Please check the examination details below before entering your candidate information

Candidate surname | Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9–1)

Centre Number | Candidate Number

Monday 12 November 2018

Morning (Time: 1 hour 30 minutes) | Paper Reference **1MA1/3H**

Mathematics

Paper 3 (Calculator)
Higher Tier

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may be used**.
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.

Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

P 5 5 5 9 8 A 0 1 2 0

Pearson

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) Write 7357 correct to 3 significant figures.

$7 > 5$
round up

7360

(1)

(b) Work out $\dfrac{\sqrt{17 + 4^2}}{7.3^2}$

Write down all the figures on your calculator display.

$= \dfrac{\sqrt{33}}{7.3^2} =$ type in calculator

0.1077981356

(2)

(Total for Question 1 is 3 marks)

2 Last year Jo paid £245 for her car insurance.
This year she has to pay £883 for her car insurance.

Work out the percentage increase in the cost of her car insurance.

Percentage increase $= \dfrac{\text{new} - \text{original}}{\text{original}} \times 100$

$= \dfrac{883 - 245}{245} \times 100$

$= 2.604\ldots \times 100$

$= \underline{\quad 260.4 \quad}$ %

(Total for Question 2 is 3 marks)

3 (a) Complete this table of values for $y = x^2 + x - 4$

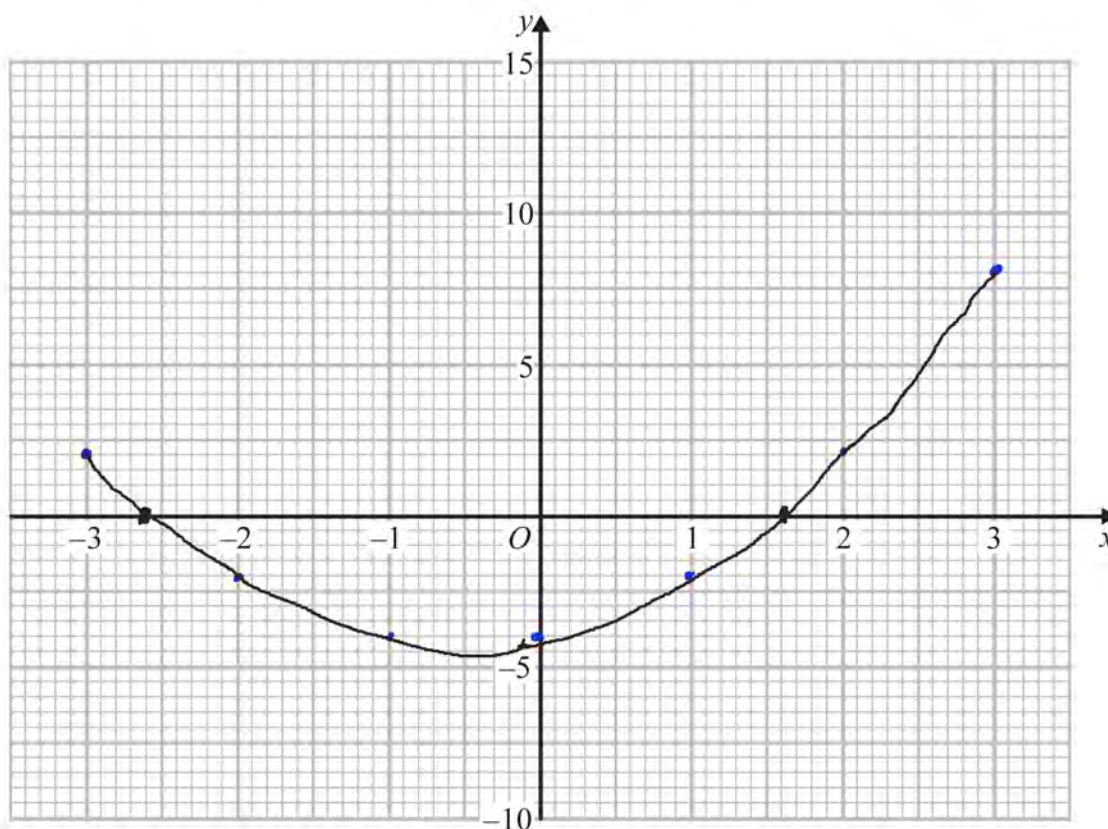| x	-3	-2	-1	0	1	2	3
y	2	-2	-4	-4	-2	2	8

$(-3)^2 - 3 - 4 = 2$

$0^2 - 0 - 4 = -4$

$2^2 + 2 - 4 = 2$

$3^2 + 3 - 4 = 8$

(2)

