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0580/43

May/June 2019

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** Here is part of a train timetable for a journey from London to Marseille.
All times given are in local time.
The local time in Marseille is 1 hour ahead of the local time in London.

London	07 19
Ashford	07 55
Lyon	13 00
Avignon	14 08
Marseille	14 46

- (a) (i)** Work out the total journey time from London to Marseille.
Give your answer in hours and minutes.

..... h min [2]

- (ii)** The distance from London to Ashford is 90 km.
The local time in London is the same as the local time in Ashford.

Work out the average speed, in km/h, of the train between London and Ashford.

..... km/h [3]

- (iii)** During the journey, the train takes 35 seconds to completely cross a bridge.
The average speed of the train during this crossing is 90 km/h.
The length of the train is 95 metres.

Calculate the length, in metres, of this bridge.

..... m [4]

- (b) The fares for the train journey are shown in the table below.

From London to Marseille	Standard fare	Premier fare
Adult	\$84	\$140
Child	\$60	\$96

- (i) For the **standard fare**, write the ratio adult fare : child fare in its simplest form.

..... : [1]

- (ii) For an **adult**, find the percentage increase in the cost of the standard fare to the premier fare.

..... % [3]

- (iii) For one journey from London to Marseille, the ratio

number of adults : number of children = 11 : 2.

There were 220 adults in total on this journey.

All of the children and 70% of the adults paid the standard fare.

The remaining adults paid the premier fare.

Calculate the total of the fares paid by the adults and the children.

\$ [5]

- (c) There were 3.08×10^5 passengers that made this journey in 2018.
This was a 12% decrease in the number of passengers that made this journey in 2017.

Find the number of passengers that made this journey in 2017.

Give your answer in standard form.

..... [3]

2 (a) Solve.

$$5x - 17 = 7x + 3$$

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

(b) Find the integer values of n that satisfy this inequality.

$$-7 < 4n \leq 8$$

$$\dots\dots\dots [3]$$

(c) Simplify.

