



1 (a) The angles of a triangle are in the ratio 2 : 3 : 5.

(i) Show that the triangle is right-angled.

[1]

(ii) The length of the hypotenuse of the triangle is 12 cm.

Use trigonometry to calculate the length of the shortest side of this triangle.

..... cm [3]

(b) The sides of a different right-angled triangle are in the ratio 3 : 4 : 5.

(i) The length of the shortest side is 7.8 cm.

Calculate the length of the longest side.

..... cm [2]

(ii) Calculate the smallest angle in this triangle.

..... [3]

2 (a) Solve.

$$\frac{x}{7} = 49$$

$x = \dots\dots\dots$  [1]

(b) Simplify.

(i)  $x^0$

$\dots\dots\dots$  [1]

(ii)  $x^7 \times x^3$

$\dots\dots\dots$  [1]

(iii)  $\frac{(3x^6)^2}{x^{-4}}$

$\dots\dots\dots$  [2]

(c) (i) Factorise completely.

$$2x^2 - 18$$

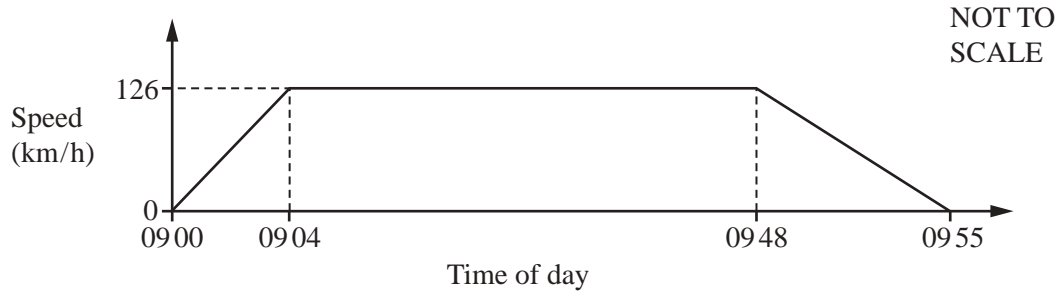
$\dots\dots\dots$  [2]

(ii) Simplify.

$$\frac{2x^2 - 18}{x^2 + 7x - 30}$$

$\dots\dots\dots$  [3]

- 3 The graph shows information about the journey of a train between two stations.



- (a) (i) Work out the acceleration of the train during the first 4 minutes of this journey.  
Give your answer in  $\text{km/h}^2$ .

.....  $\text{km/h}^2$  [2]

- (ii) Calculate the distance, in kilometres, between the two stations.

..... km [4]

- (b) (i) Show that 126 km/h is the same speed as 35 m/s.

[1]

- (ii) The train has a total length of 220 m.  
At 09 30, the train crossed a bridge of length 1400 m.

Calculate the time, in seconds, that the train took to completely cross the bridge.

.....s [3]

- (c) On a different journey, the train took 73 minutes, correct to the nearest minute, to travel 215 km, correct to the nearest 5 km.

Calculate the upper bound of the average speed of the train for this journey.  
Give your answer in km/h.

.....km/h [4]

4 The table shows information about the time,  $t$  minutes, taken for each of 150 girls to complete an essay.

Time ( $t$ minutes)	$60 < t \leq 65$	$65 < t \leq 70$	$70 < t \leq 80$	$80 < t \leq 100$	$100 < t \leq 150$
Frequency	10	26	34	58	22

(a) Write down the interval that contains the median time.

.....  $< t \leq$  ..... [1]

(b) Calculate an estimate of the mean time.

..... min [4]

(c) Rafay looks at the frequency table.

(i) He says that it is not possible to work out the range of the times.

Explain why he is correct.

.....  
 ..... [1]

(ii) He draws a pie chart to show this information.

Calculate the sector angle for the interval  $65 < t \leq 70$  minutes.

..... [2]

(d) A girl is chosen at random.

Work out the probability that she took more than 100 minutes to complete the essay.

..... [1]

- (e) Two girls are chosen at random.

Work out the probability that, to complete the essay,

- (i) they both took 65 minutes or less,

..... [2]

- (ii) one took 65 minutes or less and the other took more than 100 minutes.

