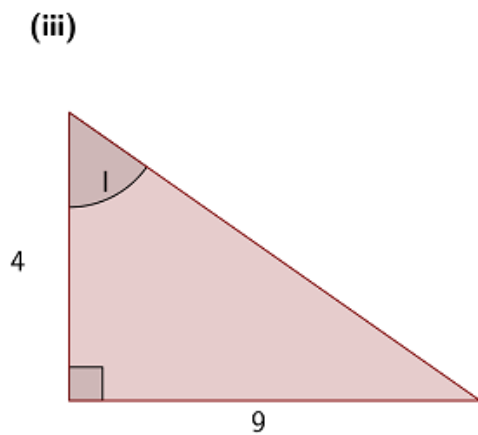
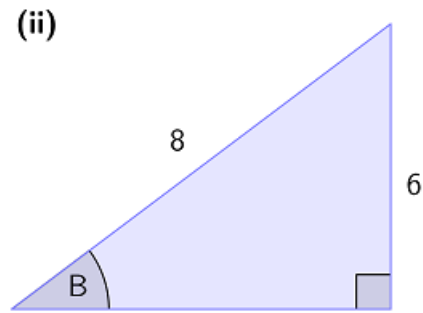
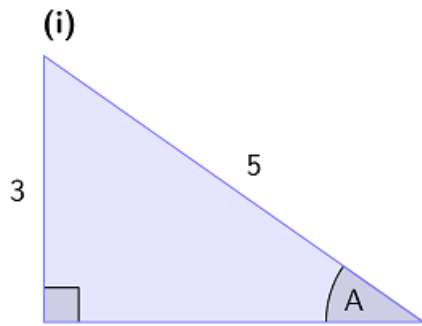
In the triangle  $ABC$ ,  $|AB| = 2$  and  $|BC| = 1$ .

- (a) Find  $|AC|$ , giving your answer in surf form.  
 (b) Write  $\cos \angle BAC$  and hence find  $|\angle BAC|$ .  
 (c) Sketch a right angles isosceles trinagle in which the equal sides are 1 unit each and use it to write  $\cos 45^\circ$  in surd form.  
 (d) Show that  $\cos 75^\circ \neq \cos 45^\circ + \cos 30^\circ$ .





5. Calculate the unknown angles in the following triangles.

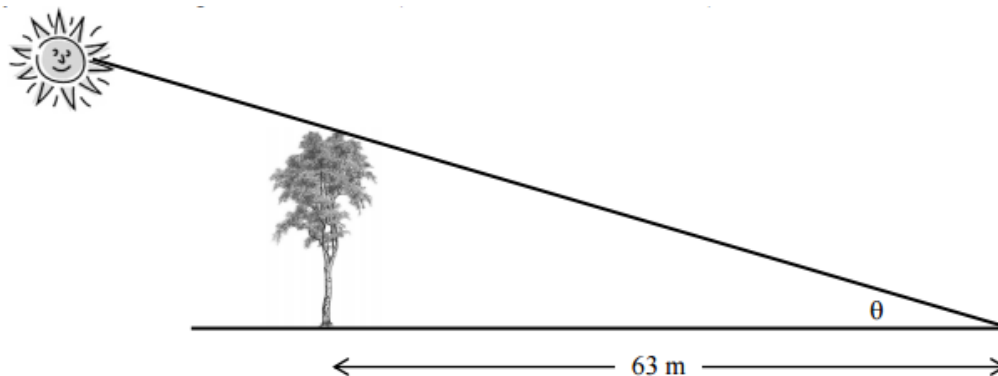




## 6. (2013 P2 Q13)

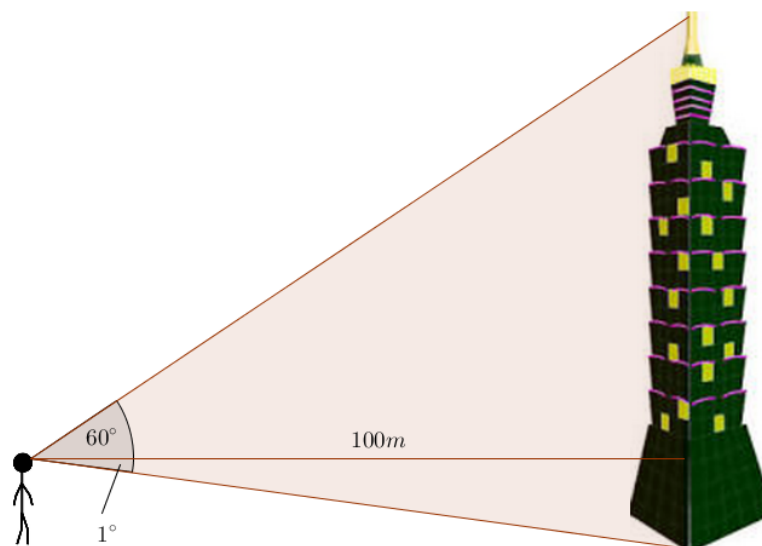
A tree 32 m high casts a shadow 63 m long. Calculate  $\theta$ , the angle of elevation of the sun.

Give your answer in degrees and minutes (correct to the nearest minute).



### 1.3 Trigonometry in Context

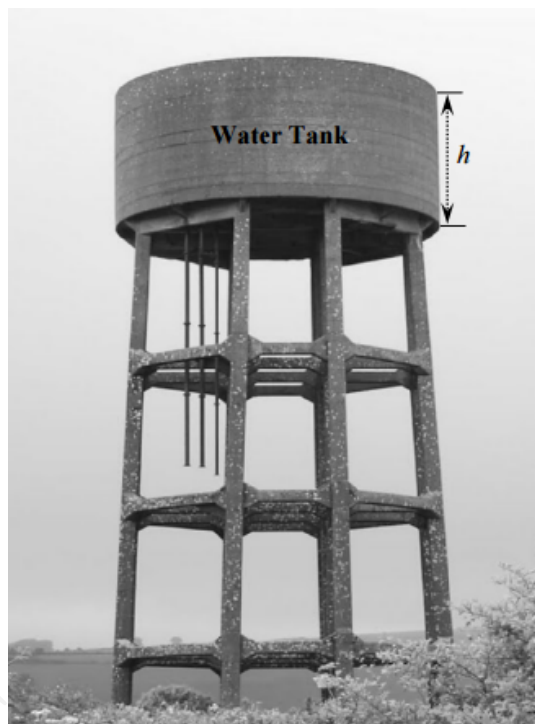
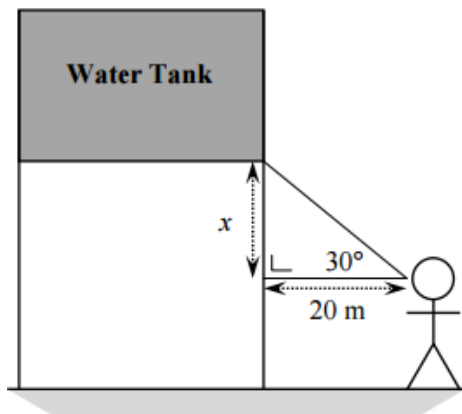
1. A stickman is standing 100m away from a skyscraper. The angle of elevation to the top of the building is measured to be  $60^\circ$  and the angle of depression to the base is  $1^\circ$ ,
  - (i) Calculate the height of the stickman.
  - (ii) Calculate the height of the skyscraper.





2. (2015 P2 Q13)

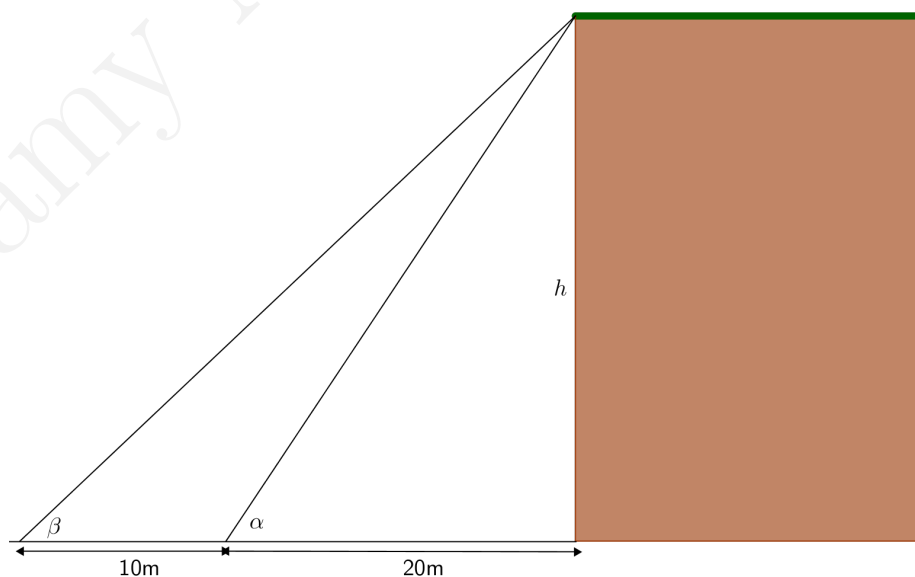
Miriam is trying to find the volume of the water tank shown in the photograph on the right. She takes some measurements and draws a diagram. Part of her diagram is shown on the below.