(b) On the grid, draw the graph of $y = x^2 + x - 4$ for values of x from -3 to 3

(2)

(c) Use the graph to estimate a solution to $x^2 + x - 4 = 0$
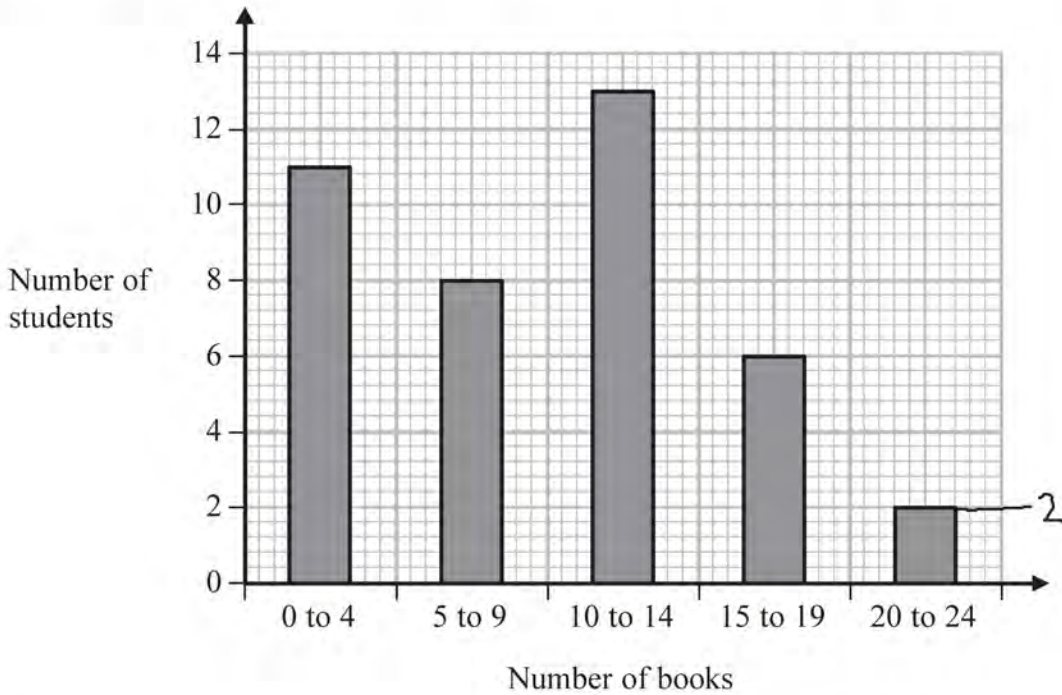
↳ when line crosses x axis

1.6 or -2.6

(1)

(Total for Question 3 is 5 marks)

4 Fran asks each of 40 students how many books they bought last year.

The chart below shows information about the number of books bought by each of the 40 students.

(a) Work out the percentage of these students who bought 20 or more books.

20 or more → $\frac{2}{40}$ = $\frac{1}{20}$ = $\frac{5}{100}$

Total →

$\frac{5}{100}$ = 5% ×100

.... 5 .... %

(2)

(b) Show that an estimate for the mean number of books bought is 9.5
You must show all your working.

$$\text{Mean} = \frac{\Sigma(\text{frequency} \times \text{midpoint})}{\text{frequency}}$$

$$= \frac{11\times2 + 8\times7 + 13\times12 + 6\times17 + 2\times22}{40}$$

$$\approx \frac{380}{40} = 9.5$$

(4)

(Total for Question 4 is 6 marks)

5   Lara is a skier.

She completed a ski race in 1 minute 54 seconds.
The race was 475 m in length.

Lara assumes that her average speed is the same for each race.