(i) $a^3 \times a^6$

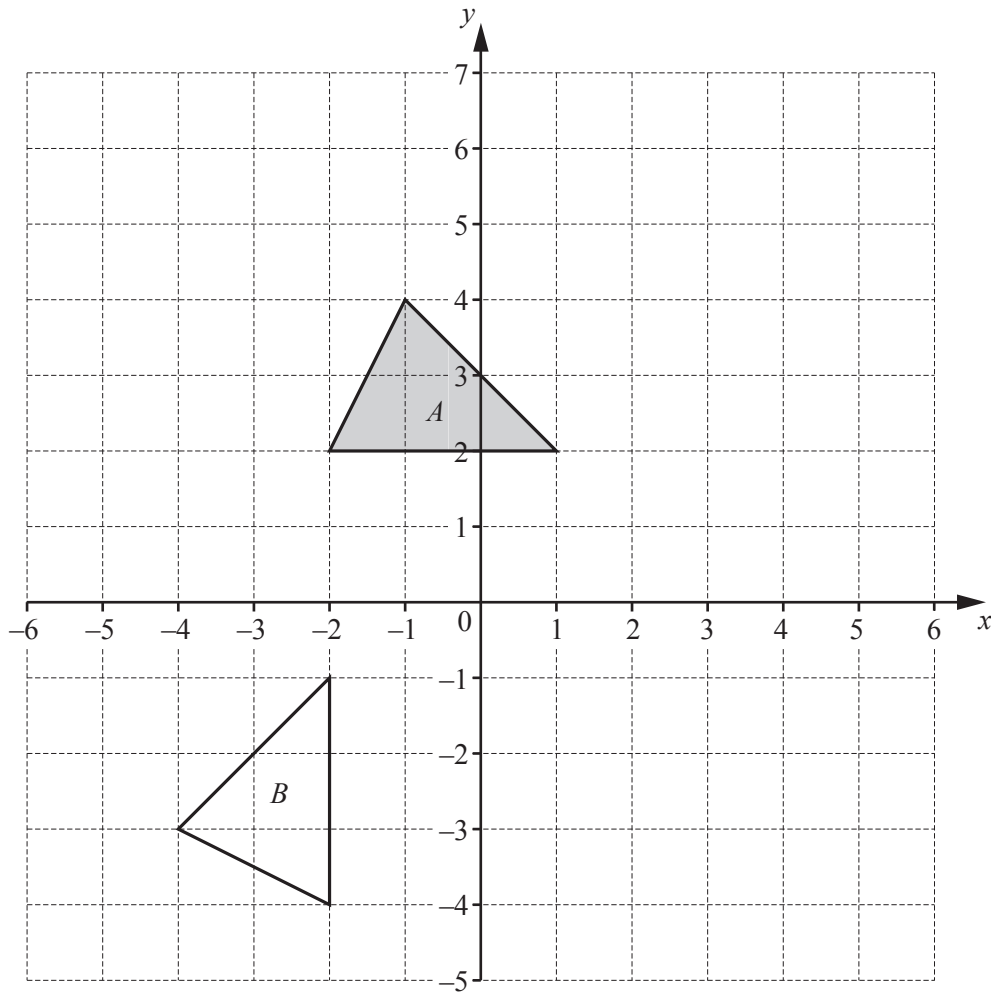
$$\dots\dots\dots [1]$$

(ii) $(5xy^2)^3$

$$\dots\dots\dots [2]$$

(iii) $\left(\frac{27x^{12}}{64y^3}\right)^{-\frac{1}{3}}$

$$\dots\dots\dots [3]$$



(a) On the grid, draw the image of

(i) triangle A after a translation by the vector $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$, [2]

(ii) triangle A after a reflection in the line $y = x$. [2]

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

..... [3]

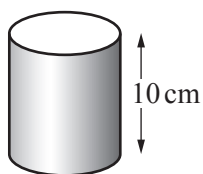
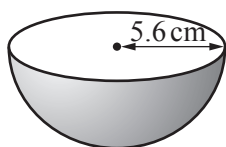
(c) (i) Find the matrix that represents an enlargement, scale factor -2 , centre $(0, 0)$.

$\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(ii) Calculate the determinant of the matrix in **part (c)(i)**.

..... [1]

4 (a)

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The diagram shows a hemispherical bowl of radius 5.6 cm and a cylindrical tin of height 10 cm.

- (i) Show that the volume of the bowl is 368 cm^3 , correct to the nearest cm^3 .
 [The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

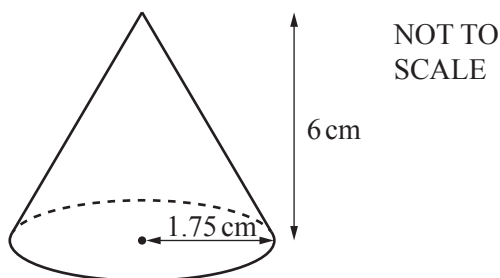
[2]

- (ii) The tin is completely full of soup.
 When all the soup is poured into the empty bowl, 80% of the volume of the bowl is filled.

Calculate the radius of the tin.

..... cm [4]

(b)

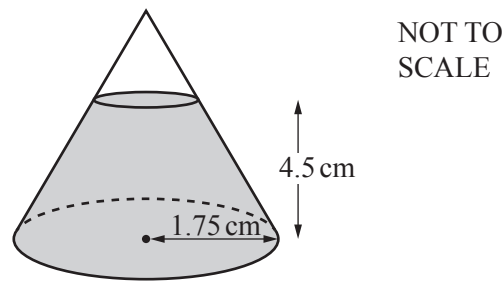


The diagram shows a cone with radius 1.75 cm and height 6 cm.

- (i) Calculate the total surface area of the cone.
 [The curved surface area, A , of a cone with radius r and slant height l is $A = \pi r l$.]

..... cm^2 [5]

(ii)



The cone contains salt to a depth of 4.5 cm.

The top layer of the salt forms a circle that is parallel to the base of the cone.