(a) Using the diagram, find the value of  $x$ .  
Give your answer in metres correct to two decimal places.

(b) The angle of elevation to the bottom of the water tank is  $30^\circ$ , as shown in the diagram. The angle of elevation to the top of the water tank is  $38^\circ$ .  
Find the distance marked  $h$  on the photograph. Give your answer correct to one decimal place.

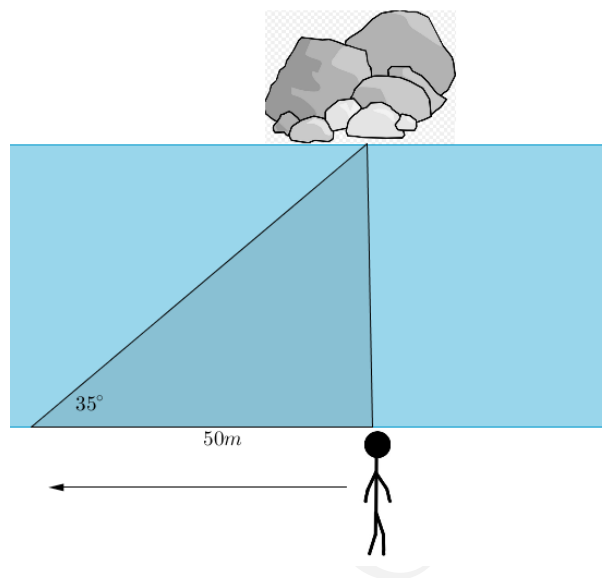
3. Calculate the angles  $\alpha$  and  $\beta$  if the height of the cliff is 50m.



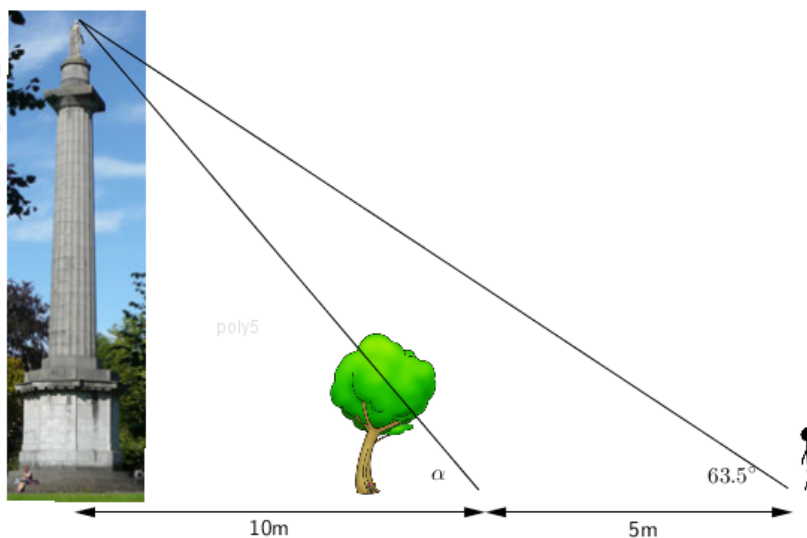




4. A stickman comes across a river and wants to approximate its width. He begins by standing directly opposite a large group of boulders, then walks 50m downstream and using a clinometer measures the angle  $35^\circ$ .
- What is the width of the river (to the nearest m)?
  - How far is he now standing from the boulders? (After he has walked 50m along the riverbank.)



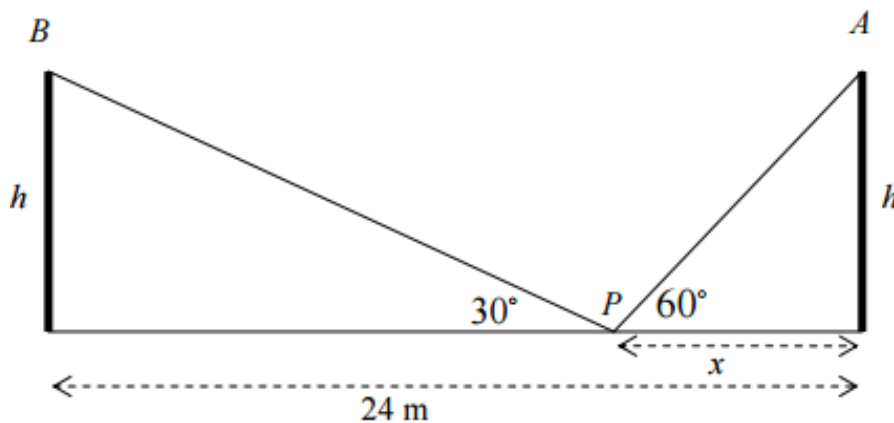
5. A student from Leamy Maths Community want's to approximate the height of the Rice's Memorial Column in the nearby People's Park. The student begins by standing directly under the monument, and measuring ten metres out. Unfortunately, from this position there is a tree blocking the view of the top, so the student walks another 5m and measures the angle of elevation to be  $63.5^\circ$ .
- How tall is the column?
  - If the tree was chopped down, what would the original attempted angle of elevation have measured (i.e.  $\alpha$ ).





6. (2012 P2 Q13)

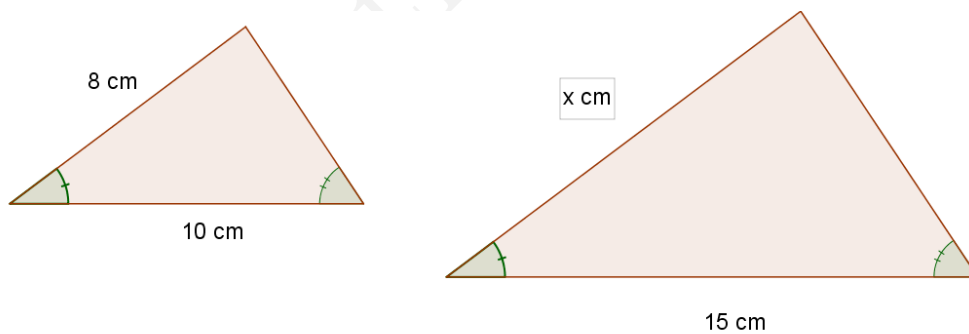
Two vertical poles  $A$  and  $B$ , each of height  $h$ , are standing on opposite sides of a level road. They are 24 m apart. The point  $P$ , on the road directly between the two poles, is a distance  $x$  from pole  $A$ . The angle of elevation from  $P$  to the top of pole  $A$  is  $60^\circ$ .



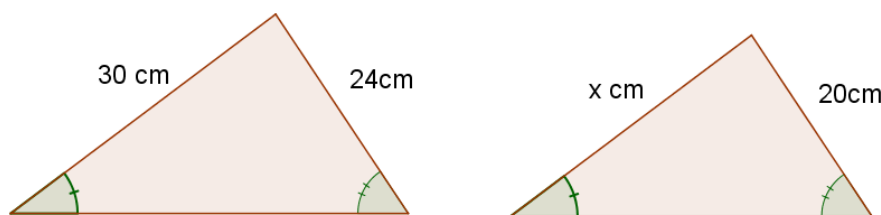
- (a) Write  $h$  in terms of  $x$ .
- (b) From  $P$  the angle of elevation to the top of the pole  $B$  is  $30^\circ$ . Find  $h$ , the height of the two poles.

## 2 Similar Triangles

1. The triangles below are similar. Find the value of  $x$ .

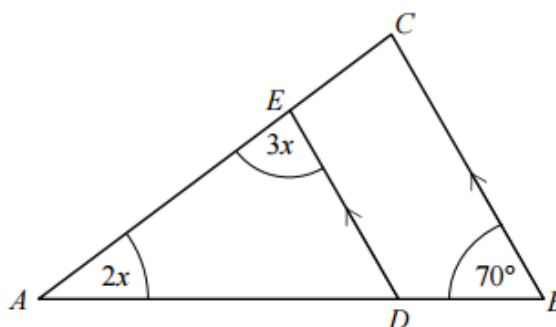


2. The triangles below are similar. Find the value of  $x$ .

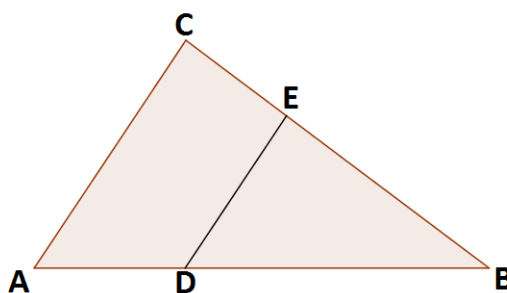




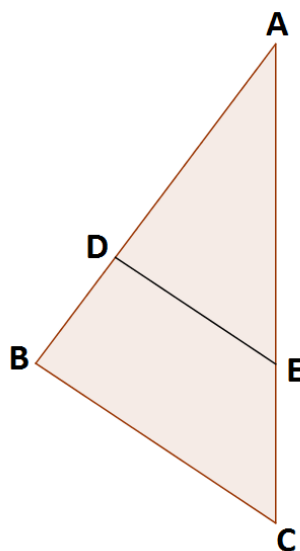
3. (2015 P2 Q7) The diagram shows the triangle  $ABC$ .  
 $DE$  is parallel to  $BC$ .  
 The sizes of some of the angles are shown.



