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4024/21

October/November 2019

2 hours 30 minutes

Additional Materials: Geometrical instruments
Electronic calculator

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

For π , use either your calculator value or 3.142, unless the question requires the answer in terms of π .

The total of the marks for this paper is 100.

This document consists of **19** printed pages and **1** blank page.

1 Neema travels on a business trip.

- (a) The total cost of her flight is \$406 including tax.
The cost of the flight excluding tax is \$350.

Calculate the tax as a percentage of \$350.

..... % [2]

- (b) Neema takes a suitcase with mass 15.5 kg, correct to the nearest 0.5 kg.
She also takes 6 packets each with mass 1.2 kg, correct to the nearest 0.1 kg.
She has a luggage limit of exactly 23 kg for the flight.

Can Neema be certain that the mass of her luggage is below the limit?
Show how you decide.

.....
..... [2]

- (c) Neema changes \$245 to euros (€) for the trip.
The exchange rate is $\$1 = €0.73$.

On the trip she spends €124.

When she returns, she changes the remaining euros back to dollars at a rate of $\$1 = €0.76$.

Calculate the amount of money she receives.
Give your answer correct to the nearest dollar.

\$ [3]

- (d) On her next trip, Neema hires a car.
 She drives a total of 657 km in the car.
 The car uses fuel at a rate of 4.3 litres per 100 km driven.
 Neema pays \$1.29 per litre of fuel.

Calculate the amount she spends on fuel during the trip.

\$ [3]

- (e) Neema stays in a hotel for 7 nights.
 This is her hotel bill.

Item	Cost
7 nights at \$..... per night	\$805
4 dinners at \$..... each	\$.....
Total before tax	\$.....
Total including tax at 6.5%	\$996.84

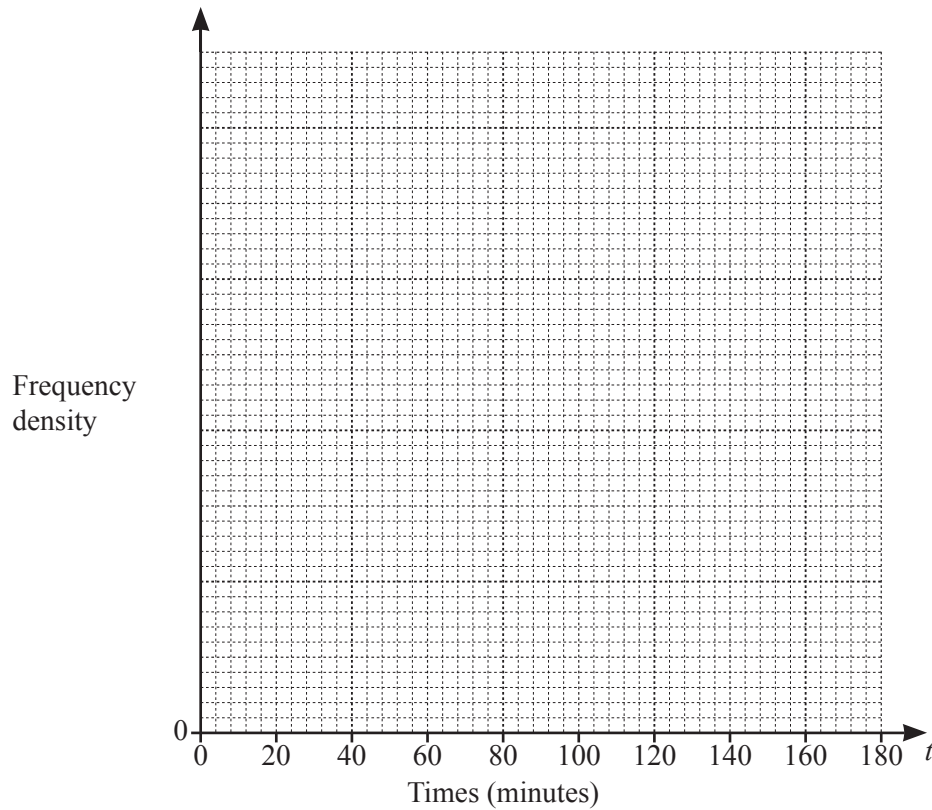
Complete the missing values in the hotel bill.

