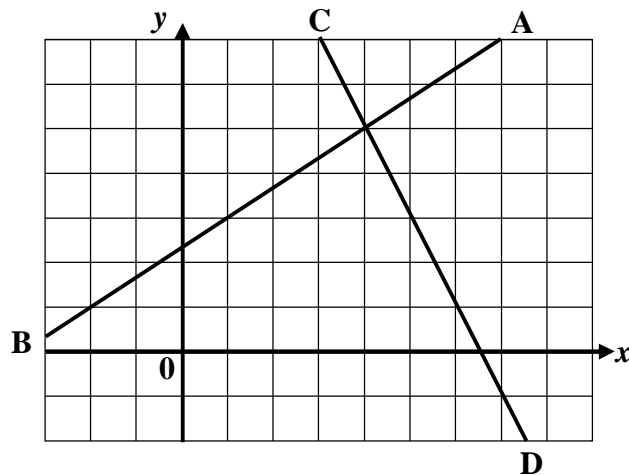


### S3 Homework – Relationships

#### DETERMINING the EQUATION of a STRAIGHT LINE

1. Calculate the gradients of the lines AB and CD shown below. (2)



2. A line passes through the points A(-2, -4) and B(8, 1).  
(a) Find the gradient of the line AB. (2)  
(b) Find the equation of the line AB. (2)
3. Find the equation of the line passing through P(4, 6) which is parallel to the line with equation  $4x - 2y + 6 = 0$ . (4)
4. A straight line has equation  $3y - 2x = 6$ .  
Find the gradient and y-intercept of the line. (3)
5. Find the equation of the straight line joining the points P(-4, 1) and Q(2, -3). (3)

**16 marks**

### S3 Homework – Relationships

#### FUNCTIONAL NOTATION

1. A function is defined as  $f(x) = x^2 - 4$ . Evaluate
- (a)  $f(-1)$  (b)  $f(0)$  (c)  $f(9)$  (4)
2. A function is defined by the formula  $g(x) = 12 - 5x$
- (a) Calculate the value of  $g(5) + g(-2)$  (3)
- (b) If  $g(k) = 14$ , find  $k$ . (3)
3. A function is defined as  $f(x) = x^2 + 3$
- Find a simplified expression for  $f(a + 2) - f(a - 5)$  (6)

**16 marks**

## **S3 Homework – Relationships**

### **EQUATIONS and INEQUALITIES**

1. Solve these equations

(a)  $2x - 12 = -3$                       (b)  $5z + 9 = 4$                       (c)  $6y - 9 = 2y + 5$                       (6)

2. Solve these equations by first multiplying out the brackets

(a)  $3(2x - 4) = 6$     (b)  $6(a - 1) = 4(a + 2)$     (5)

3. Solve these inequalities

(a)  $7x > 42$     (b)  $3x - 2 > -11$     (3)

4. Solve these inequalities

(a)  $9x + 2 \leq 6x + 11$     (b)  $5(y - 2) > 2(y + 4)$     (5)

5. Solve these inequalities, giving your answer from the set  $\{-3, -2, -1, 0, 1, 2, 3, 4, 5, 6\}$

(a)  $7x - 3 > 2x - 23$     (b)  $9(y + 2) \leq 7(y + 4)$     (5)

**24 marks**

## S3 Homework – Relationships

### WORKING with SIMULTANEOUS EQUATIONS

- Two lines have equations  $2x + 3y = 12$  and  $x + y = 5$ .  
By drawing graphs of the two lines, find the point of intersection of the 2 lines. (3)
- Solve, by substitution, the equations  $3a + 1.2b = 14.4$   
 $a = 0.5b + 3$  (4)
- Solve, by elimination, the equations  $3p - 2q = 4$   
 $p - 3q = 13$  (3)
- Mr. Martini is ordering tea and coffee for his cafe. He spends exactly £108 on these each month.  
In March he orders 4kg of tea and 6kg of coffee. In April he changes his order to 8kg of tea and 3 kg of coffee.  
How much do the tea and coffee cost each per kilogram? (6)
- An electrical goods warehouse charges a fixed price per item for goods delivered plus a fixed rate per mile.  
The total cost to a customer 40 miles from the warehouse for the delivery of 5 items was £30.  
A customer who lived 100 miles away paid £54 for the delivery of 2 items.  
Find the cost to a customer who bought 3 items and lives 70 miles away. (5)
- A straight line with equation  $y = ax + b$  passes through the points (2, 4) and (-2, -2).  
Find the equation of the line. (4)