- (a) Find the value of  $x$ .  
 (b) Given that  $|AE| = 100$ ,  $|AC| = 130$ , and  $|DE| = 74$ , find the value of  $|BC|$ .
4. In the triangle below,  $|AB| = 18$  and  $|DB| = 12$ . If  $|CB| = 12$ , find  $|EB|$ .



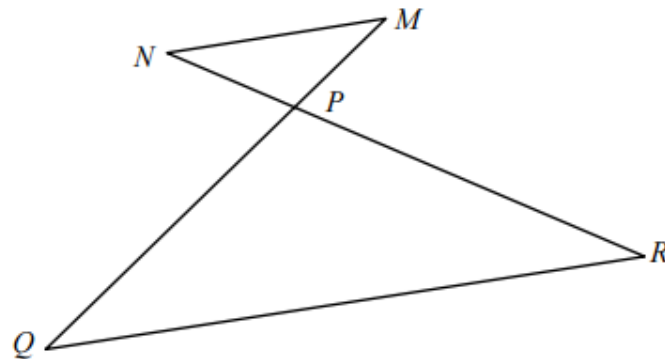
5. In the triangle below,  $|AB| = 14$  and  $|DB| = 4$ . If  $|EC| = 6$ , find  $|AE|$ . (Hint, let  $|AE| = x$ )





## 6. (2014 P2 Q9)

In the diagram below,  $|\angle MNP| = |\angle PRQ|$ .



i. Prove that  $\triangle MNP$  and  $\triangle PRQ$  are similar.

ii. Is  $NM$  parallel to  $QR$ ? Give a reason for your answer.

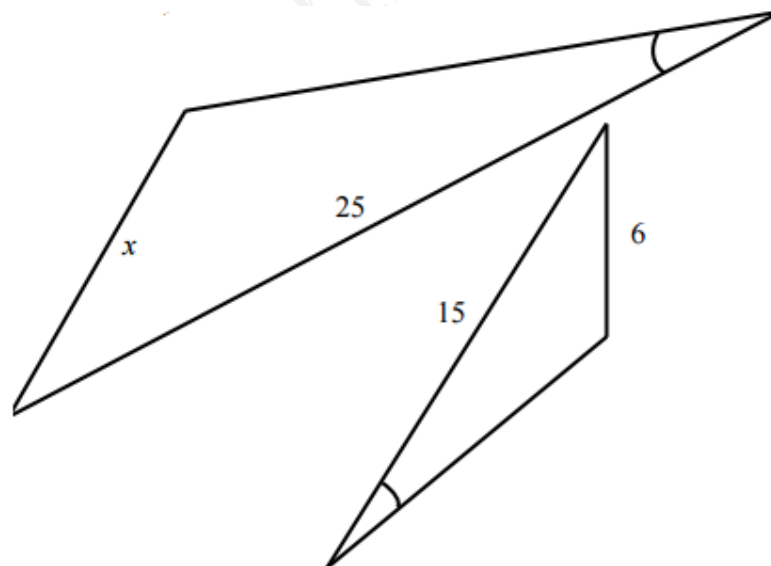
Given that  $|MN| = 6$ ,  $|NP| = 4$ ,  $|QP| = 9$ , and  $|PR| = 10$ , find:

iii.  $|QR|$

iv.  $|QM|$

## 7. (2013 P2 Q11)

The two triangles shown are similar. Find the value of  $x$ .





## 8. (2014 Sample P2 Q9)

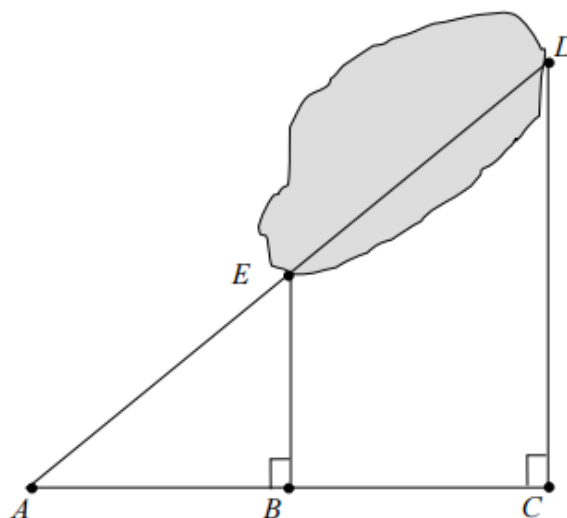
Three paths,  $[AE]$ ,  $[BE]$  and  $[CD]$ , have been constructed to provide access to a lake from a road  $AC$  as shown in the diagram. The lengths of the paths from the road to the lake are as follows:

$$|AE| = 120m$$

$$|BE| = 80m$$

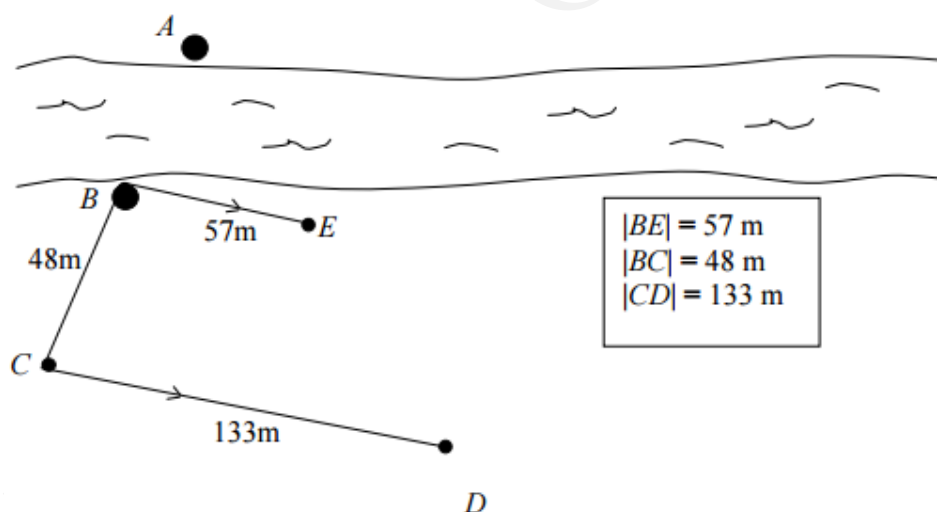
$$|CD| = 200m$$

- Explain how these measurements can be used to find  $|ED|$ .
- Find  $|ED|$ .



## 9. (2011 P2 Q9)

A group of students were trying to find the distance between two trees on opposite sides of a river using pegs, a measuring tape and a large amount of string. They align the pegs in a particular way, take several measurements and sketch this diagram. On the diagram,  $A$  and  $B$  are the trees and  $C$ ,  $D$  and  $E$  are the pegs.



- In what way must the pegs and the trees be aligned if the students are to use these measurements to calculate  $|AB|$ .
- Calculate the distance between the trees.
- Another group of students repeats the activity. They have a similar diagram but different measurements. Their measurements are  $|BE| = 40$  m and  $|BC| = 9$  m. Based on the value of  $|AB|$  that the first group got, what measurement will this second group have for  $|CD|$ .