[4]

- 2 (a) One afternoon, there were 200 visitors to a library.
The table summarises the time, in minutes, each visitor spent in the library.

Time (t minutes)	$0 < t \leq 20$	$20 < t \leq 40$	$40 < t \leq 60$	$60 < t \leq 90$	$90 < t \leq 180$
Frequency	26	76	56	24	18

- (i) On the grid, draw a histogram to represent this data.



[3]

- (ii) Work out the percentage of these visitors who spent more than 40 minutes in the library.

..... % [2]

- (b) Mario recorded the number of books borrowed by each of the 200 visitors to the library. His results are shown in the table.

Number of books	0	1	2	3	4	5	6
Frequency	17	47	42	28	32	21	13

- (i) Find the median.

..... [1]

- (ii) Calculate the mean.

..... [2]

- (iii) One of the visitors is selected at random.

Find the probability that this visitor borrowed more than 4 books.

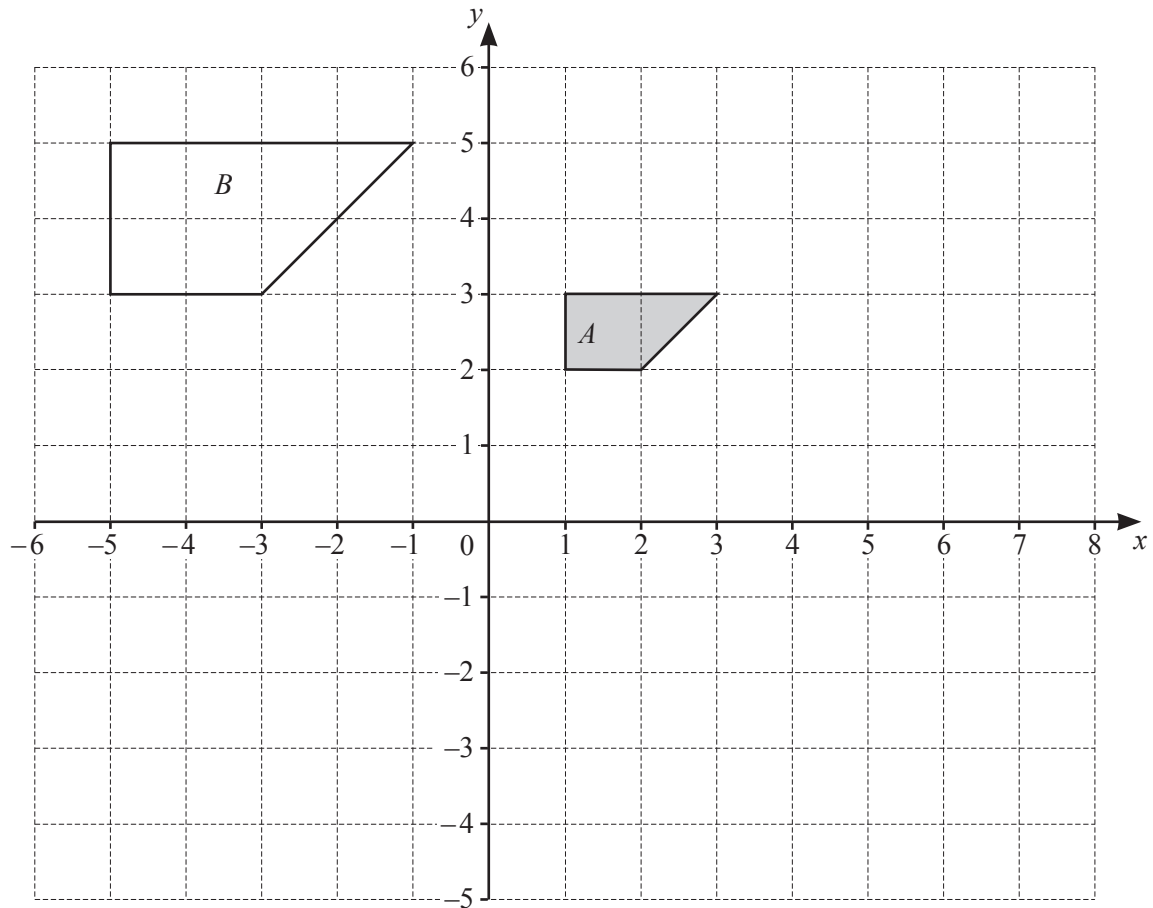
..... [1]