**25 marks**

### S3 Homework – Relationships

#### CHANGING the SUBJECT of a FORMULA

1. The formula for changing from °C to °F is  $C = \frac{5}{9}F - 32$

Change the subject of the formula to  $F$ . (3)

2.  $H = w + \frac{50}{m^2}$  Change the subject of the formula to  $m$ . (4)

3. Change the subject of the formula to  $x$ :  $A = 5 + 4\sqrt{x}$  (3)

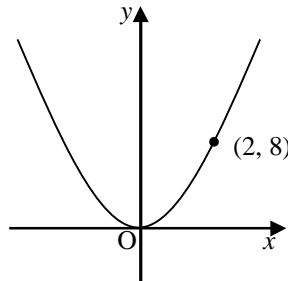
4. Given that  $A = \frac{b+c}{b}$ , express  $b$  in terms of  $A$  and  $c$ . (4)

**14 marks**

## S3 Homework – Relationships

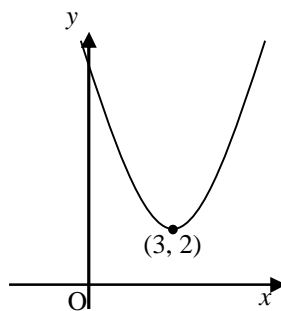
### QUADRATIC GRAPHS

1. (a) This graph has equation in the form  $y = kx^2$ . Find the value of  $k$ .



(2)

- (b) This graph has equation of the form  $y = (x + p)^2 + q$ . Write down its equation.



(2)

2. Sketch the graphs of the following showing clearly any intercepts with the axes and the turning point.

(a)  $y = (x - 4)(x + 2)$

(b)  $y = (x - 5)^2 + 3$

(7)

3. For the quadratic function  $y = 3 - (x + \frac{1}{2})^2$ , write down

(a) its turning point and the nature of it.

(3)

(b) the equation of the axis of symmetry of the parabola.

(1)

**15 marks**

## S3 Homework – Relationships

### WORKING with QUADRATIC EQUATIONS

1. Draw a suitable sketch to solve these quadratic equations.

(a)  $x(x - 4) = 0$

(b)  $x^2 + 8x + 12 = 0$

(5)

2. Solve these quadratic equations algebraically.

(a)  $5x^2 - 15x = 0$

(b)  $6x^2 - 7x - 3$

(5)

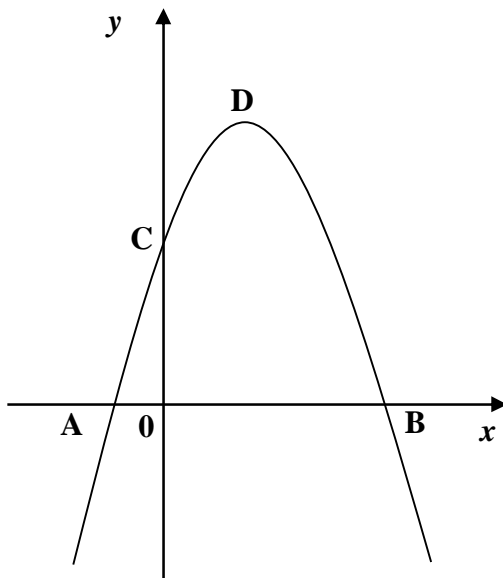
3. Solve the equation  $3x^2 - 3x - 5 = 0$ , giving your answer correct to 2 decimal places.

(4)

4. Solve the equation  $4x(x - 2) = 7$ , giving your answer correct to 1 decimal place.

(5)

5.



The graph shows the parabola  $y = 16 + 6x - x^2$ .

Find the coordinates of A, B, C and D.