(a) Using this assumption, work out how long Lara should take to complete a 700 m race.
    Give your answer in minutes and seconds.

$$1m \; 54sec = 60 + 54 = 114 sec$$

$$speed = \frac{dist}{time} = \frac{475}{114} = 4.166... \; m/s$$

$$Time = \frac{dist}{speed} = \frac{700}{4.166...} = 168 sec$$

$$168 sec = 2min \; 48sec$$

$$168 - 120 = 48$$

............2............ minutes ....48............ seconds

(3)

Lara's average speed actually increases the further she goes.
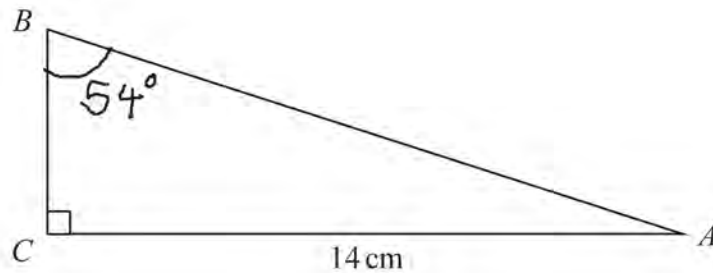
(b) How does this affect your answer to part (a)?

The time will be less because it is an underestimate

(1)

(Total for Question 5 is 4 marks)

6 *ABC* is a right-angled triangle.

AC = 14 cm.
Angle *C* = 90°

size of angle *B* : size of angle *A* = 3 : 2

Work out the length of *AB*.
Give your answer correct to 3 significant figures.

$$3 + 2 = 5 \text{ parts}$$

$$180 - 90 = 90$$

$$\frac{90}{5} \times 3 = 54° = \text{angle } B$$

$$\sin \theta = \frac{opp}{nyp}$$

$$\sin 54 = \frac{14}{AB}$$

$$AB = \frac{14}{\sin 54} = 17.304 \ldots$$

$$0 < 5 \text{ round down}$$

..................**17.3**.................. cm

(Total for Question 6 is 4 marks)

7 The table gives information about the speeds of 70 cars.

Speed (s mph)	Frequency
$0 < s \leqslant 10$	14
$10 < s \leqslant 20$	18
$20 < s \leqslant 30$	26
$30 < s \leqslant 40$	12

Mid point

5

15

25

35

Draw a frequency polygon for this information.
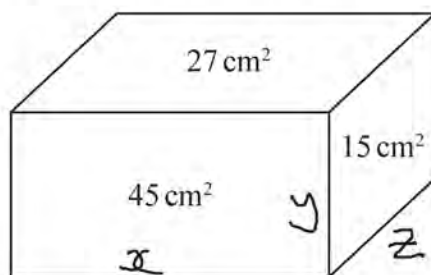
Points at midpoints
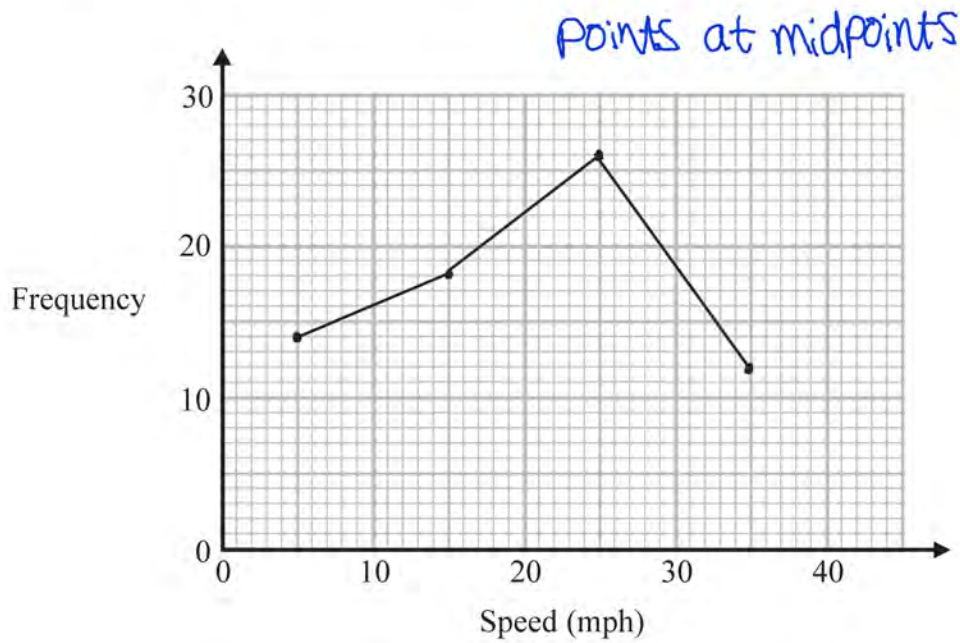
(Total for Question 7 is 2 marks)

8 The diagram shows a solid metal cuboid.

The areas of three of the faces are marked on the diagram.
The lengths, in cm, of the edges of the cuboid are whole numbers.