- (iv) Two of the visitors are selected at random.

Find the probability that only one of them borrowed 6 books.
Give your answer as a decimal correct to 4 significant figures.

..... [3]

3



Shape A and shape B are drawn on the grid.

- (a) Describe fully the enlargement that maps shape A onto shape B .

.....
 [2]

- (b) Shape A is mapped onto shape C by a rotation of 90° clockwise, centre $(1, 0)$.

Draw and label shape C on the grid.

[2]

- (c) Transformation P is represented by the matrix $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$.

P maps shape *A* onto shape *D*.

- (i) Draw and label shape *D* on the grid.

[2]

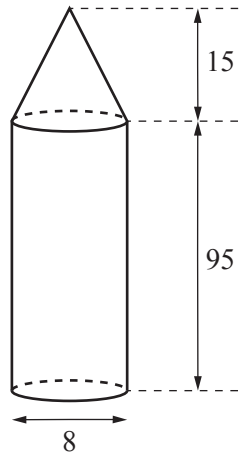
- (ii) Describe fully the **single** transformation P.

.....

..... [2]

4 [Volume of cone = $\frac{1}{3}\pi r^2 h$]

[Curved surface area of a cone = $\pi r l$]



The diagram shows a gate post.

It is made in the shape of a cylinder with a cone on top.

The cylinder and the cone each have diameter 8 cm.

The height of the cylinder is 95 cm and the height of the cone is 15 cm.

(a) Calculate the volume of the gate post.

..... cm³ [3]

(b) Show that the total curved surface area of the gate post is 2580 cm², correct to 3 significant figures.

- (c) A geometrically similar gate post has a **total** height of 150 cm.

Calculate the total curved surface area of this gate post.

..... cm² [2]

5 (a) (i) $x^2 + 7x - 13 = (x + a)^2 + b$

Find the value of a and the value of b .

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots [2]$$

- (ii) Hence solve the equation $x^2 + 7x - 13 = 0$.
Show your working and give your answers correct to 3 significant figures.

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

(b) Simplify $\frac{4x^2 - 9}{2x^2 - 11x + 12}$.

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

(c) Solve $\frac{2x}{x+4} + \frac{6}{x-1} = 2$.

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

- 6 These are the first four patterns in a sequence made using counters.

Pattern 1



Pattern 2



Pattern 3



Pattern 4



- (a) Complete the table for the patterns in this sequence.

Pattern number	1	2	3	4	5
Number of counters	3	8	15		

[1]

- (b) Find an expression, in terms of n , for the number of counters in Pattern n .

..... [2]

- (c) Ken has a bag containing 1358 counters.
He makes the largest possible pattern in the sequence, Pattern p , using these counters.

- (i) Find the value of p .

