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Candidate surname

Other names

Centre Number

Candidate Number

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

**Monday 11 November 2024**

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 or B pencil, eraser, calculator, Formulae Sheet (enclosed). Tracing paper may be used.

Total Marks

## Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **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  $\pi$  button, take the value of  $\pi$  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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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**.CG Maths.**  
Worked Solutions



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 should be written in the exam.

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

If you find any mistakes or have any requests or suggestions, please send an email to [curtis@cgmaths.co.uk](mailto:curtis@cgmaths.co.uk)

Answer ALL questions.

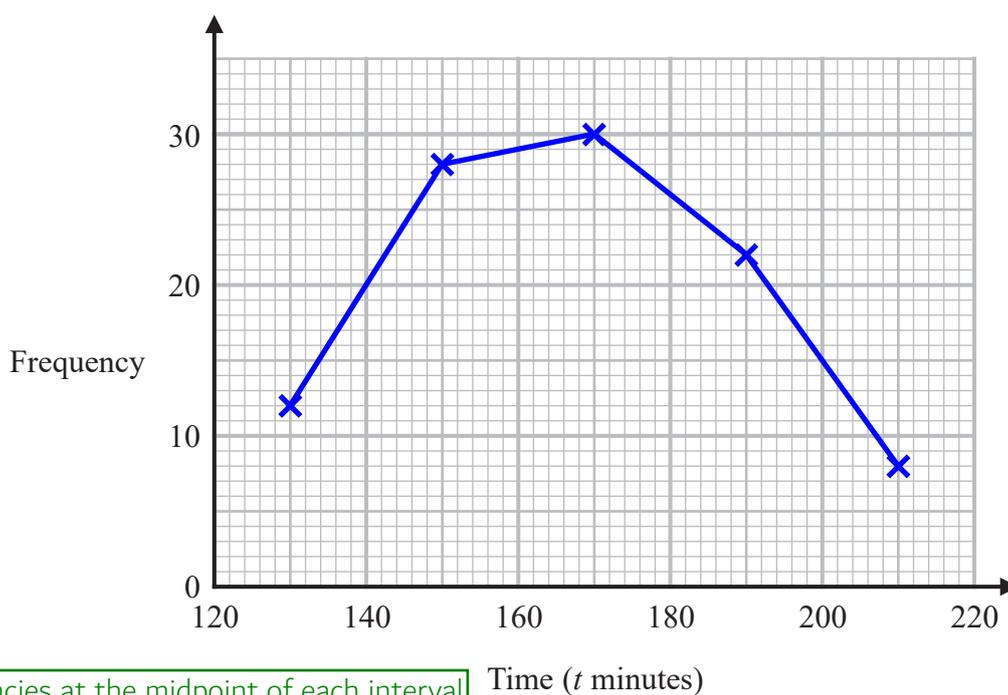
Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 The table shows information about the times, in minutes, 100 people took to complete a bike race.

Time ( $t$ minutes)	Frequency
$120 \leq t < 140$	12
$140 \leq t < 160$	28
$160 \leq t < 180$	30
$180 \leq t < 200$	22
$200 \leq t < 220$	8

On the grid below, draw a frequency polygon for this information.



Plotted the frequencies at the midpoint of each interval then joined them up with a series of straight lines

(Total for Question 1 is 2 marks)



- 2 (a) Write  $3.402 \times 10^5$  as an ordinary number.

It can be put into the calculator and it will convert it to an ordinary number

340200

(1)

- (b) Write 0.8026 in standard form.