The metal cuboid is melted and made into cubes.
Each of the cubes has sides of length 2.5 cm.

Work out the greatest number of these cubes that can be made.

① $xy = 45$

② $xz = 27$

③ $yz = 15$

Using ①, $y = \dfrac{45}{x}$ $\div x$

Using ③, $\dfrac{45}{x} \times z = 15$ $\times x$ $\times x$

$45z = 15x$ $\div 15$

$3z = x$

Using ②, $3z \times z = 27$

$z^2 = 9$ $\div 3$

$\sqrt{}$

⊕ root → $z = 3$ cm, $x = 3 \times 3$, $y = \dfrac{45}{9}$
length can't
be negative $\qquad = 9$ cm $\qquad = 5$ cm

Total volume $= 9 \times 5 \times 3 = 135$ cm³

Volume of cubes $= 2 \cdot 5^3$

Number of cubes $= \dfrac{135}{2 \cdot 5^3} = 8 \cdot 64$

$\downarrow$

round down to 8 whole cubes

$\underline{\hspace{1cm} 8 \text{ cubes} \hspace{1cm}}$

(Total for Question 8 is 5 marks)

9 (a) Expand and simplify $(x \overset{1}{-} 2)(2x \overset{3}{+} 3)(x \overset{2}{+} 1)$

$1 \times 2 = (x-2)(x+1)$
$= x^2 - 2x + x - 2 = x^2 - x - 2$

$1 \times 2 \times 3$

$= (x^2 - x - 2)(2x+3)$

$2x^3 + 3x^2 - 2x^2 - 3x - 4x - 6$

$= 2x^3 + x^2 - 7x - 6$

(3)

$\dfrac{y^4 \times y^n}{y^2} = y^{-3}$

(b) Find the value of n.

$y^4 \times y^n = y^{4+n}$

$\dfrac{y^{4+n}}{y^2} = y^{4+n-2} = y^{2+n}$

$n+2 = -3$
$n = -5$

$n = -5$

(2)

(c) Solve $5x^2 - 4x - 3 = 0$
Give your solutions correct to 3 significant figures.

$a=5 \quad b=-4 \quad c=-3$

$\text{Quad formula} = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \dfrac{+4 \pm \sqrt{16 + 4 \times 5 \times 3}}{10}$

$= \dfrac{2 \pm \sqrt{19}}{5} = \oplus 1.2717$
$\ominus -0.4717$

1.27 or
-0.472

(3)

(Total for Question 9 is 8 marks)

10 $f(x) = 4\sin x°$

(a) Find f(23)
Give your answer correct to 3 significant figures.

$$f(23) = 4\sin 23$$
$$= 1.5629$$

1.56
(1)

$g(x) = 2x - 3$

(b) Find fg(34)
Give your answer correct to 3 significant figures.

$$g(34) = 2 \times 34 - 3$$
$$= 65$$
$$f(65) = 4\sin 65$$
$$= 3.625$$

3.63
(2)

$h(x) = (x + 4)^2$

Ivan needs to solve the following equation $h(x) = 25$

He writes

$(x + 4)^2 = 25$
$x + 4 = 5$
$x = 1$

This is not fully correct.

(c) Explain why.

