

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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

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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 ►

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6/7/17/1/

.CG Maths.

Hints



Pearson

Please note that these worked solutions have neither been provided nor approved by Pearson Education and may not necessarily constitute the only possible solutions. Please refer to the original mark schemes for full guidance.

Any writing in blue indicates what must be written in order to answer the questions and get the marks. The worked solutions have been designed to show the smallest amount of work which needs to be done to answer the question.

Anything written in green in a cloud doesn't have to be written in the exam.

Anything written in orange in a rectangle doesn't have to be written in the exam and is there to show what should be put into a calculator or measured using a ruler or protractor.

If you find any mistakes or have any requests or suggestions, please send an email to curtis@cgmaths.co.uk

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.

Only the first three figures are quoted.
All other figures become 0. The third figure needs to be rounded up or down depending on what the fourth figure is

.....
(1)

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

Write down all the figures on your calculator display.

Type into the calculator

.....
(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.

Use the percentage change formula:
 $(\text{new} - \text{old}) / \text{old} \times 100$

.....%

(Total for Question 2 is 3 marks)

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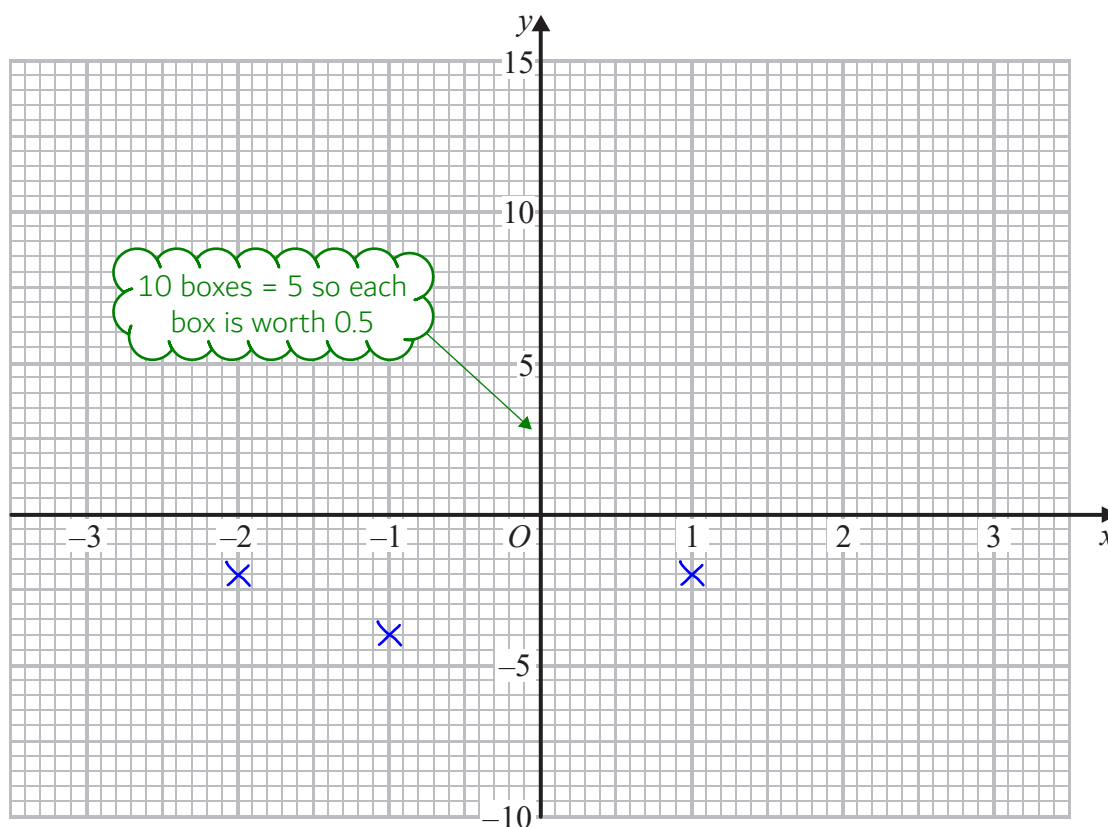
3 (a) Complete this table of values for $y = x^2 + x - 4$