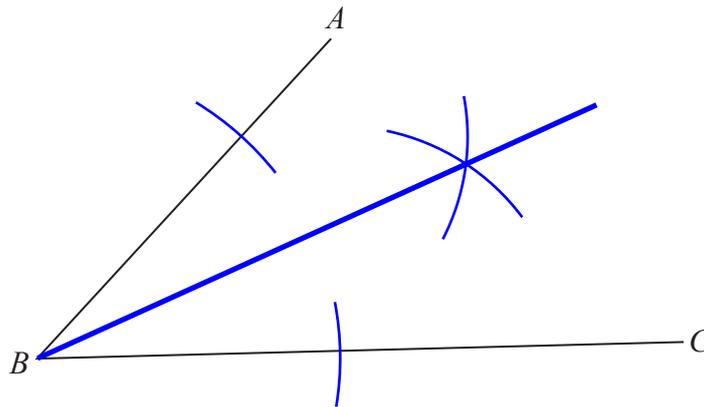
Standard form is  $a \times 10^n$ , where  $1 \leq a < 10$  and  $n$  is an integer. Multiplying 0.8026 by ten 1 time gives 8.026, which is at least 1 and less than 10. So  $a$  is 8.026. This must be divided by ten 1 time to keep it equal to the original 0.8026 so it is multiplied by  $10^{-1}$

$8.026 \times 10^{-1}$

(1)

(Total for Question 2 is 2 marks)

- 3 Use ruler and compasses to construct the bisector of angle  $ABC$ . You must show your construction lines.



(Total for Question 3 is 2 marks)

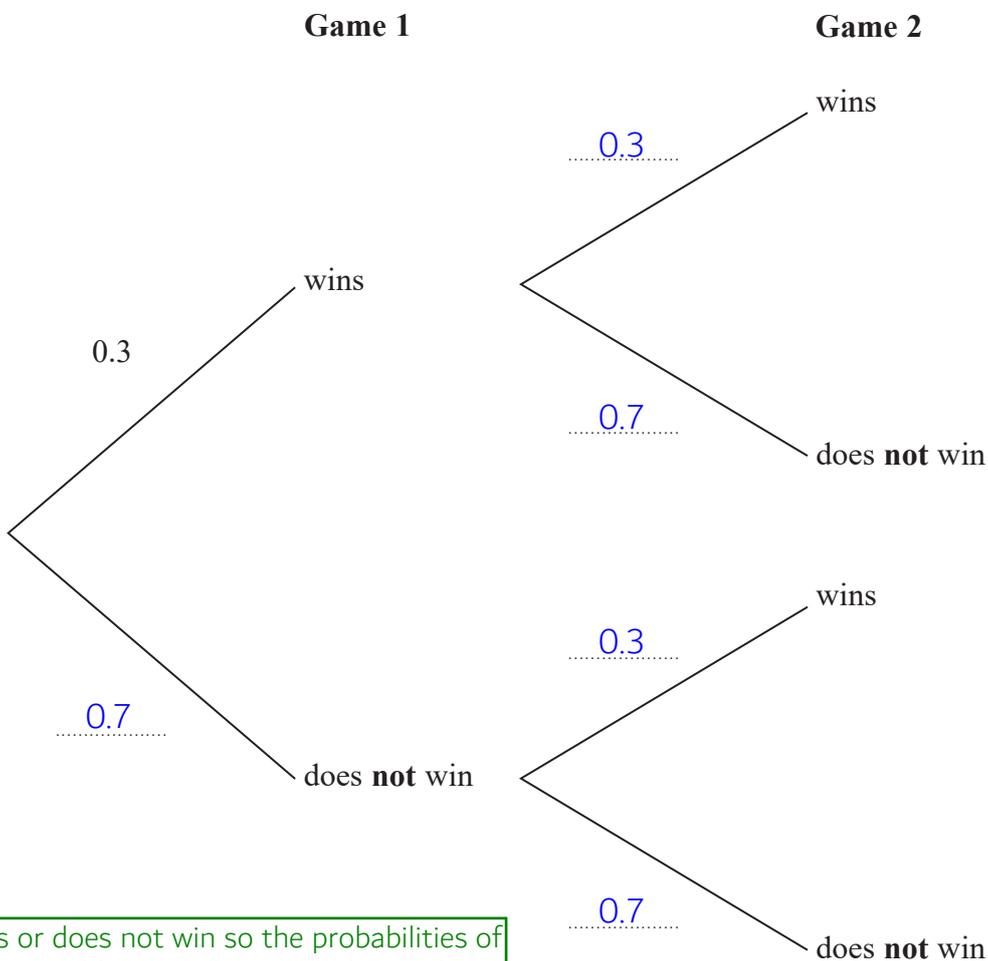
Putting the needle of the compass in at B and scribing an arc on AB and an arc on BC using the same radius. Then scribing arcs from these two arcs which form a cross. Drawing a straight line from B through this cross

