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0580/43

October/November 2017

2 hours 30 minutes

Additional Materials: Electronic calculator Geometrical instruments
Tracing paper (optional)

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

For π , use either your calculator value or 3.142.

The total of the marks for this paper is 130.

This document consists of **16** printed pages.

- 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.

$$2x^2 - 18$$

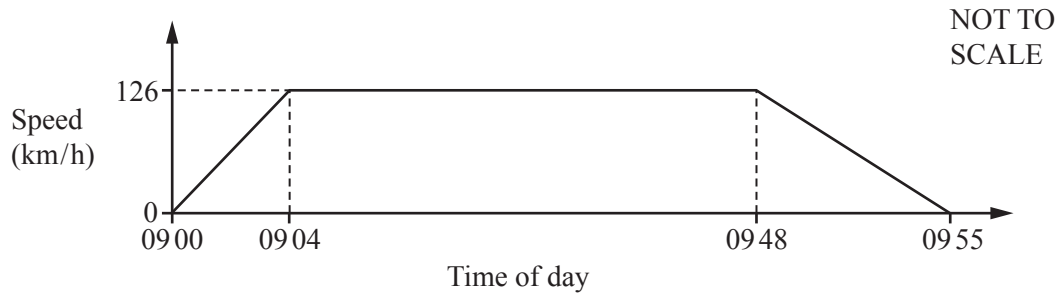
$\dots\dots\dots$ [2]

(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 km/h^2 .

..... 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.

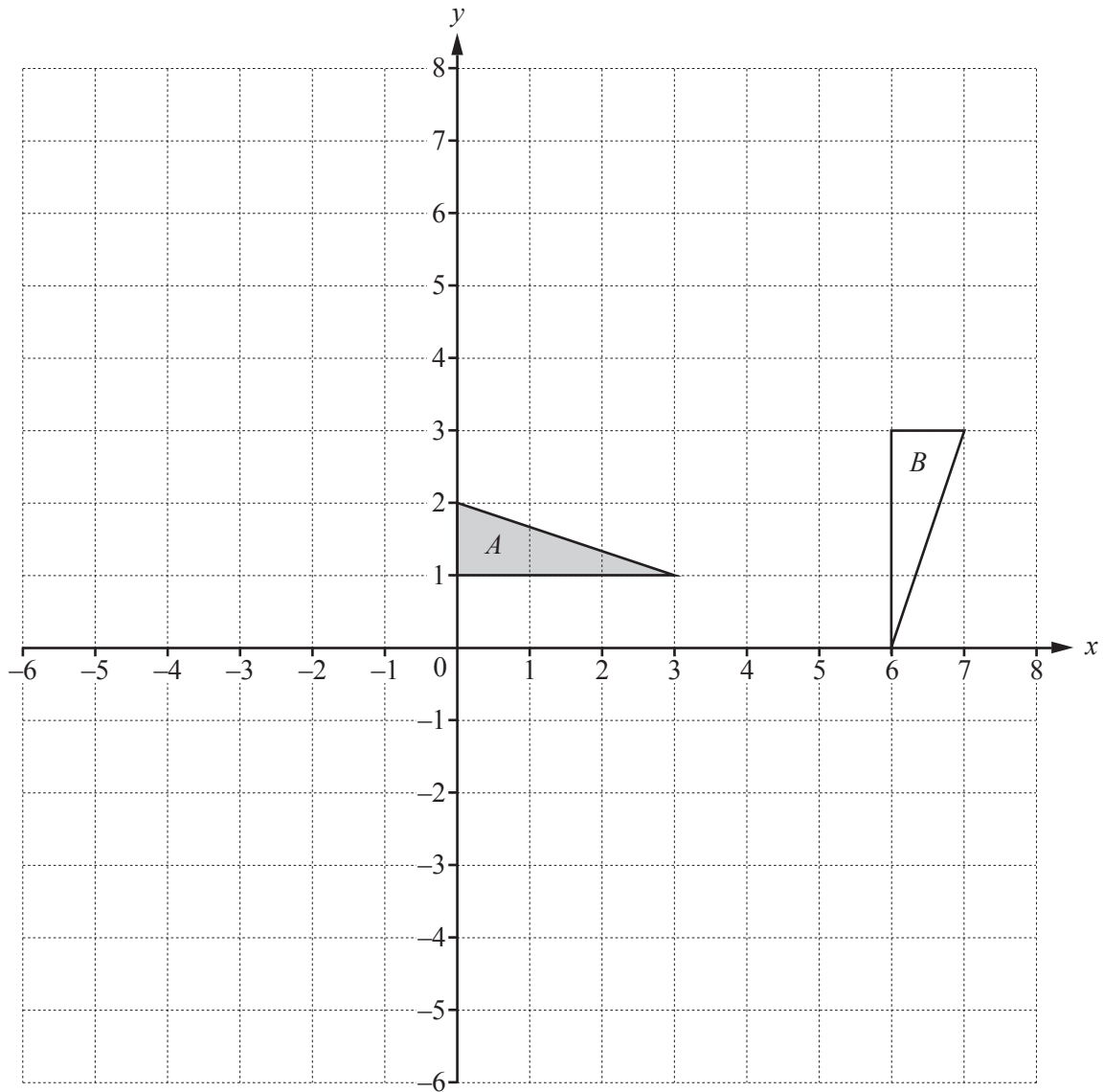
..... [3]

- (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]



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

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

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

(.....,) [2]

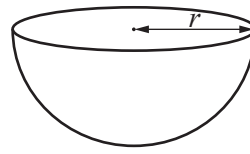
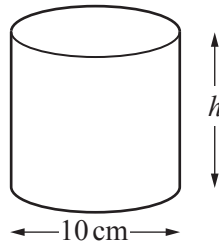
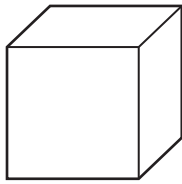
(ii) Find $\mathbf{TU}(P)$.