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

Use table mode by pressing Menu then 3. Type in $f(x) = x^2 + x - 4$.
Start: -3. End: 3. Step: 1

(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 $x^2 + x - 4 = 0$

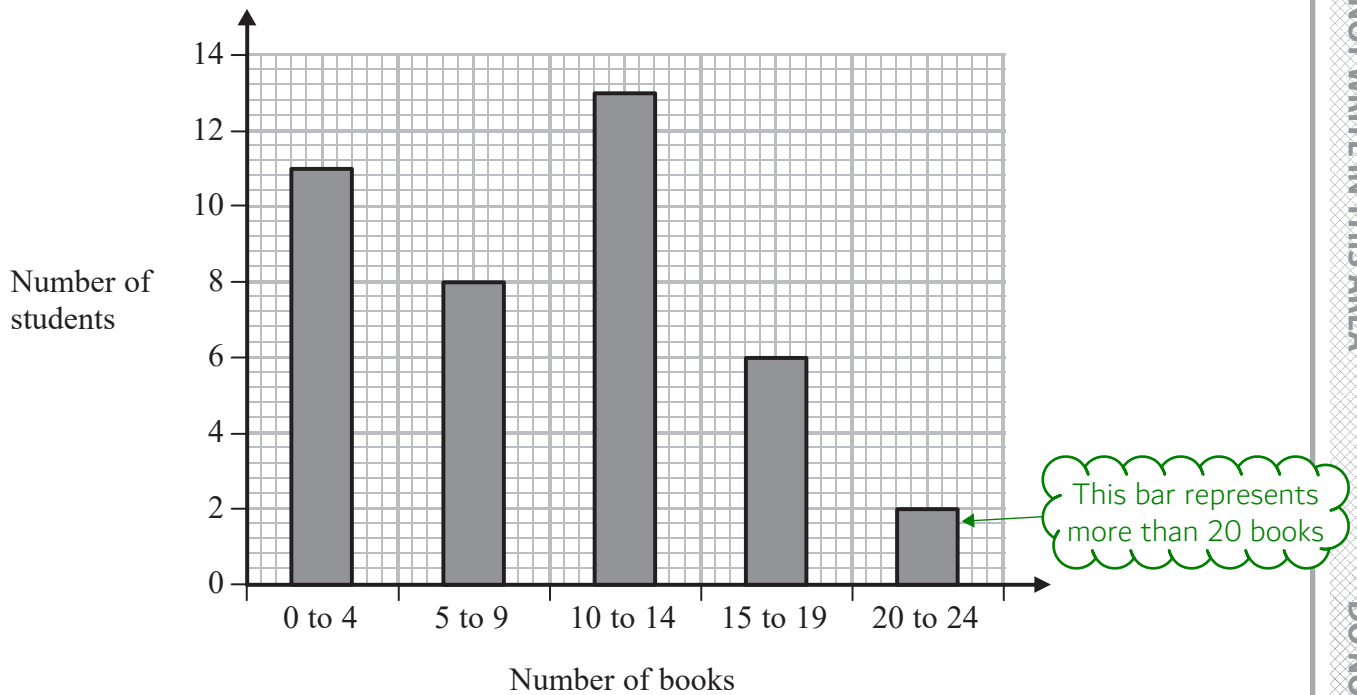
Estimate what x is when y is 0

(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.

Express the number of students who bought more than 20 books as a fraction of the total number of students. Then multiply by 100 to convert it into a percentage

..... %
(2)

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

Mean = total/number. To estimate the total,
multiply the number of students for each
category by the mid point of the number of books
for that category then add together all the results.
The number is 40 as there are 40 students

(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.

$$\frac{d}{s \quad t}$$

1. Work out the average speed for the 475m race in metres per second. Convert the minutes and seconds into seconds to do this.
2. Work out the time taken for the 700m race in seconds by using the same average speed as the 475m race.
3. Convert the seconds into minutes and seconds

..... minutes seconds
(3)

Lara's average speed actually increases the further she goes.