..... [3]

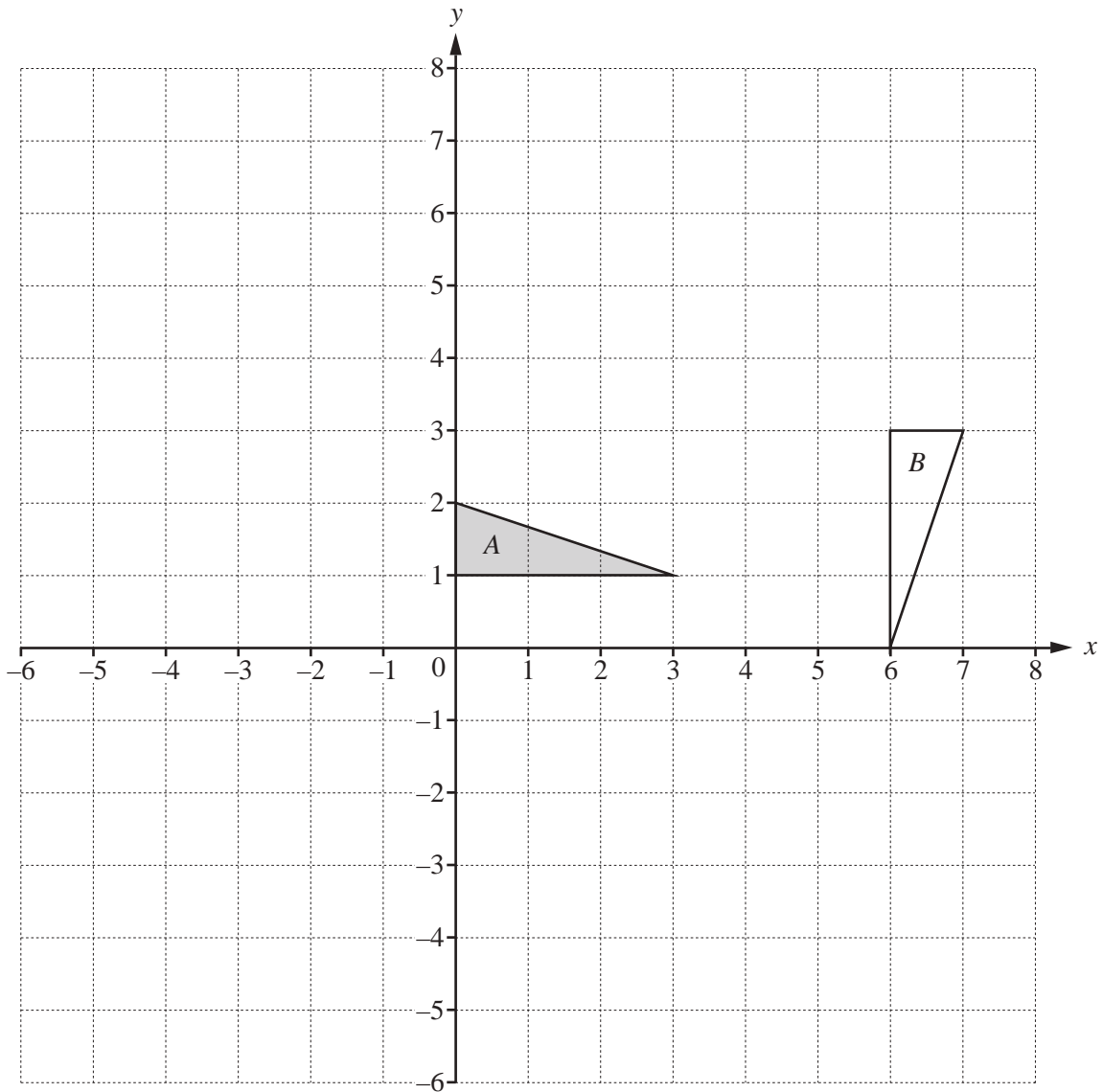
- (f) The information in the frequency table is shown in a histogram.  
The height of the block for the  $60 < t \leq 65$  interval is 5 cm.

Complete the table.

Time ( $t$ minutes)	$60 < t \leq 65$	$65 < t \leq 70$	$70 < t \leq 80$	$80 < t \leq 100$	$100 < t \leq 150$
Height of block (cm)	5				

[3]

5



(a) Draw the image of

- (i) triangle  $A$  after a reflection in the line  $x = 0$ , [2]
- (ii) triangle  $A$  after an enlargement, scale factor 2, centre  $(0, 4)$ , [2]
- (iii) triangle  $A$  after a translation by the vector  $\begin{pmatrix} -5 \\ 3 \end{pmatrix}$ . [2]

(b) Describe fully the **single** transformation that maps triangle  $A$  onto triangle  $B$ .

.....

..... [3]



(c)  $\mathbf{T} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$        $\mathbf{U} = \begin{pmatrix} 3 & 1 \\ 0 & 2 \end{pmatrix}$

Point  $P$  has co-ordinates  $(1, -4)$ .

(i) Find  $\mathbf{T}(P)$ .

(....., .....) [2]

(ii) Find  $\mathbf{TU}(P)$ .