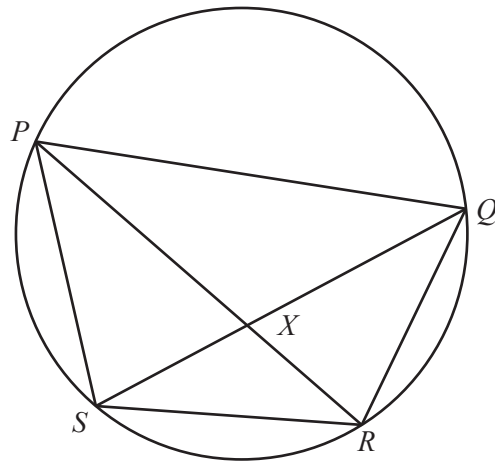
$p =$ [3]

- (ii) He uses all of the remaining counters to make another pattern in the sequence, Pattern q .

Find the value of q .

$q =$ [2]

7

NOT TO
SCALE

P , Q , R and S are points on a circle.
 PXR and QXS are straight lines.

- (a) Show that triangle PQX is similar to triangle SRX .
 Give a reason for each statement you make.

.....

.....

.....

..... [3]

- (b) $PX = 8.1$ cm, $QX = 6.3$ cm and $SX = 4.5$ cm.

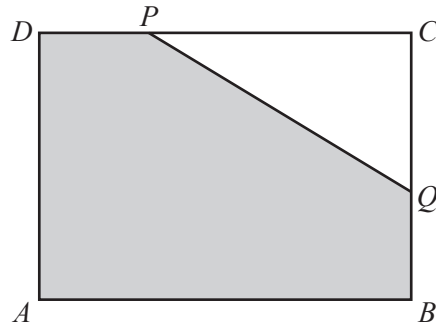
- (i) Calculate RX .

..... cm [2]

- (ii) Find the ratio area of triangle PQX : area of triangle PSX .
 Give your answer in its simplest form.

..... : [2]

8

NOT TO
SCALE

Rectangle $ABCD$ has area 80 cm^2 .

Triangle PCQ is removed from one corner of the rectangle.

$BQ = DP = 4\text{ cm}$.

$AB = x\text{ cm}$.

- (a) Write down an expression, in terms of x , for CP .

..... [1]

- (b) Explain why $CQ = \left(\frac{80}{x} - 4\right)\text{ cm}$.

.....

 [1]