(b) How does this affect your answer to part (a)?

700m is further than 475m so the average speed would be higher

(1)

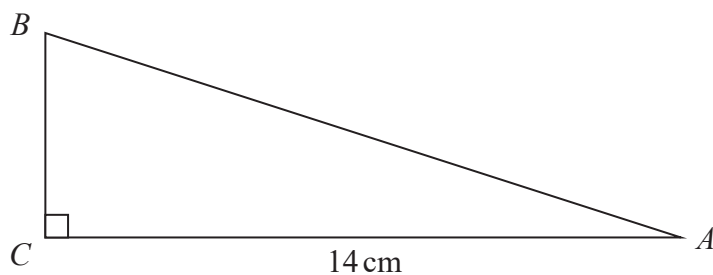
(Total for Question 5 is 4 marks)

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6 ABC is a right-angled triangle.



$AC = 14$ cm.
Angle $C = 90^\circ$

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

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

- 1. Work out the total of angles A and B then divide the result into the ratio $3:2$ to work out one of the angles.
- 2. Use SOH CAH TOA to work out the hypotenuse AB .
- 3. Round the result to 3 significant figures

.....cm

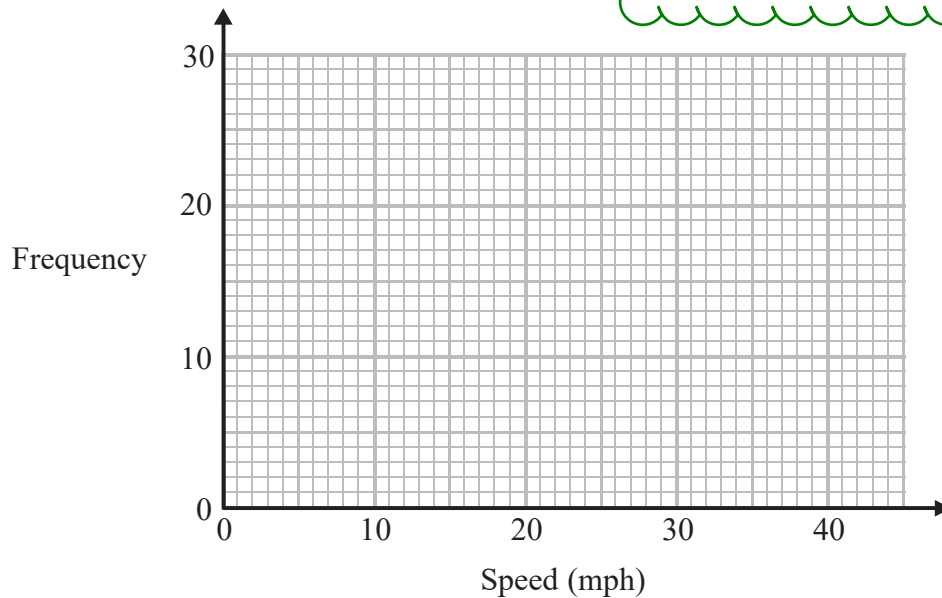
(Total for Question 6 is 4 marks)

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

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

Draw a frequency polygon for this information.

Points plotted at the midpoints of each category then joined up with straight lines



(Total for Question 7 is 2 marks)

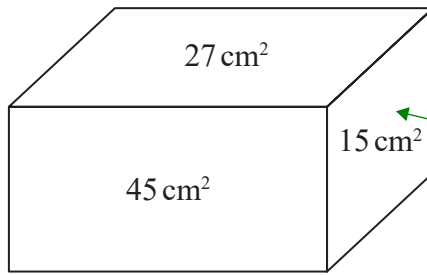
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8 The diagram shows a solid metal cuboid.

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.



Area of rectangle = length x width
The factor pairs of 15 are 1 and 15, 3 and 5. So the length and width of this face could be 15cm and 1cm or 3cm and 5cm. Check which pair works with the other faces to work out the lengths of the cuboid

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.