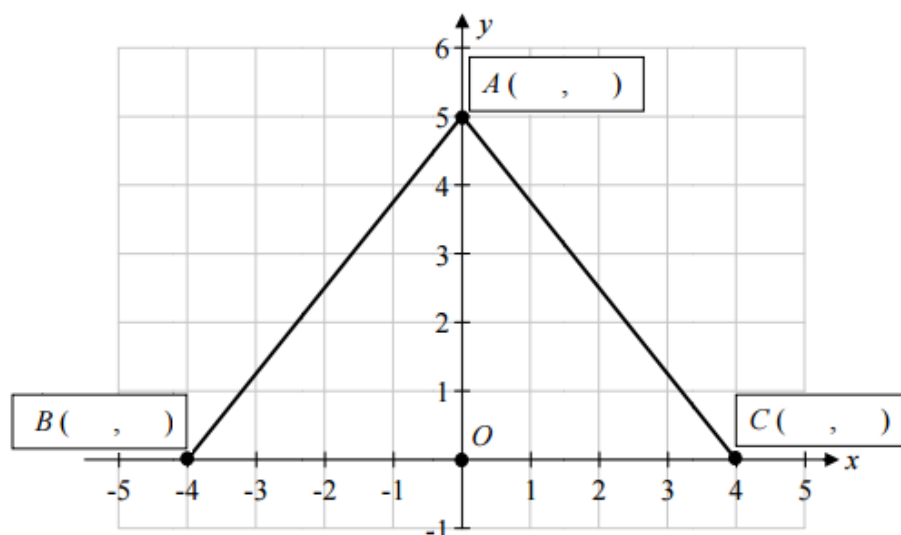




### 3 Co-Ordinate Geometry

#### 3.1 Introduction

- Plot the points  $A(1, 1)$ ,  $B(3, 6)$  and  $C(5, 1)$  on a co-ordinate plane. Show that the triangle  $ABC$  is isosceles (that two sides are the same length).
- Plot the points  $A(2, 2)$ ,  $B(2, -4)$  and  $C(-4, -1)$
  - Find  $D$ , the midpoint of  $AB$ . Plot the point  $D$ .
  - Draw the triangle  $BCD$ . Using Pythagoras Theorem, show that the triangle  $BCD$  is right angled.
- Find  $C$ , the midpoint of  $A(-3, 4)$  and  $B(5, 2)$ . Verify that  $|AC| = |CB|$ .
- (2014 P2 Q7)** The diagram below shows part of the frame of a swing on a co-ordinate grid. Each unit on the grid represents one metre. The line segments  $[AB]$  and  $[AC]$  represent metal bars.

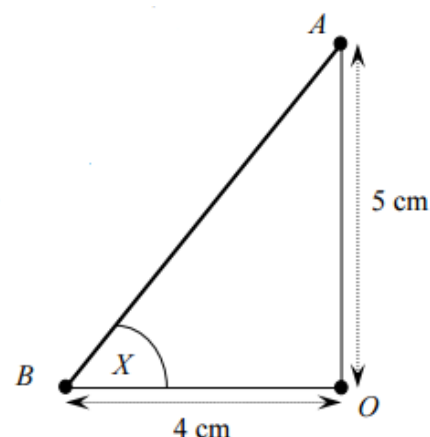


- Write the co-ordinates of the points  $A$ ,  $B$  and  $C$  in the spaces provided in the diagram.
- Find the total length of metal bar needed to make this part of the swing. Give your answer in metres, correct to one decimal place.
- Find the slope of  $AB$  and the slope of  $AC$ .
- Is  $AB$  perpendicular to  $AC$ ? Give a reason for your answer.





- v. Madison draws the scale diagram of the triangle  $OAB$  shown on the right.  
She marks the angle  $X$ .  
Recall that  $[AB]$  is a metal bar, which is part of the frame of the swing.  
Write down the value of  $\tan X$ , and hence find the size of the angle  $X$ .  
Give the size of the angle  $X$  correct to two decimal places.



- vi. In order to increase the height of the swing, it is decided to increase  $X$  by 20%.  
The distance  $|AB|$  will be kept the same.  
Find the new height of the swing. Give your answer in metres, correct to one decimal place.
5.  $P(3, 2)$ ,  $Q(0, -4)$ ,  $R(-3, -3)$  and  $S(0, 3)$  are the vertices of a parallelogram.
- Draw the parallelogram on the co-ordinate plane.
  - Show that the diagonals bisect each other (that the midpoint of  $PR$  is the midpoint of  $QS$ ).
  - Show that opposite sides of the parallelogram are equal in length.

### 3.2 Equation of a Line

- Find the equation of the following lines;
  - Point  $(2, 3)$ , slope  $= 1$
  - Point  $(3, -1)$ , slope  $= -1$
  - Point  $(-2, -5)$ , slope  $= \frac{-3}{4}$
  - Point  $(4, 0)$ , slope  $= \frac{-1}{2}$
- Find the equation of the lines containing the following points:
  - $(3, 2)$  and  $(5, 4)$
  - $(2, 1)$  and  $(3, 3)$
  - $(3, -4)$  and  $(-2, -1)$
  - $(-3, -2)$  and  $(-2, 4)$
- Check whether the following points are on the given lines:
  - Point:  $(1, 1)$  Line:  $x + y - 2 = 0$
  - Point:  $(3, -2)$  Line:  $2x + 4y + 2 = 0$
  - Point:  $(-2, 4)$  Line:  $4x - 3y - 5 = 0$
  - Point:  $(5, -3)$  Line:  $2x - y - 13 = 0$
  - Point:  $(-8, 0)$  Line:  $x + 2y + 6 = 0$

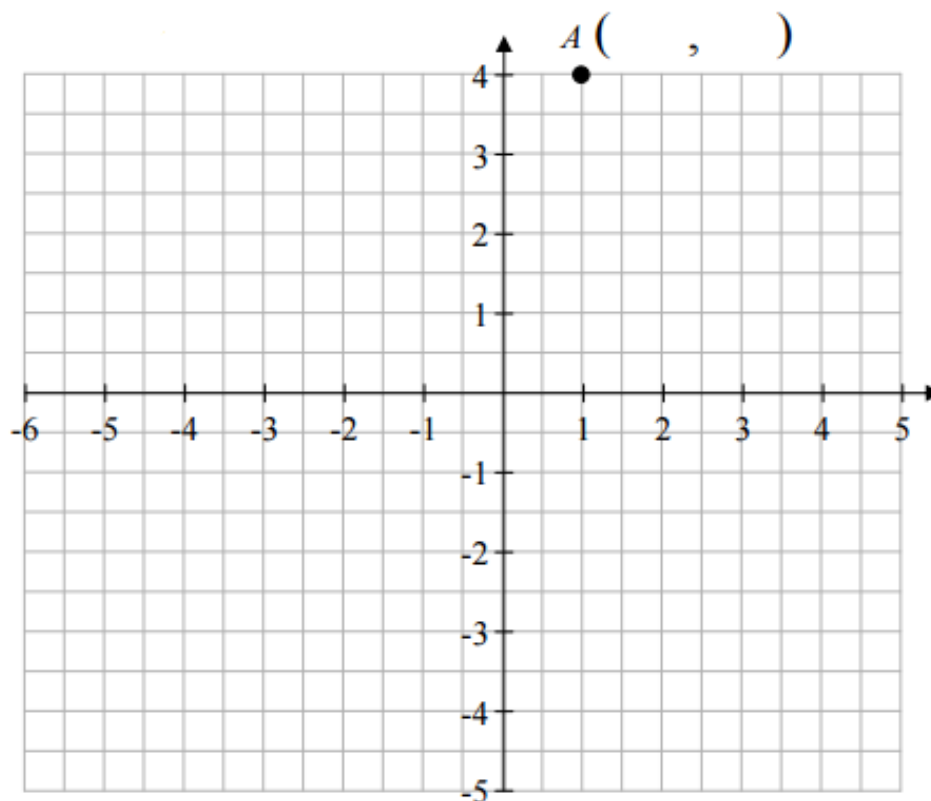




## 4. (2012 P2 Q9)

The point  $A$  is shown on the diagram.

- (a) Write down the co-ordinates of the  $A$ .



- (b) Plot the following points on the diagram above.