(6)

6. Use the discriminant to determine the nature of the roots of these quadratic equations.

(a)  $x^2 - 6x + 8 = 0$

(b)  $4x^2 + x + 3 = 0$

(5)

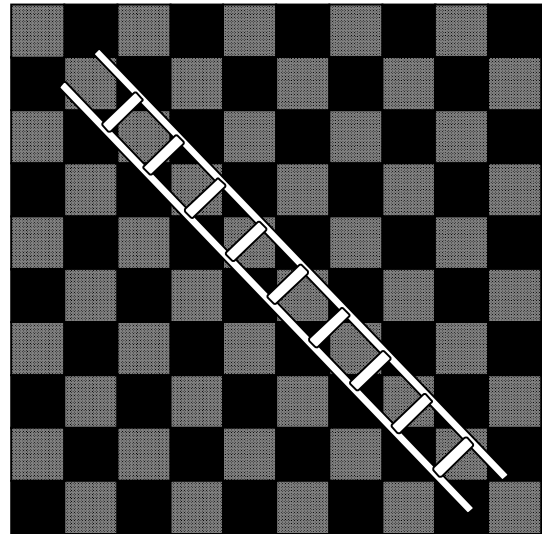
**30 marks**

**S3 Homework – Relationships**

**APPLYING the THEOREM of PYTHAGORAS**

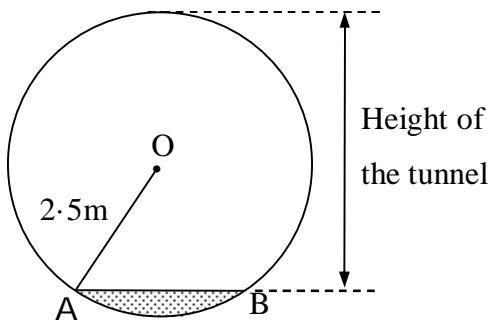
1. A square snakes & ladders board has 100 squares and a diagonal of length 35 cm.

Find the length of side of one of the



(4)

- 2.



The figure shows the cross section of a tunnel with a horizontal floor AB which is 2.4 metres wide.

The radius OA of the cross section is 2.5 metres.

(4)

Find the height of the tunnel.

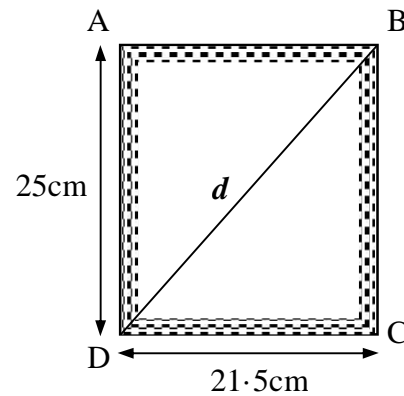
3. Calum is making a picture frame, ABCD .

It is 25 cm high and 21.5 cm wide.

To check whether the frame is rectangular, he measures the diagonal, *d*.

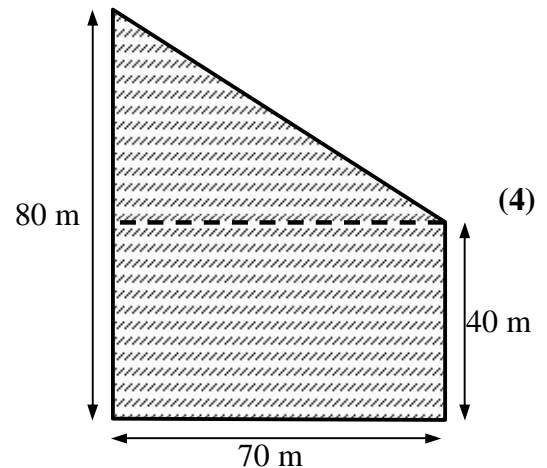
It is 31.5 cm long.

Is the frame rectangular?