Volume of a cuboid = length x width x height
Volume of a cube = length³

(Total for Question 8 is 5 marks)

- 9 (a) Expand and simplify $(x - 2)(2x + 3)(x + 1)$

Expand the first pair of brackets. Simplify by collecting the like terms. Then expand with the third bracket. Collect like terms and simplify

.....
(3)

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

- (b) Find the value of n .

Combine the powers on the left side to get a single power of y .

$$a^x \times a^y = a^{x+y}$$

$$a^x \div a^y = a^{x-y}$$

Then the powers on the left must be equal to the powers on the right

.....
(2)

- (c) Solve $5x^2 - 4x - 3 = 0$

Give your solutions correct to 3 significant figures.

Use the quadratic formula.

Where $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

.....
(3)

(Total for Question 9 is 8 marks)

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10 $f(x) = 4\sin x^\circ$

(a) Find $f(23)$

Give your answer correct to 3 significant figures.

Substitute x for 23 in $4\sin x$

.....
(1)

$g(x) = 2x - 3$

(b) Find $fg(34)$

Give your answer correct to 3 significant figures.

Substitute $g(x)$ for x in $f(x)$ to get $fg(x)$. Then substitute 34 for x in $fg(x)$

.....
(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.

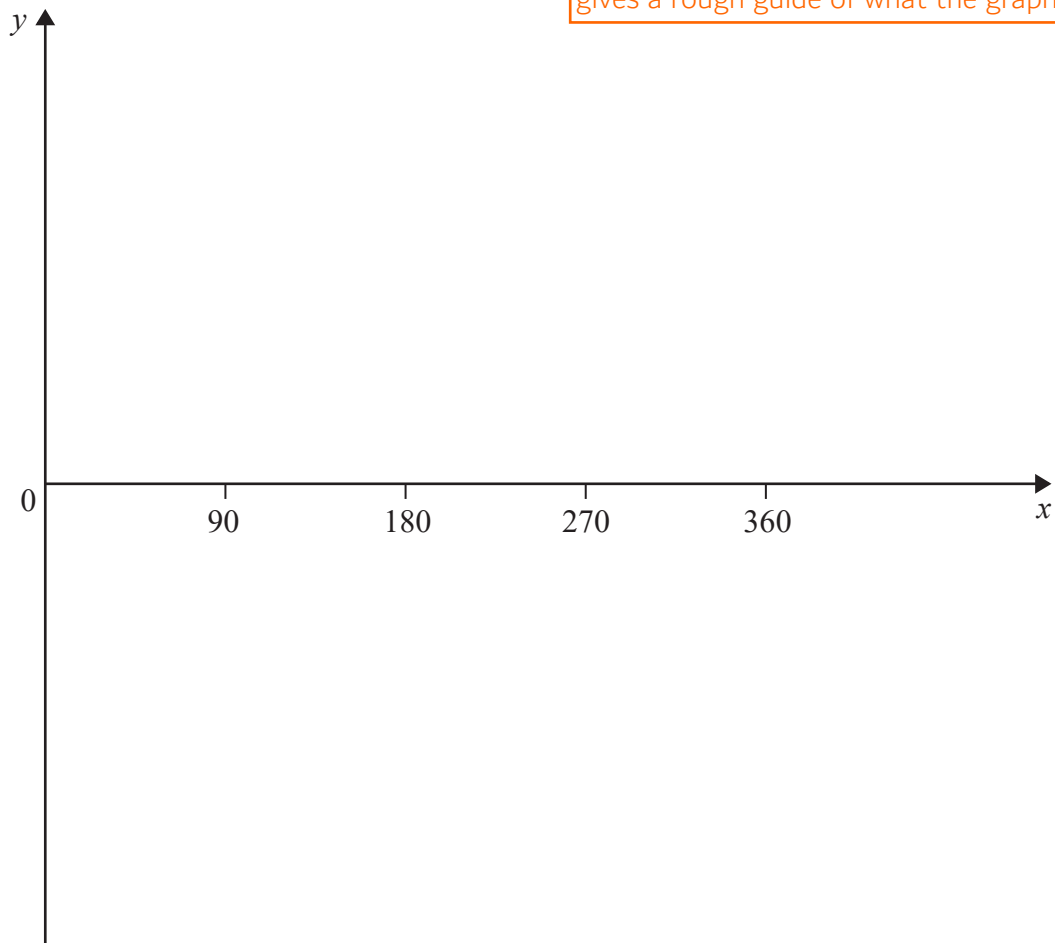
It's something to do with square rooting 25