$B$	$C$	$D$	$E$	$F$
$(2, 0)$	$(-4, -4)$	$(0, 4)$	$(-6, 0)$	$(4, -4)$

- (c) Calculate the midpoint of  $[DF]$ .
- (d) Find the slope of  $BF$ .
- (e) Write down the equation of  $BF$  in the form  $y = mx + c$ .
- (f) Find the slope of the line  $CE$ .
- (g) Write the equation of the line  $CE$  in the form of  $ax + by + c = 0$ .
- (h) What is the ratio of the area of the triangle  $BCE$  to the area of the triangle  $BCF$ .
5. Find the points of intersection of the following pairs of lines:
- $3x + y - 13 = 0$      $x - 2y + 5 = 0$
  - $x - 3y - 1 = 0$      $4x + y - 30 = 0$
  - $4x + 3y - 7 = 0$      $7x + 2y + 4 = 0$







## 6. (2016 P2 Q5)

- (a) Is the point  $(3, -5)$  on the line  $5x + 3y + 6 = 0$ ? Justify your answer.  
 (b) Find the point of intersection of the following two lines.

$$3x + 2y = 7$$

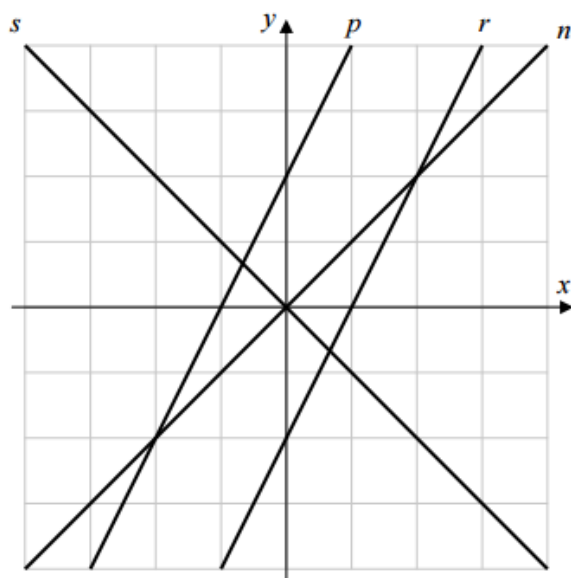
$$y = -2x + 5$$

7. Find where the following lines cut the  $x$  and  $y$  axes:

- i.  $x + y - 4 = 0$   
 ii.  $2x - 3y + 12 = 0$   
 iii.  $3x + 5y - 15 = 0$   
 iv.  $4x - 3y - 8 = 0$

3.3  $y = mx + c$ 1. Write the equations of the following lines in the form  $y = mx + c$ . Identify the slope and  $y$ -intercept of each line.

- i.  $x + y - 2 = 0$   
 ii.  $4x + 2y - 6 = 0$   
 iii.  $3x - y + 9 = 0$   
 iv.  $6x - 3y + 9 = 0$   
 v.  $3x + 2y + 8 = 0$

2. (2015 P2 Q5) The coordinate diagram below shows the lines  $n, p, r,$  and  $s$ . The table shows the equation of each line.

Equation	Line
$y = 2x - 4$	
$y = x$	
$y = -x$	
$y = 2x + 4$	

Write the letters  $n, p, r$  and  $s$  into the table to match each line to its equation.





3. Determine whether the following pairs of lines are parallel, perpendicular or neither;

(a)  $2x - y + 7 = 0$  and  $y = \frac{1}{2}x + 3$

(b)  $y = \frac{3}{2}x - 5$  and  $2x + 3y + 5 = 0$

(c)  $y = -\frac{1}{2}x - 4$  and  $x - 2y - 5 = 0$

(d)  $3x - 4y + 2 = 0$  and  $y = -\frac{4}{3}x - 8$

(e)  $3x + y - 5 = 0$  and  $y = -\frac{1}{3}x + 1$

(f)  $y = \frac{4}{5}x - 2$  and  $4x - 5y + 7 = 0$

4. (2012 P2 Q10)

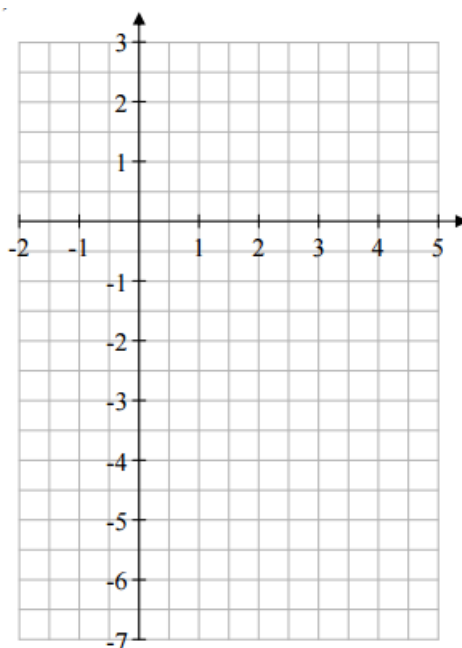
The table below gives the equations of six lines.

Line 1	$y = 3x - 6$
Line 2	$y = 3x + 12$
Line 3	$y = 5x + 20$
Line 4	$y = x - 7$
Line 5	$y = -2x + 4$
Line 6	$y = 4x - 16$

(a) Which line has the greatest slope? Give a reason for your answer.

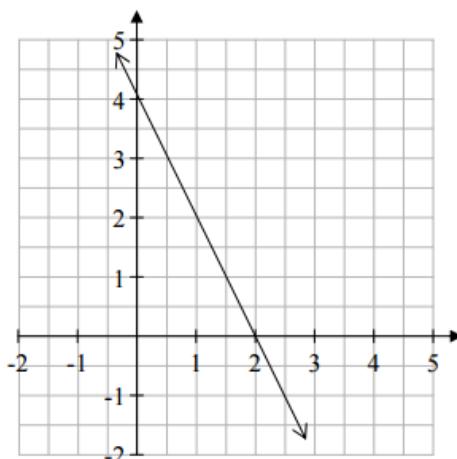
(b) Which lines are parallel. Give a reason for your answer.

(c) Draw a sketch of Line 1 on the axes below.





- (d) The diagram below represents one of the given lines. Which one does it represent?



- (e) The table below shows some values of  $x$  and  $y$  for the equation of one of the lines.  
Which equation do they satisfy?

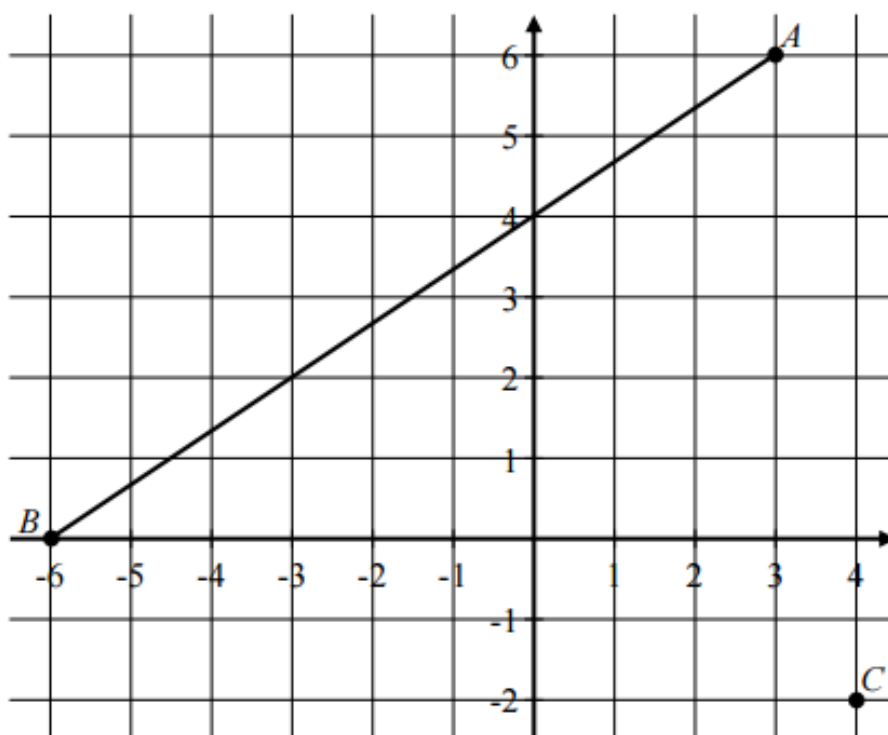
$x$	$y$
7	12
9	20
10	24

- (f) There is one value of  $x$  which will give the same value of  $y$  for Line 4 as it will for Line 6.  
Find, using algebra, this value of  $x$  and the corresponding value of  $y$ .
5. What is the slope of the line  $k$ :  $3x - 2y + 7 = 0$ ? Find the equation of the line containing the point  $(2, 2)$ , which is parallel to the line  $k$ .
6. Find the equation of the line which is parallel to  $2x + y - 4 = 0$  and contains the point  $(-1, 4)$ .
7. **(2014 P2 Q8)**  
The equation of the line  $l$  is  $x - 3y - 6 = 0$ .
- Find the slope of the line  $l$ .
  - Show that the point  $(1, -2)$  is **not** on the line  $l$ .
  - The line  $k$  passes through  $(1, -2)$  and is parallel to the line  $l$ .  
Find the equation of the line  $k$ .
8. Find the equation of the line perpendicular to  $2x + 3y - 5 = 0$  which contains the point  $(-2, -3)$ .
9. Find the equation of the line perpendicular to  $x + 3y - 3 = 0$  which contains the point  $(0, 3)$ .