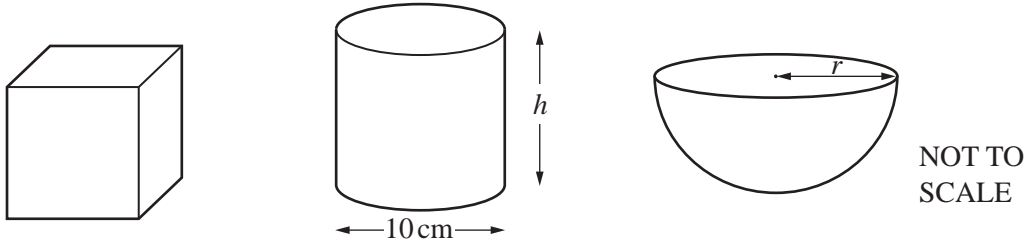
(....., .....) [2]

(iii) Describe the **single** transformation represented by the matrix  $\mathbf{T}$ .

.....

..... [3]

6 (a)



The diagrams show a cube, a cylinder and a hemisphere.  
The volume of each of these solids is  $2000\text{ cm}^3$ .

(i) Work out the height,  $h$ , of the cylinder.

$h = \dots\dots\dots\text{ cm [2]}$

(ii) Work out the radius,  $r$ , of the hemisphere.

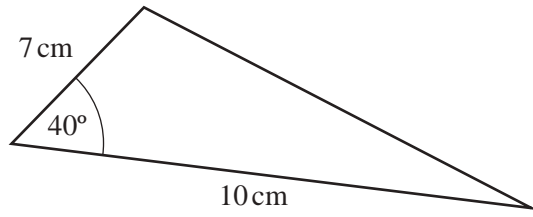
[The volume,  $V$ , of a sphere with radius  $r$  is  $V = \frac{4}{3}\pi r^3$ .]

$r = \dots\dots\dots\text{ cm [3]}$

(iii) Work out the surface area of the cube.

$\dots\dots\dots\text{ cm}^2 [3]$

(b)



NOT TO SCALE

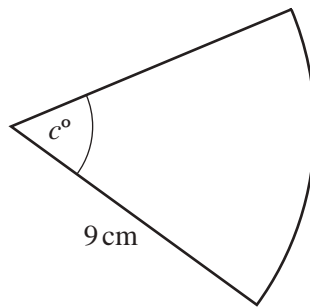
(i) Calculate the area of the triangle.

.....cm<sup>2</sup> [2]

(ii) Calculate the perimeter of the triangle and show that it is 23.5 cm, correct to 1 decimal place. Show all your working.

[5]

(c)



NOT TO SCALE

The perimeter of this sector of a circle is 28.2 cm.

Calculate the value of  $c$ .

$c =$  ..... [3]

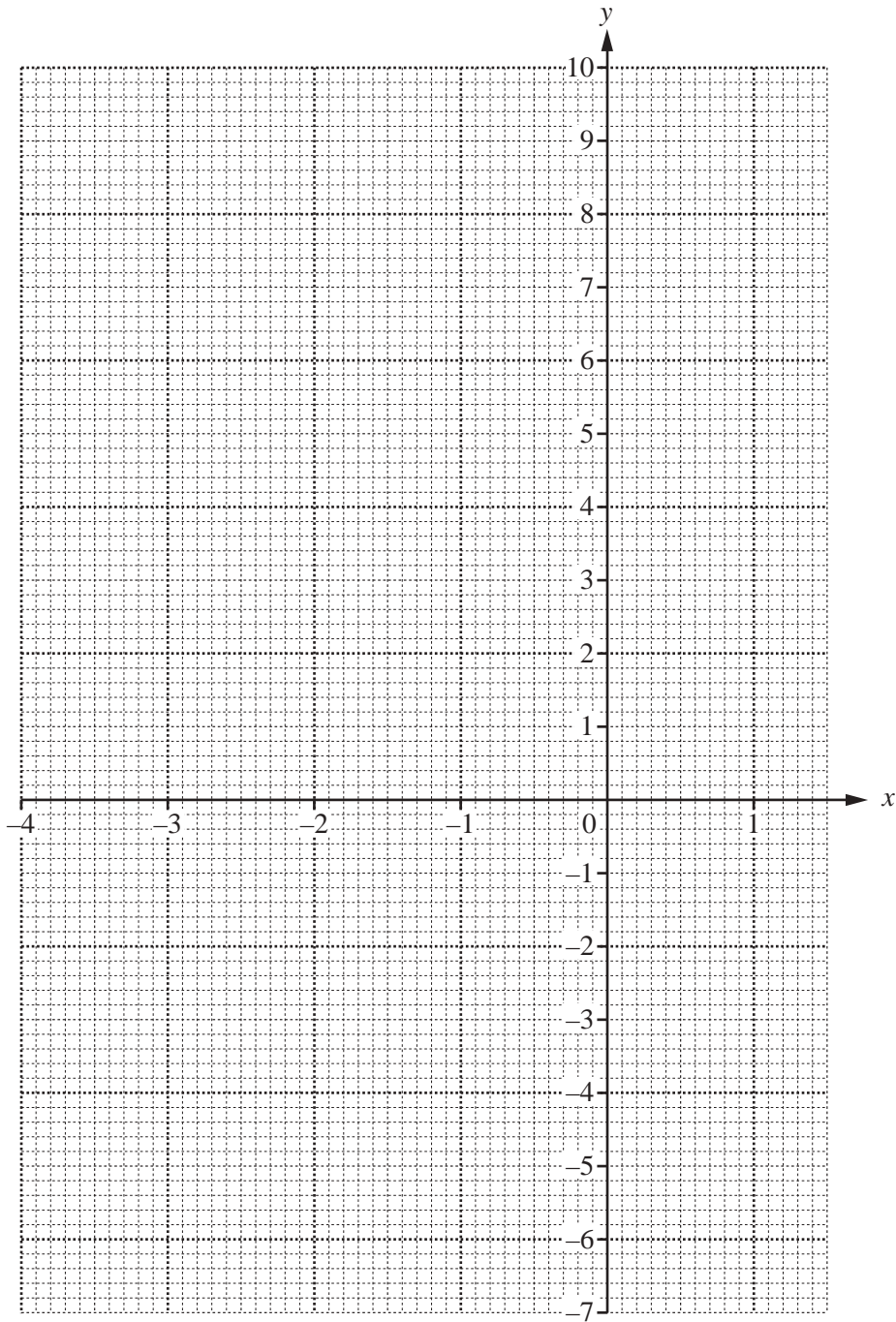
7 The table shows some values of  $y = 2x^2 + 5x - 3$  for  $-4 \leq x \leq 1.5$ .