- (a) Show that the volume of the salt inside the cone is 18.9 cm^3 , correct to 1 decimal place.
 [The volume, V , of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

[4]

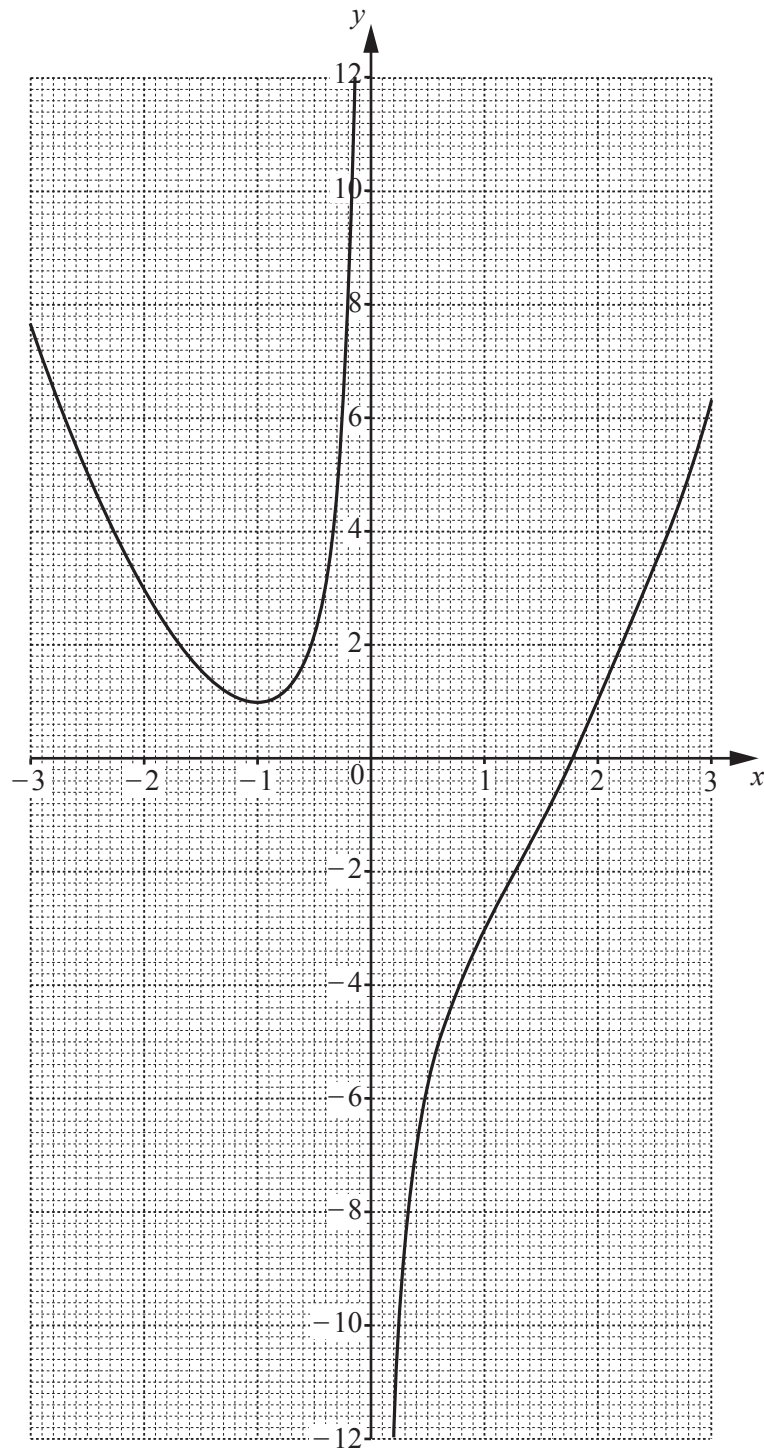
- (b) The salt is removed from the cone at a constant rate of 200 mm^3 per second.

Calculate the time taken for the cone to be completely emptied.

Give your answer in seconds, correct to the nearest second.

..... s [3]

- 5 The diagram shows the graph of $y = f(x)$ where $f(x) = x^2 - \frac{2}{x} - 2$, $x \neq 0$.



(a) Use the graph to find

(i) $f(1)$,

..... [1]

(ii) $ff(-2)$.

..... [2]

(b) On the grid opposite, draw a suitable straight line to solve the equation

$$x^2 - \frac{2}{x} - 7 = -3x \quad \text{for } -3 \leq x \leq 3.$$

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

(c) By drawing a suitable tangent, find an estimate of the gradient of the curve at $x = -2$.