4 Dan is playing cards.

The probability that he will win a game of cards is 0.3

Dan plays two games of cards.

(a) Complete the probability tree diagram.



He either wins or does not win so the probabilities of both events must add to 1. Subtracting the 0.3 from 1 gives 0.7, which is the probability of not winning

(2)

(b) Work out the probability that Dan does not win either game.

$0.7 \times 0.7$  ← Does not win AND does not win. AND means to multiply the probabilities

0.49

(2)

(Total for Question 4 is 4 marks)



5 Robyn buys a total of 240 pens and pencils, where

$$\text{number of pens} : \text{number of pencils} = 3 : 5$$

Robyn pays 9p for each pen.  
She sells each pen for 11p.

Robyn pays 6p for each pencil.  
She sells each pencil for 10p.

Robyn sells all of the pens and pencils.

Work out Robyn's percentage profit.  
Give your answer correct to 1 decimal place.  
You must show all your working.

$$240 \div 8$$

$3 + 5 = 8$  parts in total in the ratio which represent the total of the pens and pencils. So dividing the 240 pens and pencils by 8 works out that 1 part of the ratio is worth 30

$$30 \times 3 = 90$$

Multiplying the value of 1 part of the ratio by the 3 parts representing the pens works out that there are 90 pens

$$30 \times 5 = 150$$

Multiplying the value of 1 part of the ratio by the 5 parts representing the pencils works out that there are 150 pencils

$$90 \times 9 = 810$$

Multiplying the 90 pens by the 9p for each pen works out that she pays 810p for the pens

$$150 \times 6 = 900$$

Multiplying the 150 pencils by the 6p for each pencil works out that she pays 900p for the pencils

$$810 + 900 = 1710$$

Adding the 810p for the pens and the 900p for the pencils works out that 1710p was paid for the pens and pencils

$$90 \times 11 = 990$$

Multiplying the 90 pens by the 11p each pen is sold for works out that she sells the pens for 990p

$$150 \times 10 = 1500$$

Multiplying the 150 pencils by the 10p each pencil is sold for works out that she sells the pencils for 1500p

$$990 + 1500$$

Adding the 990p for the pens and the 1500p for the pencils works out that the pens and pencils were sold for a total of 2490p

$$2490 - 1710$$

Subtracting the 1710p paid from the 2490p sold for works out that the profit was 780p

$$\frac{780}{1710} \times 100$$

Putting the 780p profit over the original 1710p paid expresses the profit as a fraction. Multiplying this by 100 converts it to a percentage

45.61...% is rounded to 1 decimal place

45.6%

(Total for Question 5 is 5 marks)

6 The stem and leaf diagram shows the test scores of 23 students from School A.

3	<u>0</u>
4	<u>1</u> <u>2</u> <u>4</u> <u>4</u> <u>5</u> <u>7</u>
5	<u>3</u> <u>4</u> <u>4</u> <u>6</u> <u>7</u> <u>8</u> <u>8</u> <u>9</u>
6	<u>0</u> <u>8</u> <u>8</u> <u>9</u> <u>9</u>
7	<u>1</u> <u>3</u> <u>9</u>

Key:

3 | 0 represents 30

23 students from School B did the same test.

Their median score was 56

The range of their scores was 47

Compare the distribution of the test scores of the students from School A with the distribution of the test scores of the students from School B.