Ivon didn't include −5, which is also the square root of 25
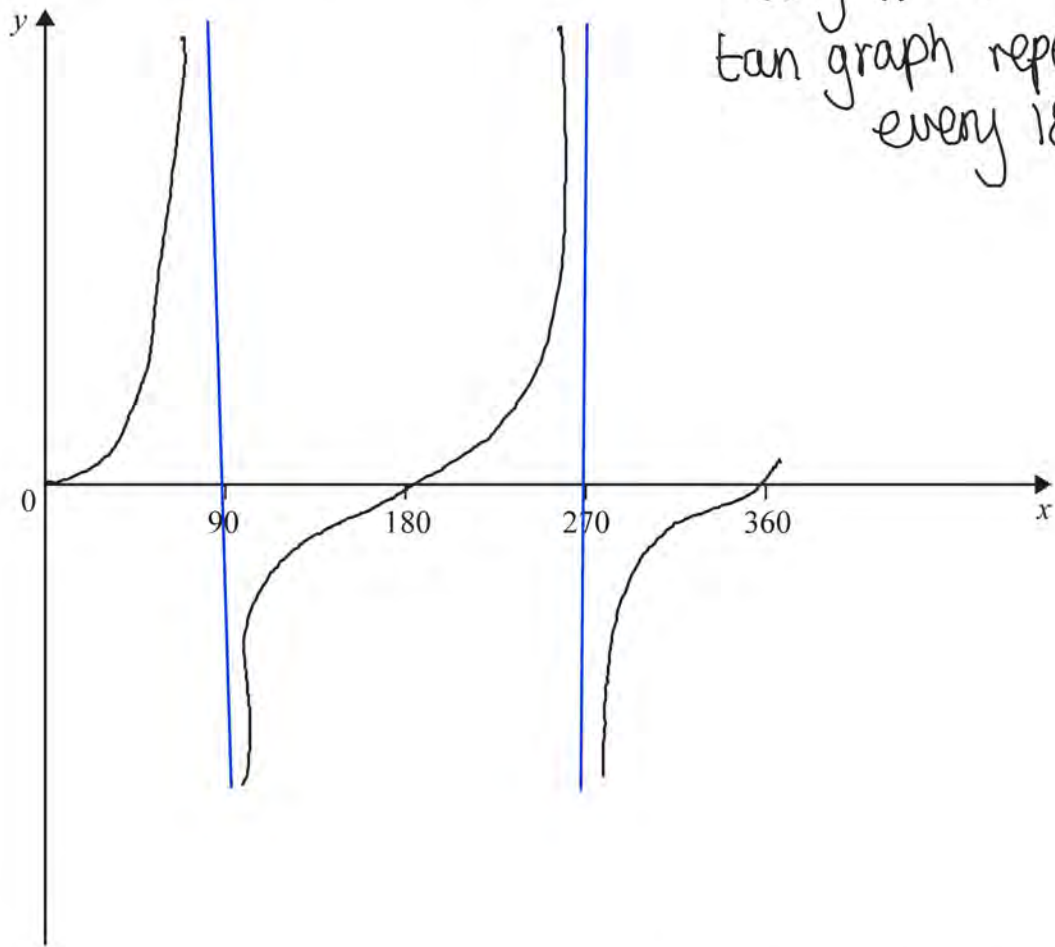
(1)

(Total for Question 10 is 4 marks)

11 Sketch the graph of $y = \tan x°$ for $0 \leqslant x \leqslant 360$

asymptote at 90°
tan graph repeats
every 180

(Total for Question 11 is 2 marks)

12 Here is a pyramid with a square base *ABCD*.
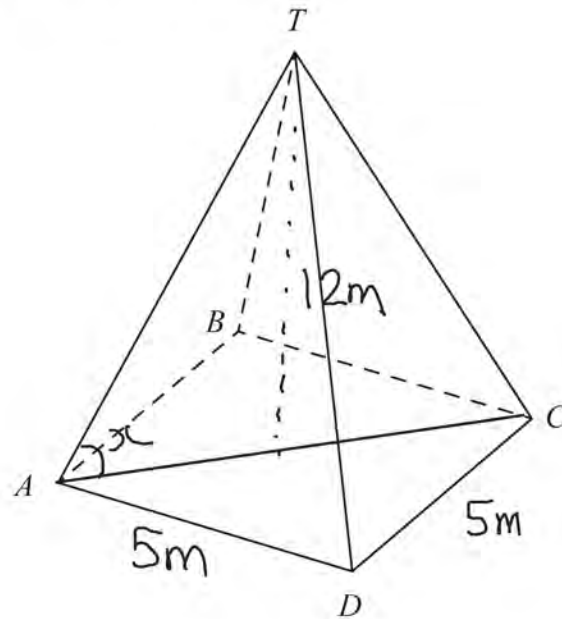
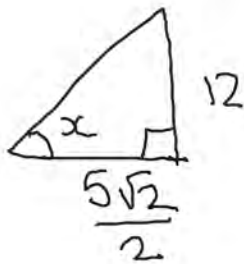*AB* = 5 m

The vertex *T* is 12 m vertically above the midpoint of *AC*.