(4)

4. Calculate the perimeter of this field, which is made up of a rectangle and a right angled triangle.



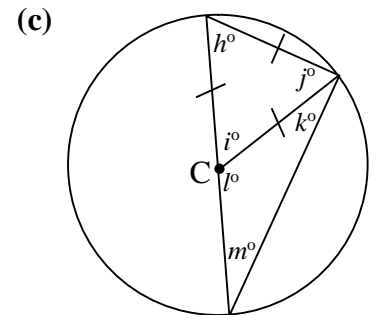
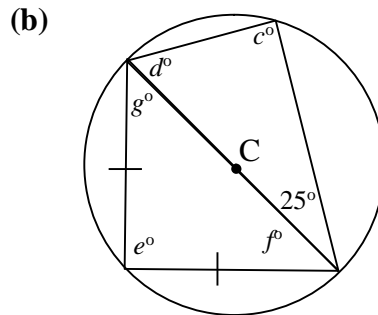
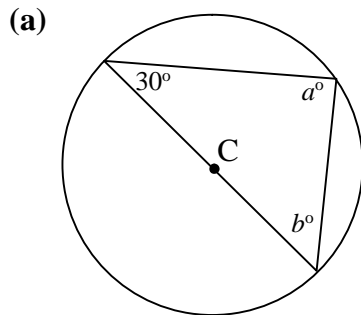
(4)



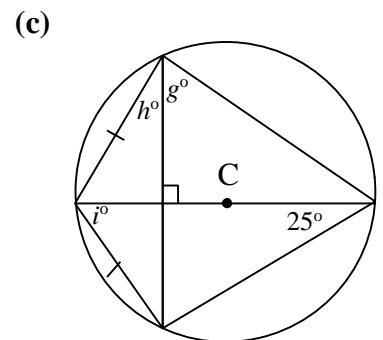
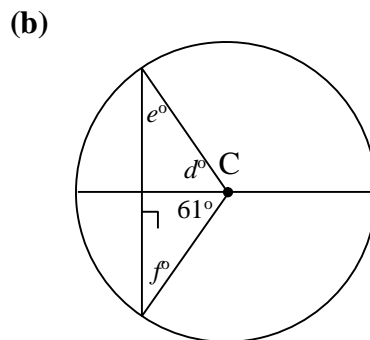
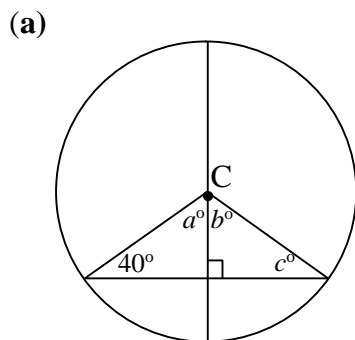
**S3 Homework – Relationships**

**APPLYING PROPERTIES of SHAPES (1)**

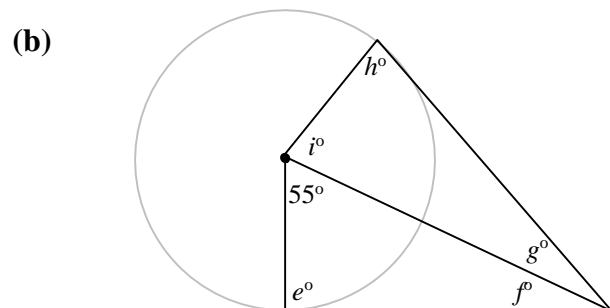
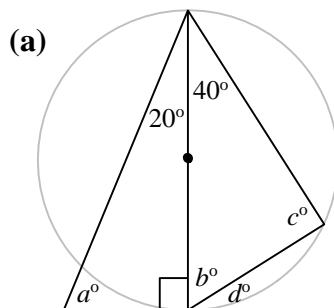
1. Find the missing angles in each of these diagrams. Each circle has centre C. (7)