School A had a range of 49, which is greater than the range of School B

$$\text{Range} = \text{largest} - \text{smallest} = 79 - 30 = 49$$

School A had a median of 57, which is greater than the median of School B

The data is already in order. Underlining from both ends until the one in the middle is found works out that the median for School A is 57

(Total for Question 6 is 4 marks)

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7 Jana used her calculator to find the value of a number  $t$ .  
The answer on her calculator began 10.2

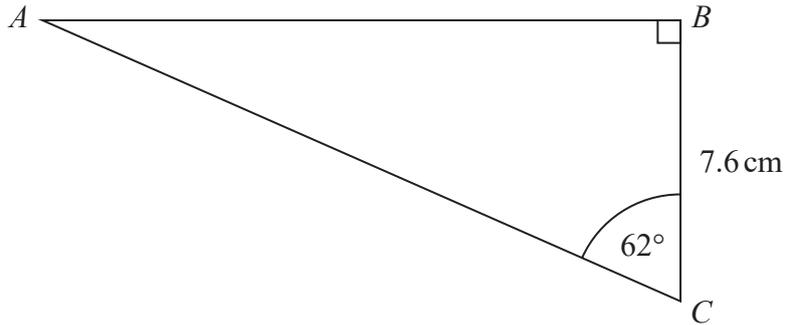
Complete the error interval for  $t$ .

The number must be at least 10.2 and less than 10.3

..... 10.2 .....  $\leq t <$  ..... 10.3 .....

(Total for Question 7 is 2 marks)

8  $ABC$  is a right-angled triangle.



Calculate the length of  $AB$ .  
Give your answer correct to 1 decimal place.

S O H C A H T O A

Using right-angled trigonometry so writing SOH CAH TOA as formula triangles. Ticking A as BC is the adjacent and ticking O as AB is the opposite. There are two ticks on the TOA formula triangle so this one can be used

$\tan 62 \times 7.6$

Covering O in the TOA formula triangle finds that opposite = tan of the angle  $\times$  adjacent

..... 14.3 ..... cm

(Total for Question 8 is 2 marks)

9 (a) Simplify fully  $2x^3y^5 \times 7x^2y$

$$2 \times 7 = 14 \text{ and } x^3 \times x^2 = x^5 \text{ and } y^5 \times y = y^6. a^w \times a^z = a^{w+z}$$

$$14x^5y^6$$

(2)

(b) Simplify  $(m^2)^{-3}$

$$(a^w)^z = a^{wz}$$

$$m^{-6}$$

(1)

(Total for Question 9 is 3 marks)

10 In a sale, the normal prices are reduced by 15%  
Amina buys a dress in the sale for £46.75

Work out the normal price of the dress.

$$100 - 15 \leftarrow \text{Subtracting the 15\% from 100\% works out that the normal prices are reduced to 85\%}$$

$$46.75 \div 85 \leftarrow \text{The } \pounds 46.75 \text{ is 85\% of the normal price. Dividing it by 85 finds that 1\% of the normal price is } \pounds 0.55$$

$$0.55 \times 100 \leftarrow \text{Multiplying the value of 1\% by 100 finds that 100\% of the normal price is } \pounds 55$$

$$\pounds \dots\dots\dots 55$$

(Total for Question 10 is 2 marks)