Calculate the size of angle *TAC*.

$$AC = \sqrt{5^2 + 5^2} = 5\sqrt{2} \quad \text{Pythagorean theorem}$$

$$\text{midpoint of } AC = \frac{5\sqrt{2}}{2}$$

$$\tan x = \frac{12}{\frac{5\sqrt{2}}{2}} \qquad \tan\theta = \frac{opp}{adj}$$

$$x = \tan^{-1}\left(\frac{12}{\frac{5\sqrt{2}}{2}}\right)$$

$$= 73.58...$$

73.6 °

(Total for Question 12 is 4 marks)

13 The number of animals in a population at the start of year t is P_t
The number of animals at the start of year 1 is 400

Given that

$$P_{t+1} = 1.01P_t$$

work out the number of animals at the start of year 3

$$P_1 = 400$$

$$P_2 = 1.01 \times 400 = 404$$

$$P_3 = 1.01 \times 404 = 408.04$$

408

(Total for Question 13 is 2 marks)

14 y is inversely proportional to x^3

$y = 44$ when $x = a$

Show that $y = 5.5$ when $x = 2a$

$$y \propto \frac{1}{x^3} \qquad y = \frac{k}{x^3}$$

$$44 = \frac{k}{a^3}$$

$$44a^3 = k$$

$$y = 5.5 \quad : \quad 5.5 = \frac{44a^3}{x^3}$$

$$x^3 = \frac{44a^3}{5.5} = 8a^3 \qquad x = \sqrt[3]{8a^3}$$

$$= 2a$$

(Total for Question 14 is 3 marks)

15 Prove algebraically that the difference between the squares of any two consecutive odd numbers is always a multiple of 8

$$\text{first odd} = 2n - 1$$
$$\text{second odd} = 2n + 1 \qquad +2$$

$$= (2n+1)(2n+1) - (2n-1)(2n-1)$$

$$= 4n^2 + 2n + 2n + 1 - (4n^2 - 2n - 2n + 1)$$

$$= 4n^2 + 4n + 1 - 4n^2 + 4n - 1$$

$$= 8n$$

$$8(n)$$

8 is a multiple

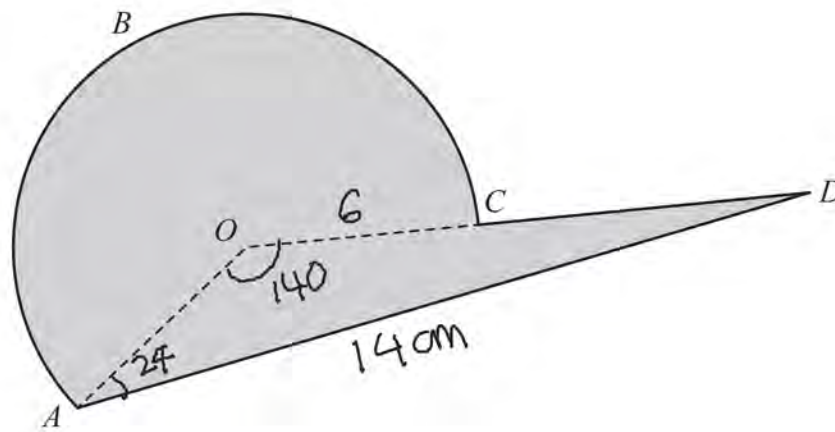**(Total for Question 15 is 3 marks)**

Turn over ▶

16 Here is a shaded shape *ABCD*.

The shape is made from a triangle and a sector of a circle, centre *O* and radius 6 cm.
OCD is a straight line.