.....
(1)

(Total for Question 10 is 4 marks)

11 Sketch the graph of $y = \tan x^\circ$ for $0 \leq x \leq 360$

Use table mode (press Menu then 3) with the $f(x) = \tan x$. Start: 0. End: 360. Step: 15. This gives a rough guide of what the graph looks like



(Total for Question 11 is 2 marks)

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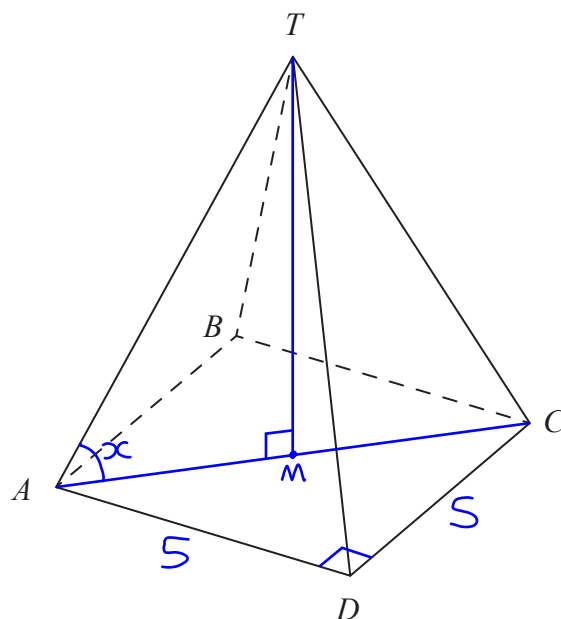
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12 Here is a pyramid with a square base $ABCD$.



$AB = 5\text{ m}$

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

Calculate the size of angle TAC .

Triangle ADC has a right angle so Pythagoras' Theorem can be used to find the missing side AC . AM is half AC as M is the midpoint of AC . Use SOH CAH TOA on the right angled triangle AMT to find angle TAC

.....
(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

$$P_1 = 400 \quad \leftarrow \text{Start of year 1}$$

$$P_2 = 1.01 \times 400 \quad \leftarrow \text{Start of year 2}$$

(Total for Question 13 is 2 marks)

- 14 y is inversely proportional to x^3

$$y = 44 \text{ when } x = a$$

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

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

Converting the proportion into an equation in terms of k

Rearrange to make k the subject and find it in terms of a by substituting in the values of x and y we are given. Then substitute the value of k back into the equation and substitute in $2a$ for x

(Total for Question 14 is 3 marks)