..... [3]

(d) (i) Complete the table for $y = g(x)$ where $g(x) = 2^{-x}$ for $-3 \leq x \leq 3$.

x	-3	-2	-1	0	1	2	3
y			2	1	0.5		0.125

[3]

(ii) On the grid opposite, draw the graph of $y = g(x)$.

[3]

(iii) Use your graph to find the **positive** solution to the equation $f(x) = g(x)$.

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

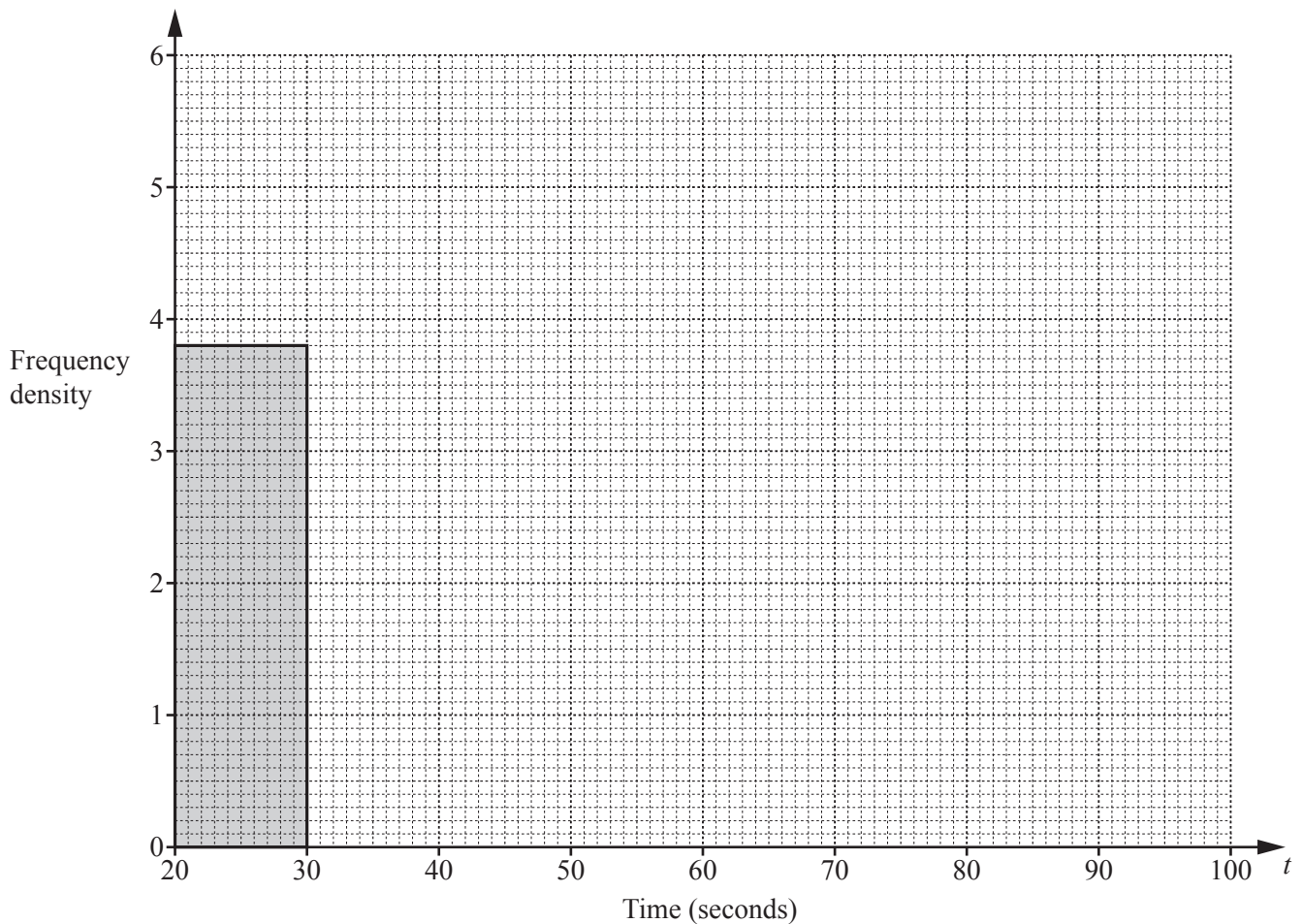
- 6 The table shows the time, t seconds, taken by each of 120 boys to solve a puzzle.