AD = 14 cm
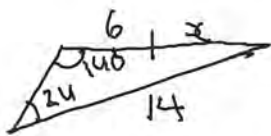Angle *AOD* = 140°
Angle *OAD* = 24°

Calculate the perimeter of the shape.
Give your answer correct to 3 significant figures.

$$\text{Circumference} = \pi \times 6 \times 2 = 12\pi$$

$$12\pi \times \frac{220}{360} = \frac{22}{3}\pi$$

part Circumference

$$\frac{14}{\sin 140} = \frac{6+x}{\sin 24}$$ ← sine rule $\frac{a}{\sin A} = \frac{b}{\sin B}$

$$\frac{14\sin 24}{\sin 140} \underset{-6}{\overset{\times \sin 24}{=}} x + 6$$

$$2.8587\ldots = x$$

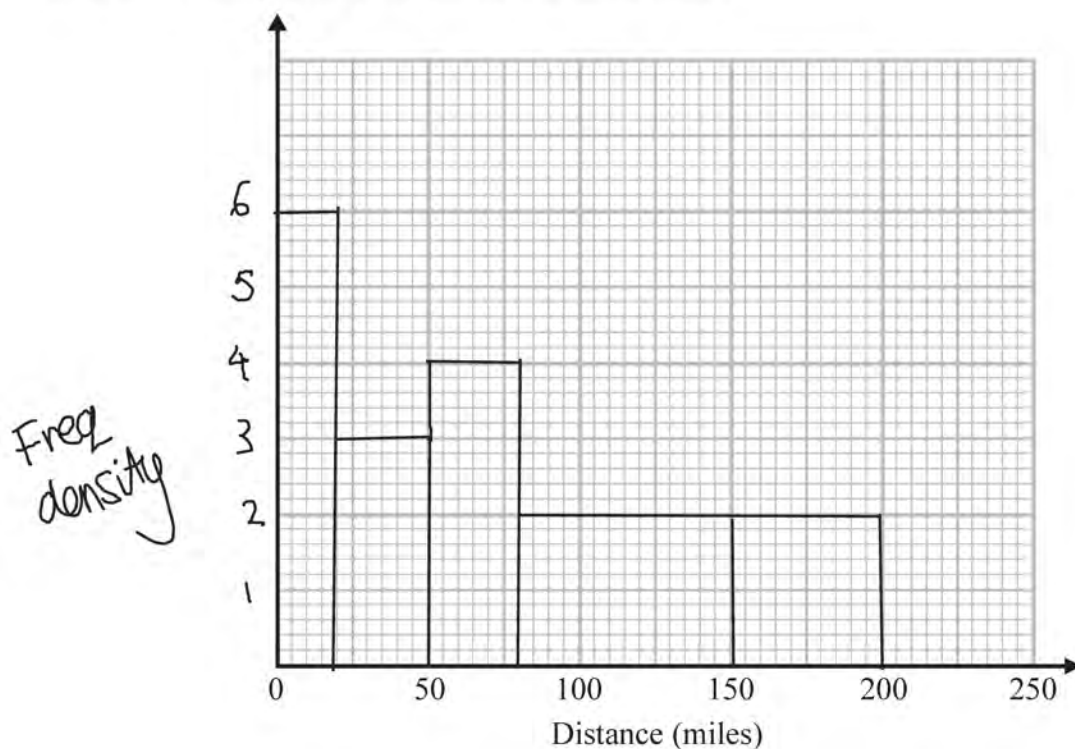$$P = x + 14 + \frac{22}{3}\pi$$

$$= 39.897$$

39.9 cm

(Total for Question 16 is 5 marks)

17 The table shows information about the distances 570 students travelled to a university open day.

Freq density (Fd)
= freq ÷ classwidth (CW)

Distance (d miles)	Frequency
$0 < d \leqslant 20$	120
$20 < d \leqslant 50$	90
$50 < d \leqslant 80$	120
$80 < d \leqslant 150$	140
$150 < d \leqslant 200$	100

CW   Fd
20   6
30   3
30   4
70   2
50   2

(a) Draw a histogram for the information in the table.

Freq density

Distance (miles)

(3)

(b) Estimate the median distance.

Median = $\frac{570}{2}$ = 285

285 − (120+90) = 75

50 + $\frac{75}{120}$ × 30 = 68.75 miles

............68.75............ miles

(2)

(Total for Question 17 is 5 marks)

P 5 5 5 9 8 A 0 1 7 2 0

18 A high speed train travels a distance of 487 km in 3 hours.

The distance is measured correct to the nearest kilometre.
The time is measured correct to the nearest minute.

By considering bounds, work out the average speed, in km/minute, of the train to a suitable degree of accuracy.
You must show all your working and give a reason for your answer.