2. Use symmetry in the circle to find the missing angles in the circles (centre C) below. (4½)

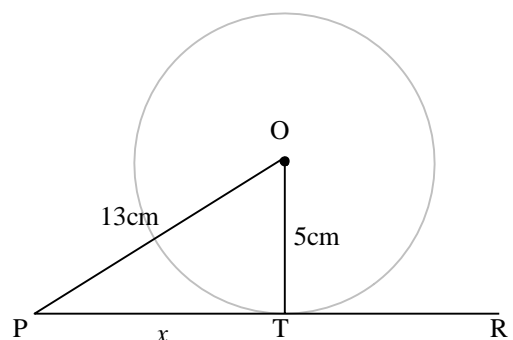


3. Calculate the sizes of the missing angles in each diagram. (4½)



4. PR is a tangent to the circle, centre O, at T. (4)

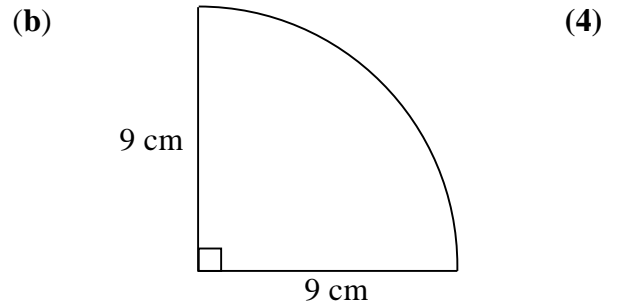
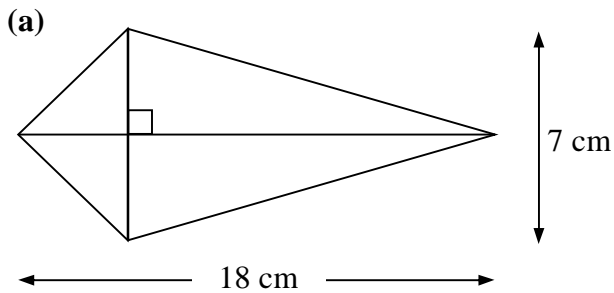
Calculate the length of the line marked  $x$ .



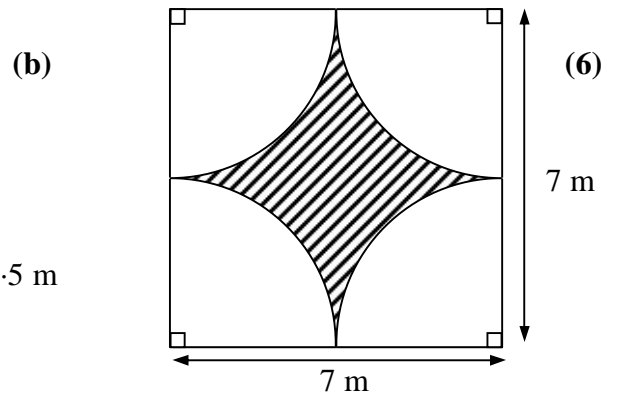
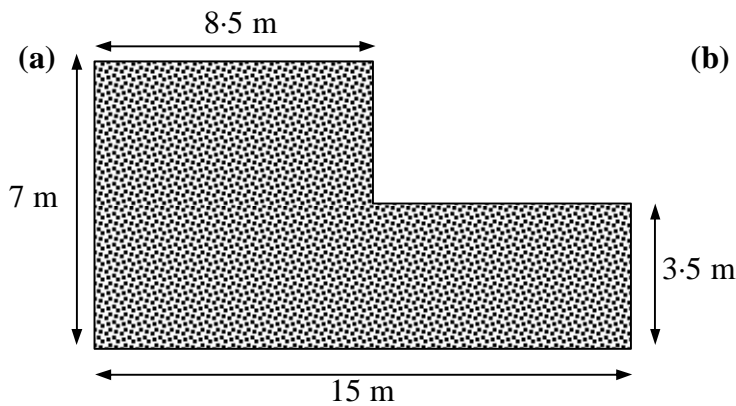
### S3 Homework – Relationships