$x$	-4	-3	-2	-1	0	1	1.5
$y$		0	-5		-3	4	

(a) Complete the table.

[3]

(b) On the grid, draw the graph of  $y = 2x^2 + 5x - 3$  for  $-4 \leq x \leq 1.5$ .



[4]

(c) Use your graph to solve the equation  $2x^2 + 5x - 3 = 3$ .

$x = \dots\dots\dots$  or  $x = \dots\dots\dots$  [2]

(d)  $y = 2x^2 + 5x - 3$  can be written in the form  $y = 2(x+a)^2 + b$ .

Find the value of  $a$  and the value of  $b$ .

$a = \dots\dots\dots$

$b = \dots\dots\dots$  [3]

8 Line A has equation  $y = 5x - 4$ .  
Line B has equation  $3x + 2y = 18$ .

(a) Find the gradient of

(i) line A,

..... [1]

(ii) line B.

..... [1]

(b) Write down the co-ordinates of the point where line A crosses the  $x$ -axis.

(....., .....) [2]

(c) Find the equation of the line perpendicular to line A which passes through the point (10, 9).  
Give your answer in the form  $y = mx + c$ .

$y =$  ..... [4]

(d) Work out the co-ordinates of the point of intersection of line A and line B.

(....., .....) [3]

(e) Work out the area enclosed by line A, line B and the  $y$ -axis.

..... [3]

- 9 Luigi and Alfredo run in a 10 km race.  
Luigi's average speed was  $x$  km/h.  
Alfredo's average speed was 0.5 km/h slower than Luigi's average speed.

- (a) Luigi took  $\frac{10}{x}$  hours to run the race.

Write down an expression, in terms of  $x$ , for the time that Alfredo took to run the race.

..... h [1]

- (b) Alfredo took 0.25 hours longer than Luigi to run the race.

- (i) Show that  $2x^2 - x - 40 = 0$ .

[4]

- (ii) Use the quadratic formula to solve  $2x^2 - x - 40 = 0$ .  
Show all your working and give your answers correct to 2 decimal places.

$x = \dots\dots\dots$  or  $x = \dots\dots\dots$  [4]

- (iii) Work out the time that Luigi took to run the 10 km race.  
Give your answer in hours and minutes, correct to the nearest minute.

..... h ..... min [3]

**Question 10 is printed on the next page.**

10 (a) (i) Write 180 as a product of its prime factors.

..... [2]

(ii) Find the lowest common multiple (LCM) of 180 and 54.

..... [2]

(b) An integer,  $X$ , written as a product of its prime factors is  $a^2 \times 7^{b+2}$ .  
 An integer,  $Y$ , written as a product of its prime factors is  $a^3 \times 7^2$ .

The highest common factor (HCF) of  $X$  and  $Y$  is 1225.

The lowest common multiple (LCM) of  $X$  and  $Y$  is 42 875.

Find the value of  $X$  and the value of  $Y$ .

$X =$  .....

$Y =$  ..... [4]

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