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

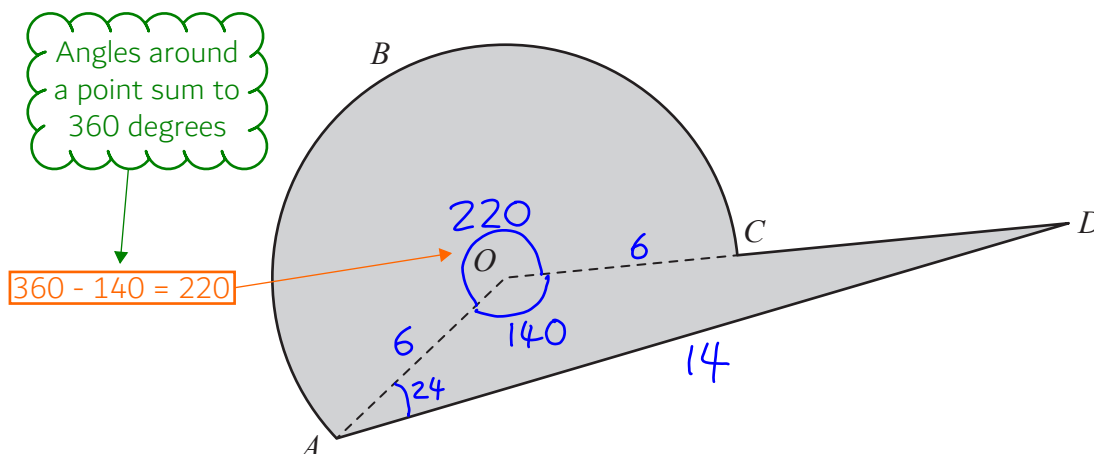
$$(2n+3)^2 - (2n+1)^2$$

2n is an even number. Adding 1 gives 2n + 1, which is an odd number. Adding 2 to this gives 2n + 3, the next odd number. Square 2n + 3 and 2n + 1. Difference is largest subtract smallest.

1. Expand out the square brackets using the rule: square the first term, double the product of the two terms and square the last term. Remember that the second bracket is negative so we need to flip the signs of each of the terms when expanding
2. Collect the like terms and simplify
3. Bring out 8 as a factor

(Total for Question 15 is 3 marks)

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.

$$AD = 14 \text{ cm}$$

$$\text{Angle } AOD = 140^\circ$$

$$\text{Angle } OAD = 24^\circ$$

Calculate the perimeter of the shape.

Give your answer correct to 3 significant figures.

1. Work out the length of the arc AC .
 $\pi \times \text{diameter} = \text{circumference}$. Diameter = $2 \times \text{radius}$. We have 220 out of the 360 degrees of the circle.
2. Use the sine rule to work out side OD . $a/\sin A = b/\sin B$
3. Subtract OC from OD to get CD .
4. Add all of the sides on the outside together to get the perimeter

.....cm

(Total for Question 16 is 5 marks)

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

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

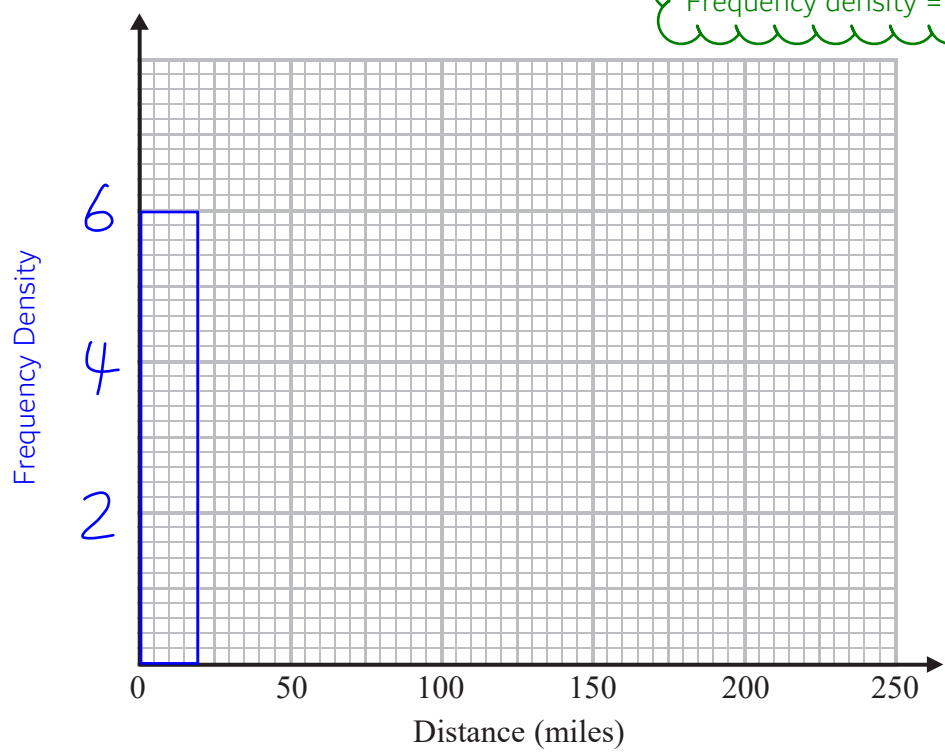
Frequency density

F.d.