#### APPLYING PROPERTIES of SHAPES (2)

1. Find the area of each shape below.

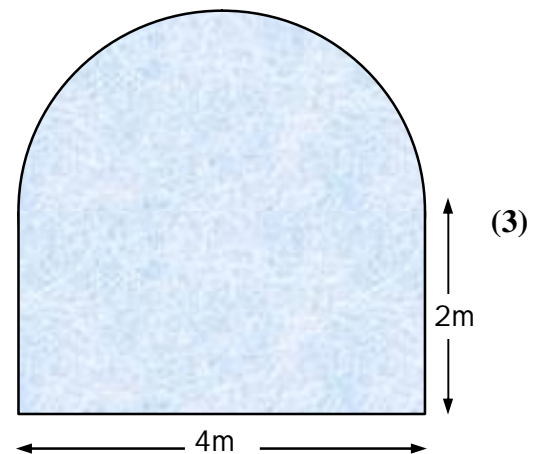


2. Find each shaded area below.

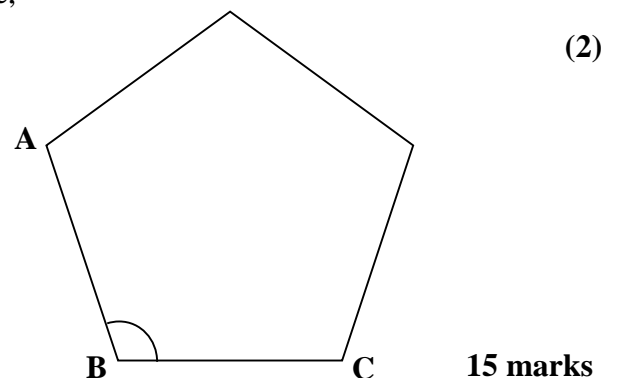


3. A window is in the shape of a rectangle 4m by 2m with a semicircle of diameter 4m on top.

Find the area of glass in the window.



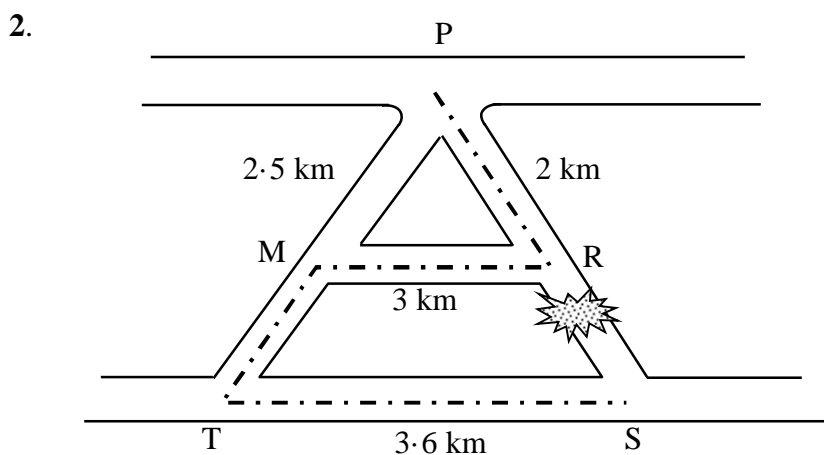
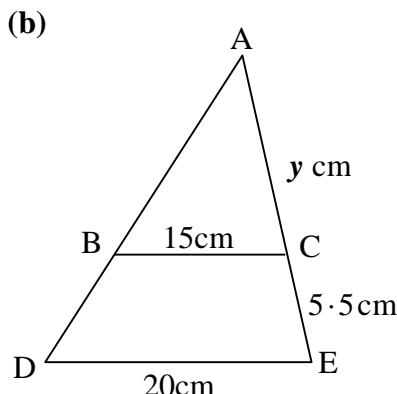
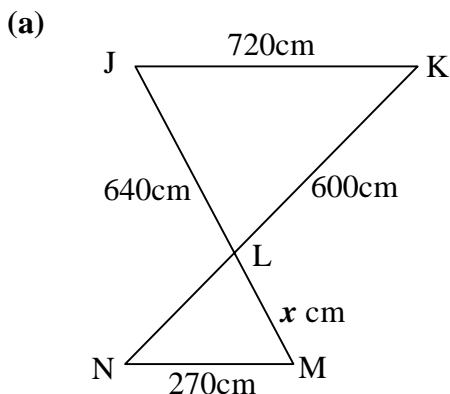
4. By dividing the pentagon into triangles or otherwise, find the size of angle ABC.