10. (2015 P2 Q6) The equation of the line  $l$  is  $5 + y - 2x = 0$ .
- Find the co-ordinates of the points where  $l$  cuts the  $x$  and  $y$  axes.
  - Find the slope of  $l$
  - The line  $j$  goes through the point  $(11, 6)$  and is perpendicular to the line  $l$ .
    - Write down the slope of the line  $j$ .
    - Find the equation of the line  $j$ .
11. (2013 P2 Q12)



- Write the co-ordinates of  $A$ ,  $B$ , and  $C$ .
- Find the co-ordinates of  $D$ , the midpoint of  $[AB]$ .
- Find the equation of the line  $AB$ .
- Find the equation of the line through  $C$ , perpendicular to  $AB$ .
- Let  $E$  be the point where this perpendicular line through  $C$  intersects  $AB$ . Calculate the coordinates of the point  $E$ .
- Which is the shorter distance,  $|CD|$  or  $|CE|$ ? Find this distance.





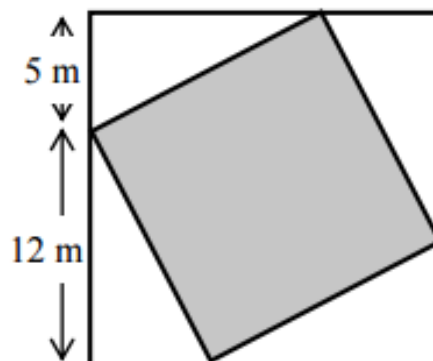
## 4 Area, Perimeter and Volume

### 4.1 Forwards Formulas

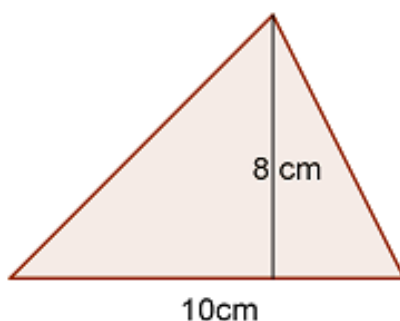
1. Find the area of a square, with a side length of 5 cm.
2. The length of one side of a square is 10 cm. What is the perimeter of the square?
3. **(2013 P2 Q1)**

Liam's garden is in the shape of a square. It has four equal right angled triangular lawns and a smaller square patio in the centre, as shown.

- (a) Find the length of the hypotenuse of one of the right angled triangular lawns.
- (b) Find the area of one of the triangular lawns.
- (c) Find the area of the square patio in the middle.
- (d) The patio is to be paved with rectangular flagstones of length 80 cm and width 50 cm. Calculate the number of flagstones Liam needs to buy to cover the patio, allowing an extra 20% for waste.



4. Find the area of a circle with a radius of 49 cm. (Use  $\frac{22}{7}$  for  $\pi$ ).
5. What is the circumference of a circle with a radius of 3. Give your answer in terms of  $\pi$ .
6. A circle has a diameter of 20 cm. What is the area of the circle? Give your answer correct to two decimal places.
7. Calculate the area of the following triangle:

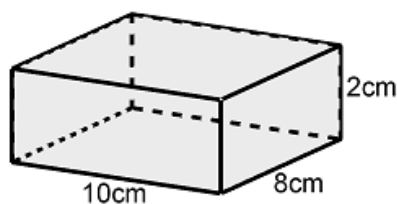


8. A cube has side length of 3 cm.
  - i. What is the volume of the cube?
  - ii. What is the surface area of the cube?

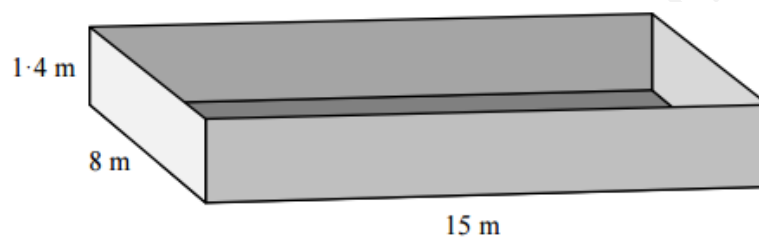




9. A rectangular solid has a length of 10 cm, a width of 8cm and a height of 2 cm.

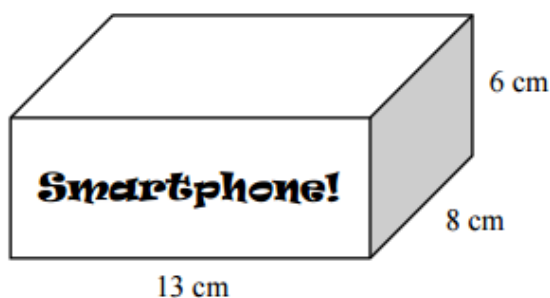


- What is the volume of the rectangular solid?
  - Draw a net of the rectangular solid.
  - What is the total surface area of the rectangular solid.
10. (2015 P2 Q4) A swimming pool is 15m long, 8m wide, and 1.4m deep, as shown in the diagram.



Harry says: "The area of the bottom of the swimming pool is  $8 \times 15 = 120 \text{ cm}^2$ ."

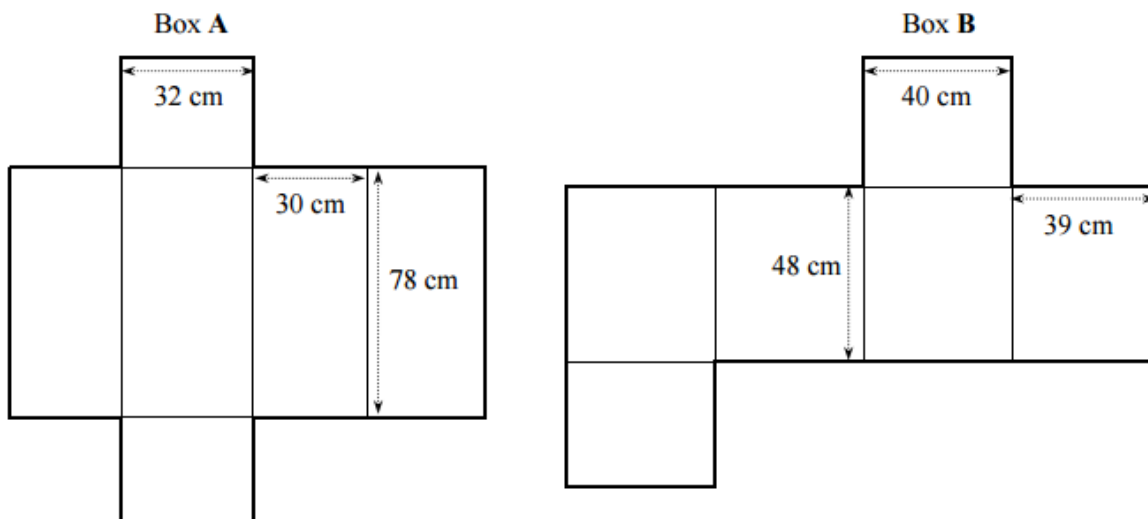
- Explain what is **wrong** with Harry's answer.
  - Harry will use  $20 \text{ cm} \times 30 \text{ cm}$  tiles to cover the inside of the pool. Find the minimum number of tiles that Harry will need.
  - The surface of the water in the swimming pool is 10 cm below the top of the pool.  
Find the volume of the water in the swimming pool.
11. (2014 P2 Q2) The box for an individual mobile phone is 13 cm long, 8 cm wide, and 6 cm high as shown.



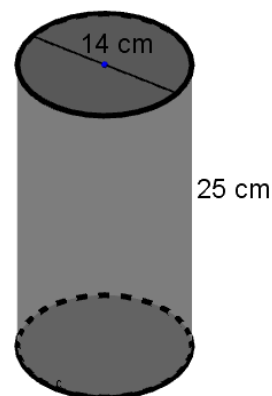


- i. Find the volume of an individual mobile phone box.  
 These individual mobile phone boxes will be shipped in a large rectangular box.

Below are diagrams of the nets of two large boxes that could be used, Box A and Box B.



- ii. Show that Box A and Box B have the same volume.  
 iii. What is the largest number of individual mobile phone boxes that will fit in each large box?  
 iv. Find the surface area of each large box.  
 v. The large boxes are made from cardboard. The cardboard costs €0.67 per m<sup>2</sup>. The cardboard just covers the net of the box. Find the cost of the box that uses the least amount of cardboard.  
 vi. An average of 140 large boxes is produced each month. Find the saving, per annum, if you choose to make the box that uses the least amount of cardboard.
12. A cylinder has a radius of 5 cm and a height of 12cm. Find the volume of the cylinder. Give your answer in terms of  $\pi$ .
13. A cylinder has a diameter of 14 cm, and a height of 25cm.  
 i. Draw a net of the cylinder.  
 ii. Find the **total** surface area of the cylinder. Give your answer correct to one decimal place.





## 14. (2016 P2 Q11)

Fiona finds the volumes of five different cylinders.