Upper and lower bounds:

$$486.5 \leq km < 487.5$$
$$179.5 \leq min < 180.5$$

$$speed = \frac{dist}{time}$$

$$UB\ speed = \frac{UB\ dist}{LB\ time} = \frac{487.5}{179.5} = 2.72\ldots$$

$$LB\ speed = \frac{LB\ dist}{UB\ time} = \frac{486.5}{180.5} = 2.695\ldots$$

Both round to 2.7 km/min

2.7 ....km/minute

(Total for Question 18 is 5 marks)

19 Solve algebraically the simultaneous equations

$$2x^2 - y^2 = 17 \quad ①$$
$$x + 2y = 1 \quad ②$$

① $x = 1 - 2y$

② $2(1 - 2y)^2 - y^2 = 17$

$2(1 - 4y + 4y^2) - y^2 - 17 = 0$

$2 - 8y + 8y^2 - y^2 - 17 = 0$

$$\underset{a}{7y^2} \underset{b}{- 8y} \underset{c}{- 15} = 0$$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{+8 \pm \sqrt{64 + 4 \times 7 \times 15}}{14}$$

$$y = \frac{8 \pm 22}{14} = \begin{array}{l} ⊕ \quad \frac{15}{7} \\ ⊖ \quad -1 \end{array}$$

$x = 1 - 2y$

$y = \frac{15}{7}, \quad x = 1 - \frac{30}{7} = \frac{-23}{7}$

$y = -1 \quad x = 1 + 2 = 3$

$$x = 3 \quad y = -1$$
$$x = \frac{-23}{7} \quad y = \frac{15}{7}$$

(Total for Question 19 is 5 marks)

P 5 5 5 9 8 A 0 1 9 2 0

20
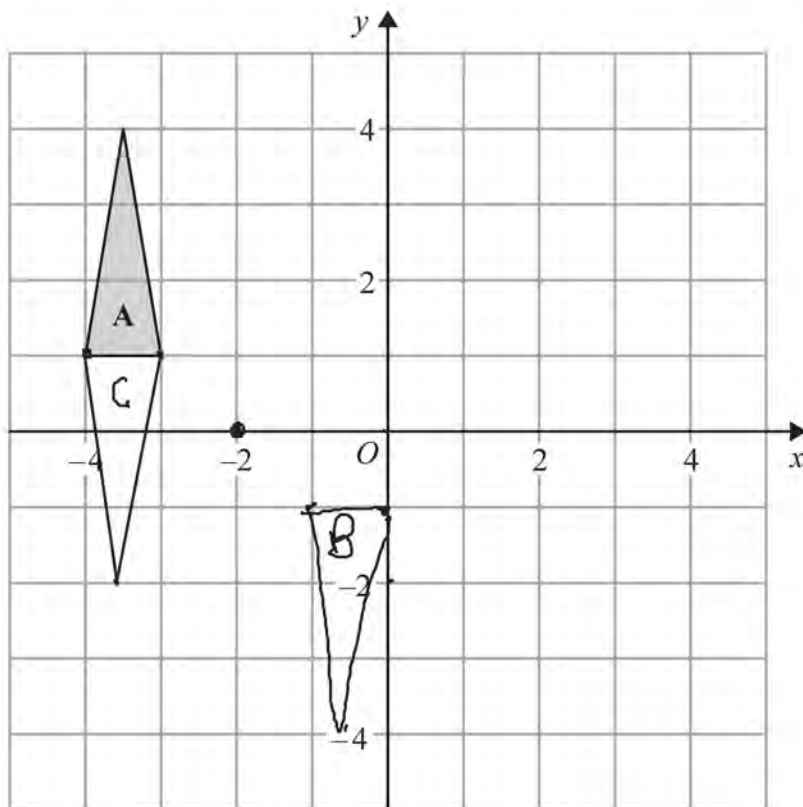
Triangle **A** is transformed by the combined transformation of a rotation of 180° about the point (−2, 0) followed by a translation with vector $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$

One point on triangle **A** is invariant under the combined transformation.

Find the coordinates of this point.

(−3.5 , 1)

(Total for Question 20 is 2 marks)

TOTAL FOR PAPER IS 80 MARKS

P 5 5 5 9 8 A 0 2 0 2 0