6 ← $120 \div 20$

Frequency = class width x frequency density
 Frequency density = frequency/class width

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



(3)

(b) Estimate the median distance.

$570 \div 2 = 285$

The median is halfway through the data. The 285th value is halfway

..... miles
(2)

(Total for Question 17 is 5 marks)

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

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

Distance needs to be in km and time needs to be in minutes

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.

$$\frac{d}{s \quad | \quad t}$$

From the formula triangle, speed = distance/time

We need to calculate the upper bound and lower bound of the speed and give one answer which both results round to at a certain degree of accuracy (number of decimal places).
To calculate the bounds of the time and distance, add and subtract half of what it is to the nearest. For example, 487 is to the nearest 1km so adding 1/2 km gives the upper bound of the distance

.....km/minute

(Total for Question 18 is 5 marks)

19 Solve algebraically the simultaneous equations

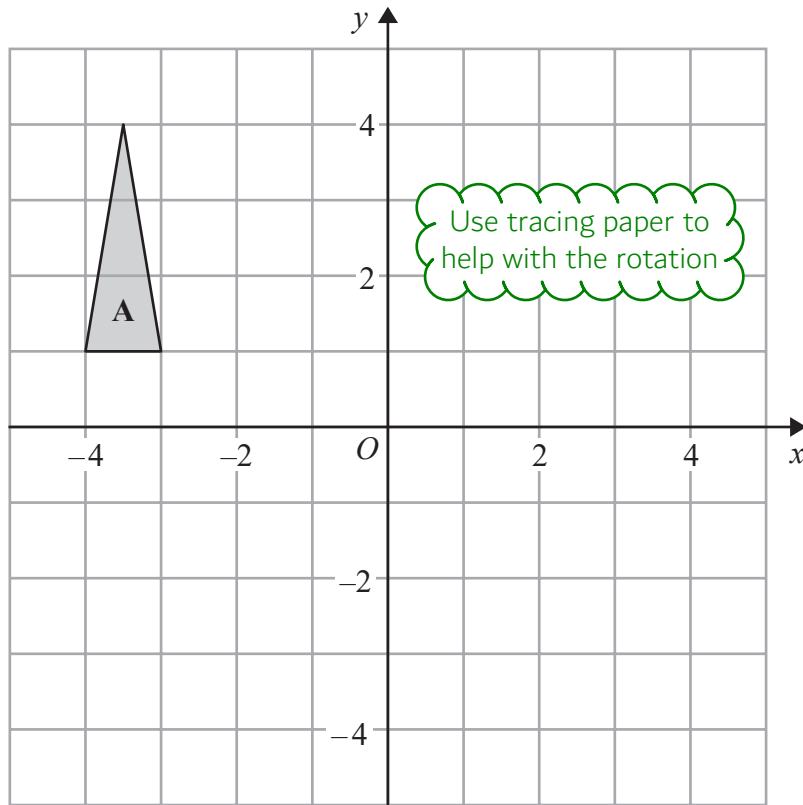
$$\begin{aligned}2x^2 - y^2 &= 17 \\ x + 2y &= 1\end{aligned}$$

$$x = 1 - 2y$$

Rearrange the second equation to make x the subject

Substitute x for 1 - 2y in the first equation to eliminate the x terms. Expand the brackets, collect like terms and simplify, rearrange into the quadratic form $ax^2 + bx + c = 0$ then solve using factorisation. Once we have the y values, we can find x by substituting in the y values into one of the earlier equations

(Total for Question 19 is 5 marks)



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

-3 in the x direction and 2 in the y direction

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

Find the coordinates of this point.

Draw out the transformations. The invariant point isn't one of the corners but is on one of the sides of the triangle

(.....,))

(Total for Question 20 is 2 marks)

TOTAL FOR PAPER IS 80 MARKS