(.....,) [2]

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

.....
 [3]

6 (a)

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The diagrams show a cube, a cylinder and a hemisphere.
The volume of each of these solids is 2000 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.

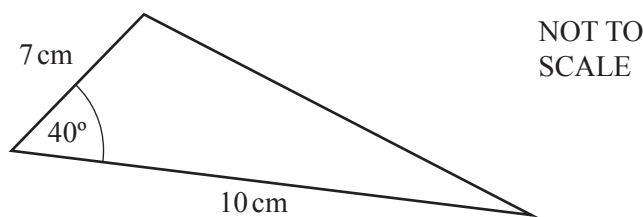
[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

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

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

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

(b)



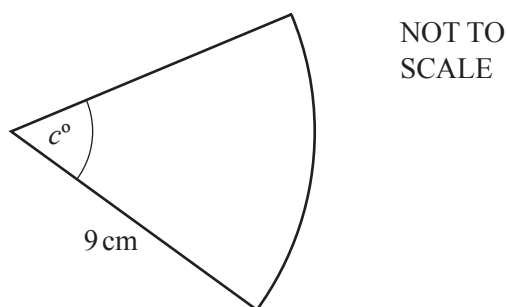
- (i) Calculate the area of the triangle.

.....cm² [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)



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

Calculate the value of c .

$c =$ [3]

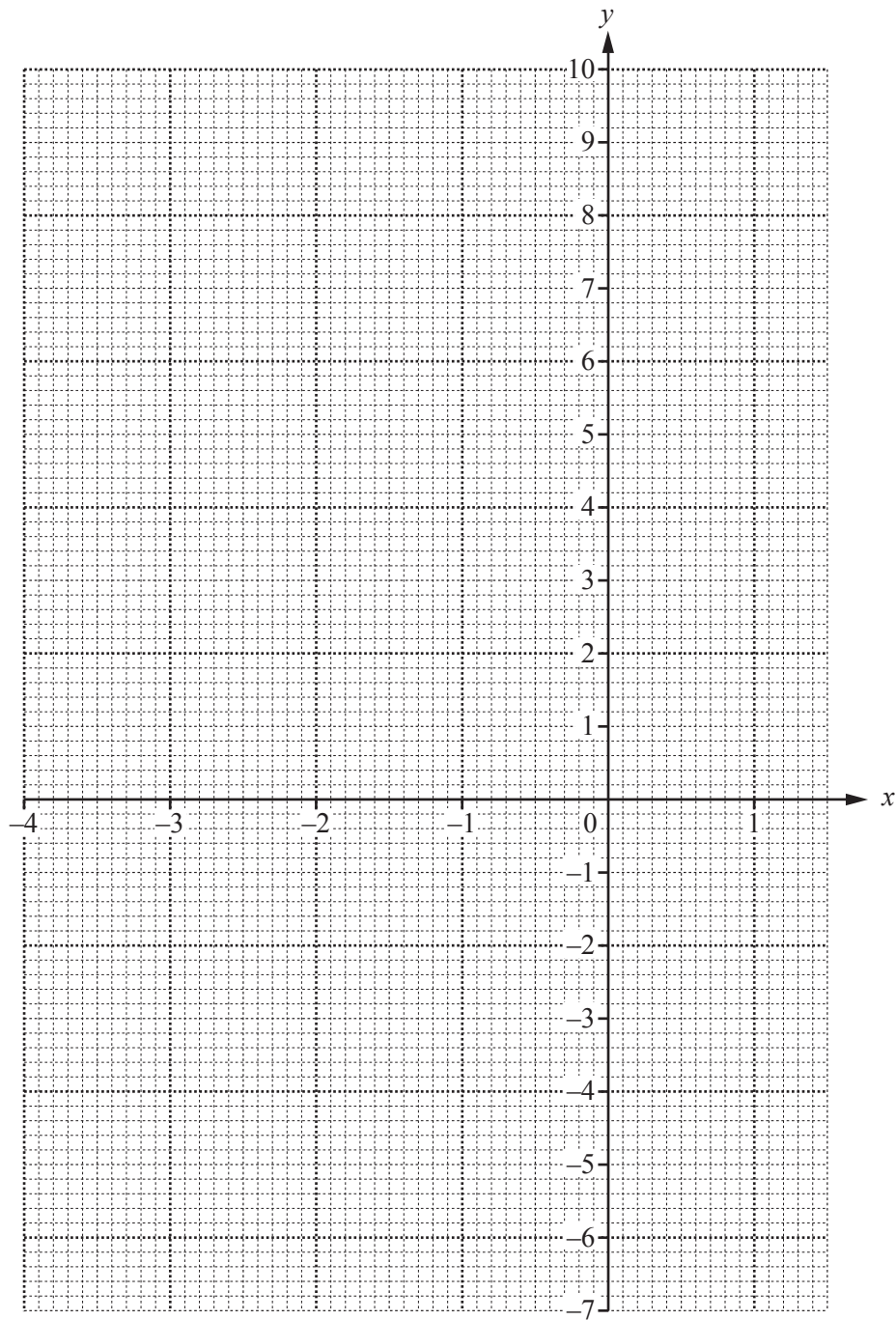
- 7 The table shows some values of $y = 2x^2 + 5x - 3$ for $-4 \leq x \leq 1.5$.

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 $2x^2 + 5x - 3 = 3$.

$$x = \dots\dots\dots \text{ or } x = \dots\dots\dots [2]$$

- (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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