- (c) Show that the shaded area, $y\text{ cm}^2$, is given by

$$y = 32 + 2x + \frac{160}{x}.$$

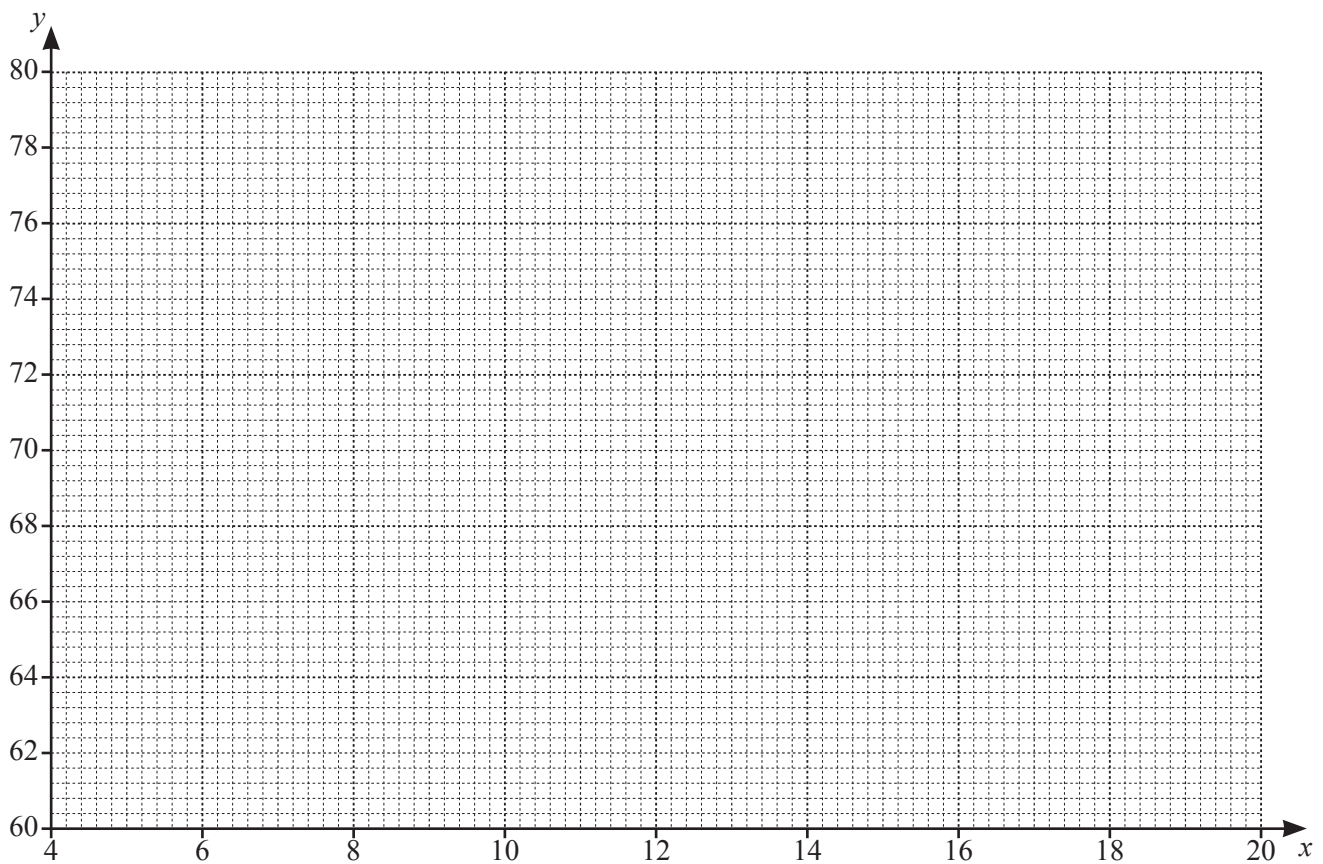
- (d) Complete the table for $y = 32 + 2x + \frac{160}{x}$.

Values are given to 1 decimal place where appropriate.

x	4	6	8	10	12	14	16	18	20
y	80	70.7	68	68	69.3	71.4		76.9	80

[1]

- (e) On the grid, draw the graph of $y = 32 + 2x + \frac{160}{x}$ for $4 \leq x \leq 20$.

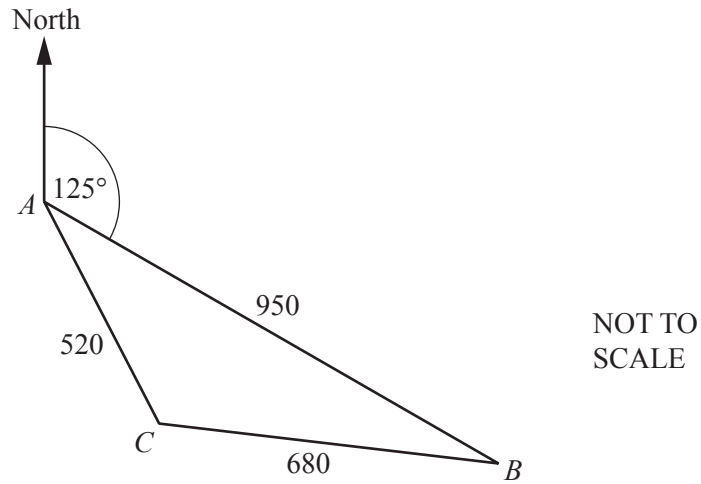


[3]

- (f) Use your graph to find the minimum possible shaded area.