**S3 Homework – Relationships**

**SIMILARITY (1)**

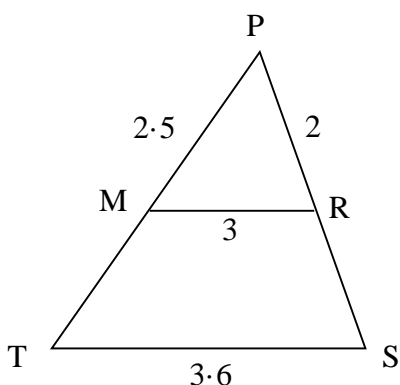
1. Calculate the value of  $x$  and  $y$  in the diagrams below. (7)



The diagram shows a system of roads which are represented below as similar triangles.

A man driving from P to S, reaches R before discovering that the road between R and S is blocked.

He takes the detour  $P \rightarrow R \rightarrow M \rightarrow T \rightarrow S$ .



$PM = 2.5$  km,  $MR = 3$  km,  $PR = 2$  km and  $ST = 3.6$  km.

How much **greater** was his journey than going directly from P to S?

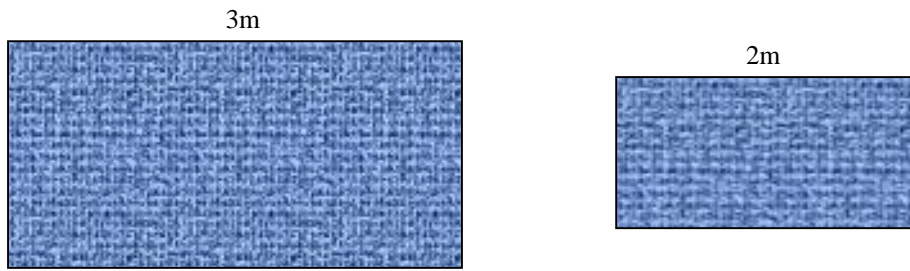
(5)

**12 marks**

## S3 Homework – Relationships

### SIMILARITY (2)

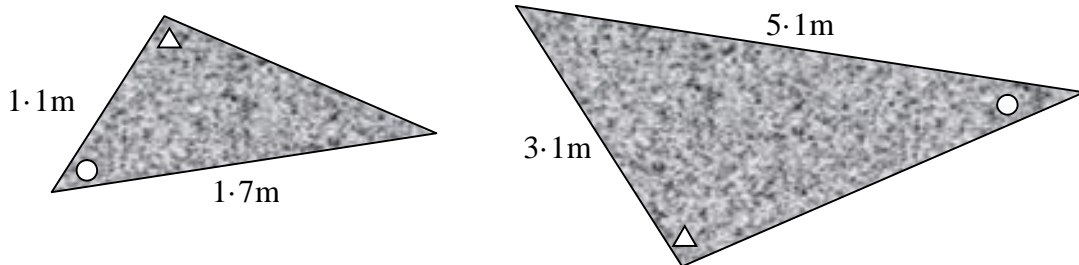
1. These two rugs are mathematically similar.



The area of the larger one is  $4.5\text{m}^2$ . What is the area of the smaller one? (3)

2. I have two triangular plots in my garden which I have had turfed.

The diagrams below show plans of both areas. Equal angles are marked with the same shape.

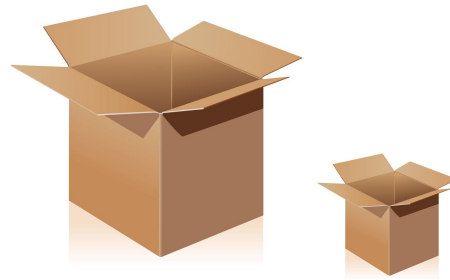


The cost depends on the area being tiled.

It cost £16.75 to buy turf for the smaller area. How much did it cost for the larger one if the triangles are mathematically similar? (3)

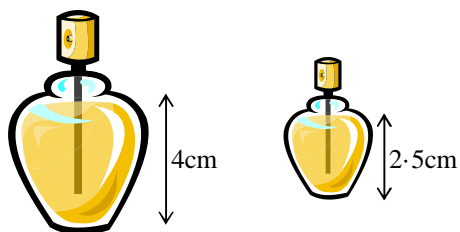
3. These two parcels are mathematically similar.

The smaller one has dimensions which are half those of the larger.