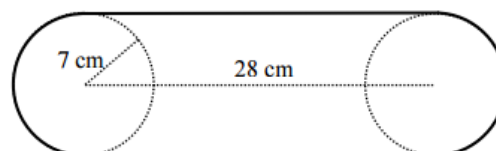
Each of them has a height of  $K$  centimetres.

- (a) Complete the table to show the volume of each of the five cylinders. Give each answer in terms of  $\pi$  and  $K$ .
- (b) Is the sequence of volumes in the table linear, quadratic, exponential, or none of these? Justify your answer.

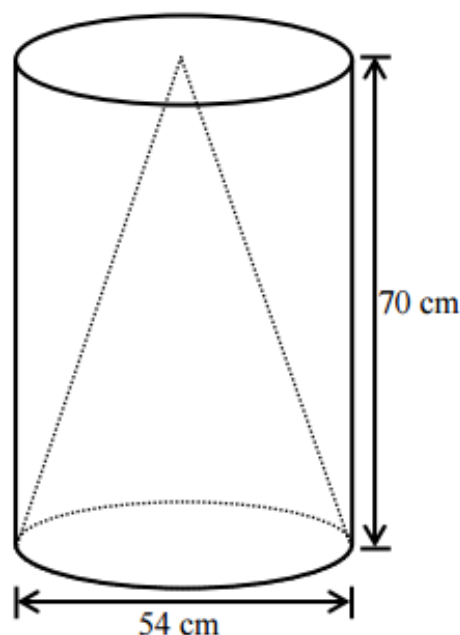
Radius of cylinder (cm)	Height of cylinder (cm)	Volume of cylinder ( $\text{cm}^3$ )
1	$K$	
2	$K$	
3	$K$	$9\pi K$
4	$K$	
5	$K$	

15. A cone has a radius of 15 cm and a height of 7 cm. Find, in terms of  $\pi$ , the volume of the cone.
16. A sphere has a radius of 3 cm. What is the volume of the sphere? Give your answer in terms of  $\pi$ .
17. A sphere has a radius of 20 cm. What is the surface area of the sphere, correct to one decimal place?
18. (2011 P2 Q1)

- (a) The diagram shows two pulley wheels of equal size, connected by a drive belt. The radius of each wheel is 7 cm and the distance between the centres is 28 cm. Calculate the length of the belt. Give your answer correct to the nearest whole number.



- (b) The diagram shows a solid cylinder of diameter 54 cm and of height 70 cm. A cone, of the same diameter and height as the cylinder, is cut from inside the cylinder.
- Calculate the volume of the cylinder. Give your answer in terms of  $\pi$ .
  - Calculate the volume of the cone. Give your answer in terms of  $\pi$ .
  - What fraction of the cylinder remains after the cone is removed?

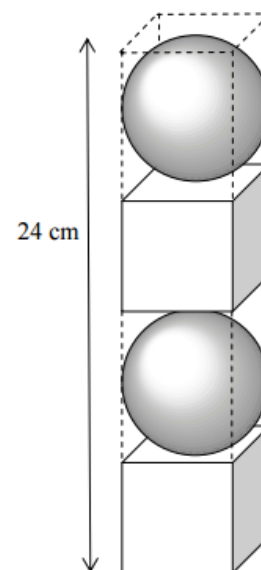






## 19. (2012 P2 Q3)

An ornament is carved from a rectangular block of wood which has a square base and a height of 24 cm. The ornament consists of two identical spheres and two identical cubes as illustrated in the diagram. The diameter of each sphere is equal to the length of the side of each cube. The ornament has the same width as the original block.

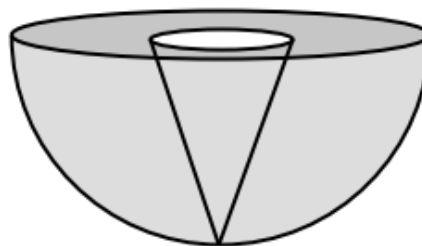


- Find the length of a side of one of the cubes.
- Find the volume of the ornament.
- In making the ornament, what percentage of the original block of wood is carved away?

## 20. (2013 P2 Q14)

A solid metal hemisphere has a radius of 12 cm.

- Calculate the volume of the hemisphere. Give your answer in terms of  $\pi$ .
- A solid cone of radius 4 cm and height 12 cm is cut from the hemisphere. Calculate the volume of the cone. Give your answer in terms of  $\pi$ .
- The remaining metal in the hemisphere is melted down and recast into cones of the same dimensions as the cone above. How many cones can be formed from the remaining metal?



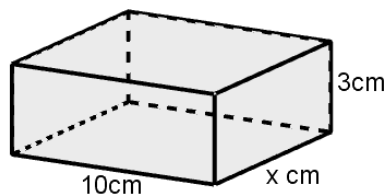
## 4.2 Backwards Formulas

- A square has an area of  $81 \text{ cm}^2$ . What is the side length of the square?
- A square has a perimeter of 48 cm. What is the area of the square?
- A circle has an area  $9\pi \text{ cm}^2$ .
  - What is the radius of the circle?
  - What is the circumference of the circle? Give your answer correct to one decimal place.
- A circle has a radius a circumference of  $18\pi \text{ cm}$ . What is the area of the circle? Give your answer in terms of  $\pi$ .
- A cube has a volume of  $64 \text{ cm}^3$ . What is the side length of the cube?





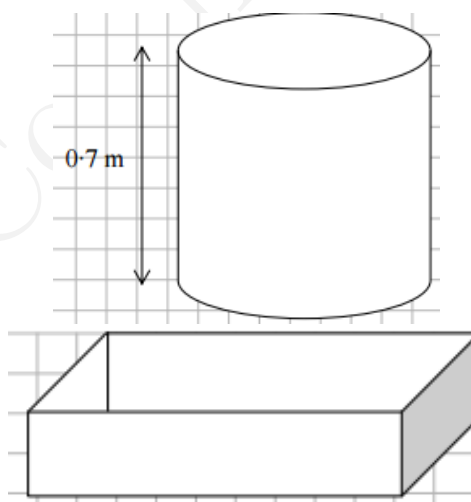
6. A rectangular solid has a length of 10 cm, a width of  $x$  cm and a height of 3 cm.



If the volume of the solid is  $120 \text{ cm}^3$ , find the value of  $x$ .

7. A cylinder with a radius of 3 cm has a volume of  $63\pi \text{ cm}^3$ . What is the height of the cylinder?
8. **(2012 P2 Q2)**

- (a) A container in the shape of a cylinder has a capacity of 50 litres. The height of the cylinder is 0.7 m. Find the length of the diameter of the cylinder.  
Give your answer correct to the nearest whole number.



- (b) A rectangular tank has a length of 0.6 m, a width of 0.35 m and its height measures 15 cm.  
Find the capacity of the rectangular tank.
- (c) The rectangular tank is full of water. This water is then poured into the cylindrical container in (a) above. Find the depth of the water in the cylinder.  
Give your answer correct to one decimal place.
9. A sphere has a volume of  $523.6 \text{ cm}^3$ . Find the radius of the sphere, correct to the nearest cm.





### 4.3 Mixed Problems

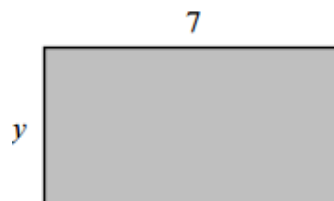
#### 1. (2016 P2 Q10)

In this question, all lengths are in cm and all areas are in  $\text{cm}^2$ .

- (a) The diagram shows a rectangle with sides of length 7 and  $y$ .

The value of the area of the rectangle is equal to the length of its perimeter.

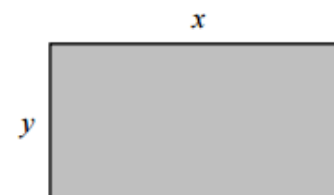
Use this information to find the value of  $y$ .



- (b) The diagram shows a rectangle with sides of length  $x$  and  $y$ , where  $x > 2$ .

The value of the area of the rectangle is equal to the length of its perimeter.

Use this information to write  $y$  in terms of  $x$ .



#### 2. (2015 P2 Q14) A small sphere has a radius of 1.5 cm.

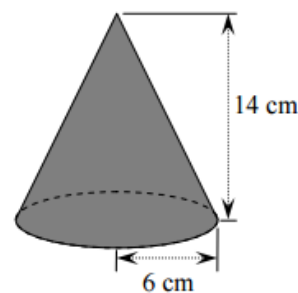
- (a) Find the volume of the small sphere. Give your answer in  $\text{cm}^3$ , in terms of  $\pi$ .
- (b) The volume of a large sphere is three times the volume of the small sphere. Find the radius of the small sphere.

Give your answer in cm, in the form  $\frac{a\sqrt[3]{a}}{b}$ , where  $a, b \in N$ .