..... cm^2 [1]

9



The diagram shows the positions of three farms A , B and C on horizontal ground.
 Farm B is on a bearing of 125° from farm A .
 $AB = 950\text{ m}$, $BC = 680\text{ m}$ and $AC = 520\text{ m}$.

- (a) Show that $\hat{BAC} = 44.0^\circ$, correct to 1 decimal place.

[3]

- (b) Calculate the bearing of A from C .

..... [1]

- (c) Farm A and farm B are joined by a straight track AB .
Amira walks along the track from A at a constant speed of 4.6 km/h.

Calculate the time it takes for Amira to walk from A to the point that is closest to farm C .
Give your answer in minutes and seconds, correct to the nearest second.

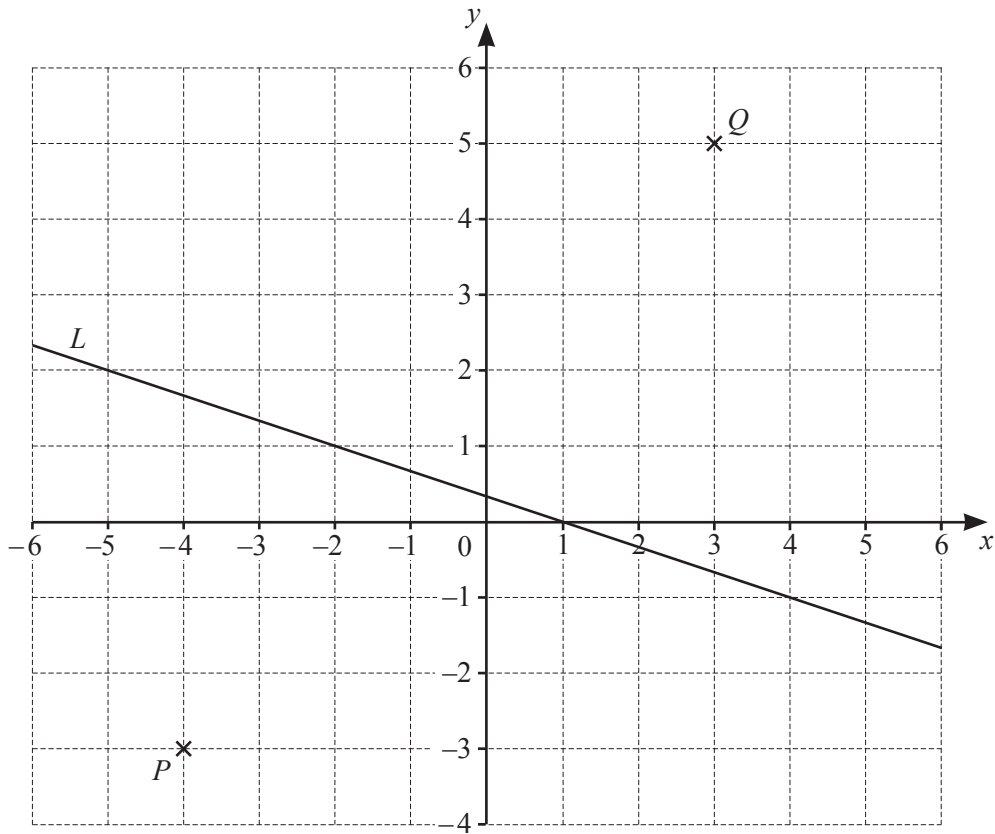
..... minutes seconds [4]

- (d) A helicopter hovers vertically above farm B .
The angle of elevation of the helicopter from farm A is 10.7° .

Calculate the angle of elevation of the helicopter from farm C .

..... [4]

10



Points P and Q and the line L are shown on the grid.

(a) Calculate the length of PQ .

..... cm [2]

(b) Show that the equation of line L is $3y + x = 1$.

- (c) Line M is perpendicular to line L and passes through point P .

Find the equation of line M .

Give your answer in the form $y = mx + c$.

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

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