Time (t seconds)	$20 < t \leq 30$	$30 < t \leq 35$	$35 < t \leq 40$	$40 < t \leq 60$	$60 < t \leq 100$
Frequency	38	27	21	16	18

- (a) Calculate an estimate of the mean time.

..... s [4]

- (b) On the grid, complete the histogram to show the information in the frequency table.



[4]

7 A straight line joins the points $A(-2, -3)$ and $C(1, 9)$.

(a) Find the equation of the line AC in the form $y = mx + c$.

$y = \dots\dots\dots$ [3]

(b) Calculate the acute angle between AC and the x -axis.

$\dots\dots\dots$ [2]

(c) $ABCD$ is a kite, where AC is the longer diagonal of the kite.
 B is the point $(3.5, 2)$.

(i) Find the equation of the line BD in the form $y = mx + c$.

$y = \dots\dots\dots$ [3]

(ii) The diagonals AC and BD intersect at $(-0.5, 3)$.

Work out the co-ordinates of D .

$(\dots\dots\dots, \dots\dots\dots)$ [2]

- 8 (a) Angelo has a bag containing 3 white counters and x black counters. He takes two counters at random from the bag, without replacement.

- (i) Complete the following statement.

The probability that Angelo takes two black counters is

$$\frac{x}{x+3} \times \frac{\dots\dots\dots}{\dots\dots\dots}.$$

[2]

- (ii) The probability that Angelo takes two black counters is $\frac{7}{15}$.

- (a) Show that $4x^2 - 25x - 21 = 0$.

[4]

- (b) Solve by factorisation.

$$4x^2 - 25x - 21 = 0$$

$$x = \dots\dots\dots \text{ or } x = \dots\dots\dots [3]$$

- (c) Write down the number of black counters in the bag.

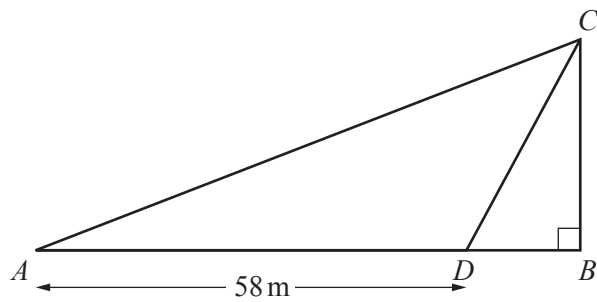
..... [1]

- (b) Esme has a bag with 5 green counters and 4 red counters.
She takes three counters at random from the bag without replacement.

Work out the probability that the three counters are all the same colour.

..... [4]

9 (a)

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In the diagram, BC is a vertical wall standing on horizontal ground AB .
 D is the point on AB where $AD = 58$ m.
 The angle of elevation of C from A is 26° .
 The angle of elevation of C from D is 72° .

(i) Show that $AC = 76.7$ m, correct to 1 decimal place.

[5]

(ii) Calculate BD .

$BD = \dots\dots\dots$ m [3]

- (b) Triangle EFG has an area of 70 m^2 .
 $EF : FG = 1 : 2$ and angle $EFG = 40^\circ$.

(i) Calculate EF .

$EF = \dots\dots\dots \text{ m}$ [4]

- (ii) A **different** triangle PQR also has an area of 70 m^2 .
 $PQ : QR = 1 : 2$ and $PQ = EF$.

Find angle PQR .

Angle $PQR = \dots\dots\dots$ [1]

Question 10 is printed on the next page.

10 (a) 19, 15, 11, 7,

(i) Write down the next two terms of the sequence.

....., [2]

(ii) Find the n th term of this sequence.

..... [2]

(iii) Find the value of n when the n th term is -65 .

$n =$ [2]

(b) Another sequence has n th term $2n^2 + 5n - 15$.

Find the difference between the 4th term and the 5th term of this sequence.

..... [2]

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