If the smaller one has volume  $150\text{cm}^3$ , calculate the volume of the larger. (3)

4. These two perfume bottles are mathematically similar.



The cost depends on the volume of perfume in them.

The larger bottle costs £62.

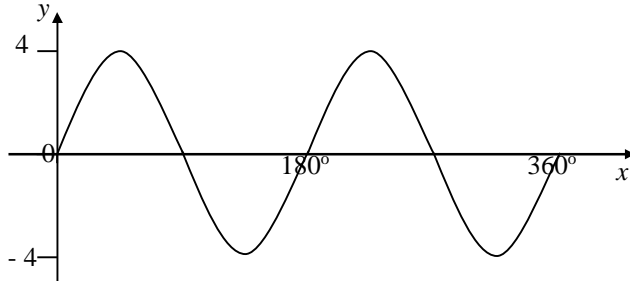
Find the cost of the smaller bottle correct to the nearest penny. (3)

## S3 Homework – Relationships

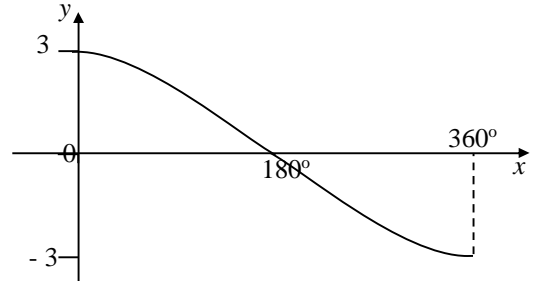
### TRIGONOMETRY (1)

1. Write down the equations of the following graphs. (6)

(a)

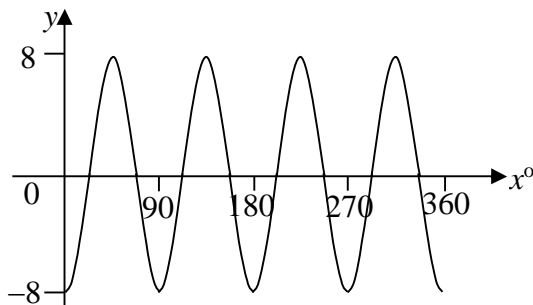


(b)

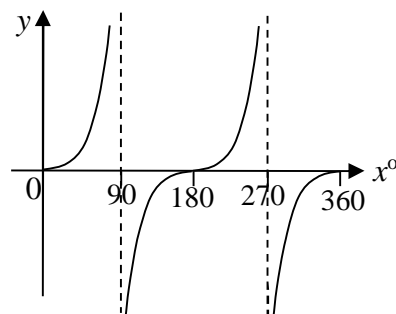


2. Write down the equation of each graph shown below: (5)

(a)



(b)



3. Make a neat sketch of the function  $y = -3 \sin 2x^\circ$ ,  $0 \leq x \leq 360$ , showing the important values. (3)

4. Make a neat sketch of each of the following for  $0 \leq x \leq 360$ , showing all important points.

(a)  $y = 4\sin(x - 45)^\circ$

(b)  $y = 2\cos x^\circ + 1$

(6)

### S3 Homework – Relationships

#### TRIGONOMETRY (2)

1. Write down the exact values of :

(a)  $\sin 60^\circ$       (b)  $\tan 225^\circ$       (c)  $\cos 300^\circ$       (d)  $\sin 315^\circ$       (4)

2. Write down the period of the following

(a)  $y = 3 \cos 2x^\circ$       (b)  $y = 2 \sin 5x^\circ$       (c)  $y = 4 \cos \frac{1}{2} x^\circ$       (3)

3. Solve for  $0 \leq x \leq 360$ , giving your answer correct to 3 significant figures.

(a)  $\sin x^\circ = 0.839$       (b)  $4\cos x^\circ + 7 = 6$       (c)  $\tan^2 x^\circ = 25$       (11)

4. Prove the following identities:

(a)  $(\sin x^\circ + \cos x^\circ)^2 = 1 + 2 \sin x^\circ \cos x^\circ$       (b)  $\tan x^\circ \times \sin x^\circ = \frac{1}{\cos x^\circ} - \cos x^\circ$       (6)

**24 marks**