#### 3. (2014 P2 Q10)

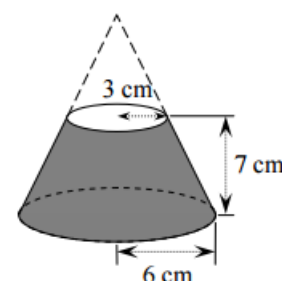
A solid cone has a radius of 6 cm and a height of 14 cm, as shown.

- i. Find the volume of the cone. Give your answer in terms of  $\pi$ .



The shape shown below is a frustum. This is made by taking the cone above, cutting it horizontally at a height of 7 cm, and removing the upper portion. The radius of the circular top of the frustum is 3 cm, as shown in the diagram.

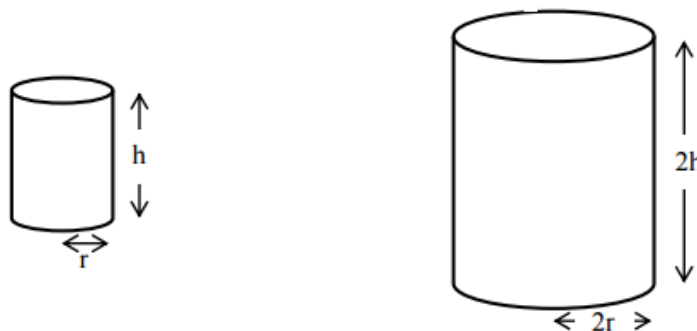
- ii. Find the ratio of the volume of the frustum to the volume of the original cone.





## 4. (2013 P2 Q15)

The dimensions of two solid cylinders are shown in the diagram below.



- Calculate the ratio of the curved surface area of the smaller cylinder to the curved surface area of the larger cylinder.
- Calculate the ratio of the volume of the smaller cylinder to the volume of the larger cylinder.

## 5 Extra Cross-Topic Questions

## 1. (2016 P2 Q9)

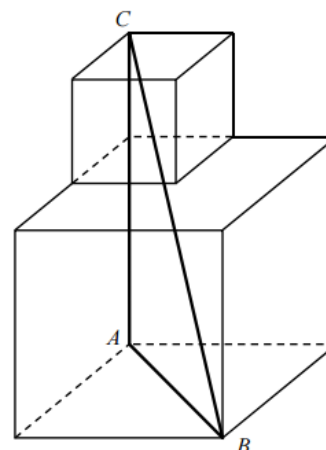
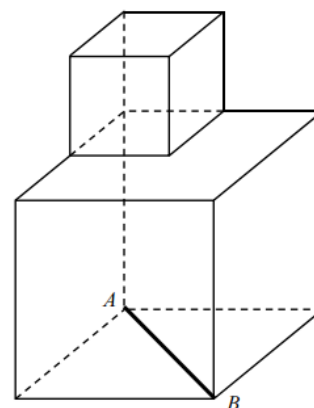
A shape is made by placing a small cube on top of a larger one, as shown. The cubes have edges of length 1 unit and 2 units.

- Find the total surface area of this shape.
- The line segment  $[AB]$  is a diagonal of the base of the shape, as shown.

- Find  $|AB|$ . Give your answer in surd form.

The right angled triangle  $ABC$  is constructed inside this shape, as shown.

- Find  $|BC|$ . Give your answer in surd form.
- Find the length of the part of the line  $BC$  that is inside the larger cube.



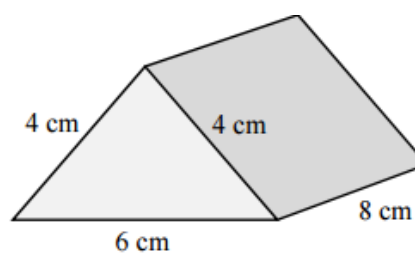


## 2. (2016 P2 Q12)

- (a) A packet of sweets is in the shape of a closed triangular-based prism.

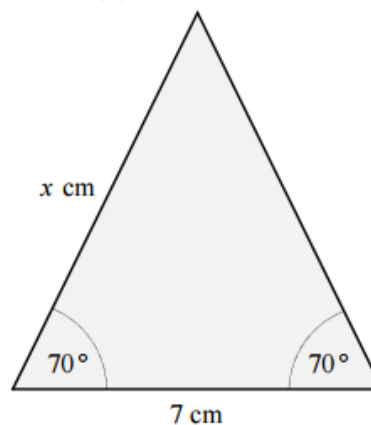
It has a height of 8 cm and a triangular base with sides of length 4 cm, 4 cm and 6 cm.

Construct an accurate **net** of the prism. Show all of your construction lines clearly.



- (b) A different triangular-based prism has the base shown in the diagram on the right.

- i. Use trigonometry to find the length of the side marked  $x$  cm. Give your answer to two decimal places.

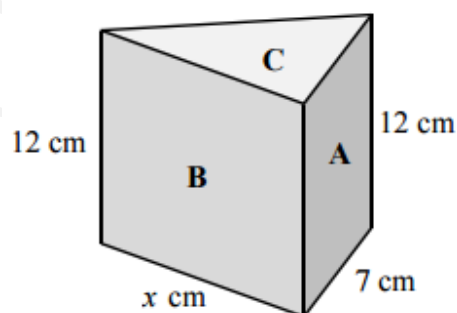


This prism is shown in the diagram on the right.

It has a height of 12 cm.

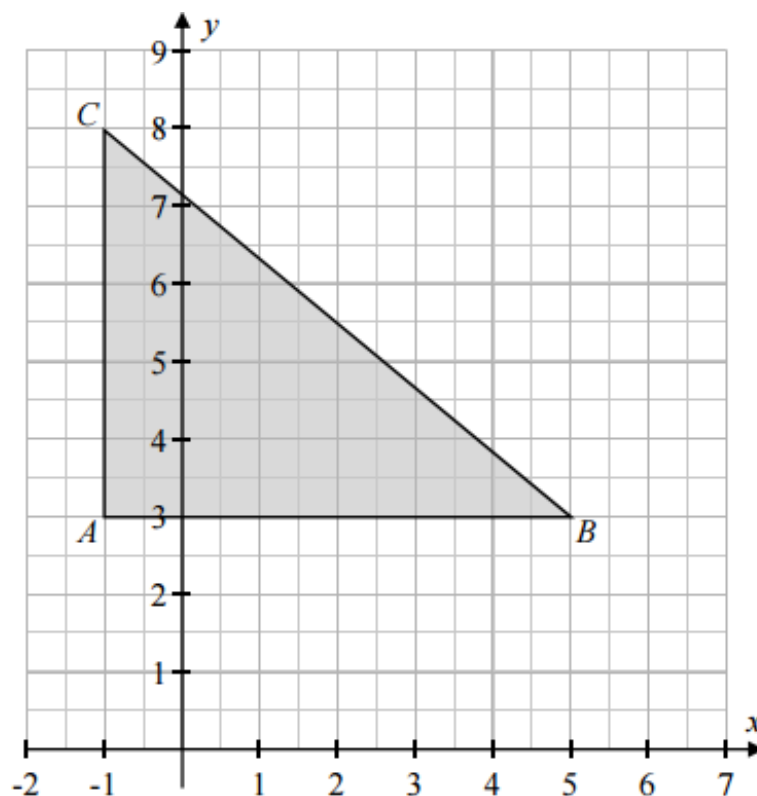
Three of its faces are labelled  $A$ ,  $B$ , and  $C$ .

- ii. Find the area of each of the faces labelled  $A$ ,  $B$ , and  $C$  in the diagram. Give your answer correct to the nearest  $cm^2$ .





3. (2016 P2 Q4) The triangle  $ABC$  is shown on the co-ordinate grid below.



- (a) Write down the co-ordinates of the points  $A$ ,  $B$ , and  $C$
- (b) Find the equations of each of the lines  $AB$ ,  $AC$  and  $BC$
- (c) Use trigonometry to find the measure of the angle  $ABC$ .  
Give your answer in degrees, correct to two decimal places.
- (d) i. Find  $|BC|$ . Give your answer in surd form.  
ii. Hence, or otherwise, find the area of the circle that goes through the points  $A$ ,  $B$ , and  $C$ .  
Give your answer in terms of  $\pi$ .
- (e) Find the equation of the line through the point  $A$  that is perpendicular to the line  $BC$ .



**4. (2011 P2 Q15)**

A group of students wish to calculate the height of the Millennium Spire in Dublin. The spire stands on flat level ground. Maria, who is 1.72 metres tall, looks up at the top of the spire using a clinometer and records an angle of elevation of  $60^\circ$ . Her feet are 70 m from the base of the spire. Ultan measures the circumference of the base of the spire as 7.07 m.

- (a) Explain how Ultan's measurement will be used in the calculation of the height of the spire.
- (b) Draw a suitable diagram and calculate the height of the spire, to the nearest metre, using the measurements obtained by the students.