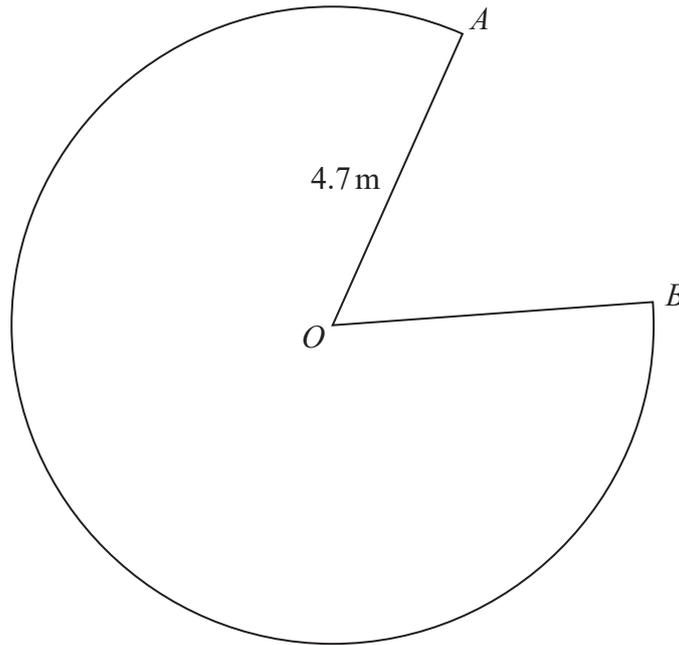


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11  $OAB$  is a sector of a circle with centre  $O$  and radius 4.7 m.



The sector has a perimeter of 34.3 m.

Find the size of the reflex angle  $AOB$ .

Give your answer correct to the nearest degree.

$$4.7 + 4.7$$

Adding  $OA$  and  $OB$  (which are both radii) works out that the diameter of the circle is 9.4 cm and also works out that there is 9.4 cm on the perimeter excluding arc  $AB$

$$34.3 - 9.4$$

Subtracting the the total of  $OA$  and  $OB$  from the perimeter works out that arc  $AB$  must be 24.9 cm

$$\frac{x}{360} \times \pi \times 9.4 = 24.9$$

Let  $x$  be reflex angle  $AOB$ . Putting this over 360 (as there are  $360^\circ$  around the centre of a circle) expresses the fraction of the circumference which arc  $AB$  is. Multiplying this fraction by the circumference expresses the length of arc  $AB$ . Circumference =  $\pi \times$  diameter. Setting it equal to the value of the length of arc  $AB$ , 24.9 cm

$$x = \frac{24.9 \times 360}{\pi \times 9.4}$$

Multiplying both sides by 360 and dividing both sides by  $\pi \times 9.4$  gets  $x$  on its own

303.5... is rounded to the nearest degree

304

(Total for Question 11 is 3 marks)

12 Rudi invests £4500 in a savings account.

He gets compound interest at a rate of

2.4% for the first year

1.8% for each extra year.

(a) Work out the value of Rudi's investment at the end of 3 years.

$$\frac{100 + 2.4}{100}$$

Adding the 2.4% to 100% expresses the percentage it increases to. Putting this over 100 converts it to the decimal 1.024

$$\frac{100 + 1.8}{100}$$

Adding the 1.8% to 100% expresses the percentage it increases to. Putting this over 100 converts it to the decimal 1.018

$$4500 \times 1.024 \times 1.018^2$$

Multiplying the £4500 by 1.024 increases it by 2.4%.  
Multiplying this by 1.018<sup>2</sup> increases it by 1.8% twice

4775.380... is rounded to the nearest penny

£ 4775.38

(3)

Bruna buys a car for £7500

The value of the car depreciates by  $x\%$  each year.

At the end of 2 years the value of the car is £4107

(b) Work out the value of  $x$ .

$$7500 \times \left(\frac{100 - x}{100}\right)^2 = 4107$$

Subtracting the  $x\%$  from 100% expresses the percentage it decreases to each year. Putting this over 100 expresses it as a fraction. Multiplying the £7500 by this to the power of 2 decreases the £7500 by  $x\%$  twice. This must be equal to the £4107

$$\left(\frac{100 - x}{100}\right)^2 = 0.5476$$

Dividing both sides by 7500

$$\frac{100 - x}{100} = 0.74$$

Square rooting both sides

$$100 - x = 74$$

Multiplying both sides by 100

$$-x = -26$$

Subtracting 100 from both sides

Dividing both sides by -1 to cancel out the negatives

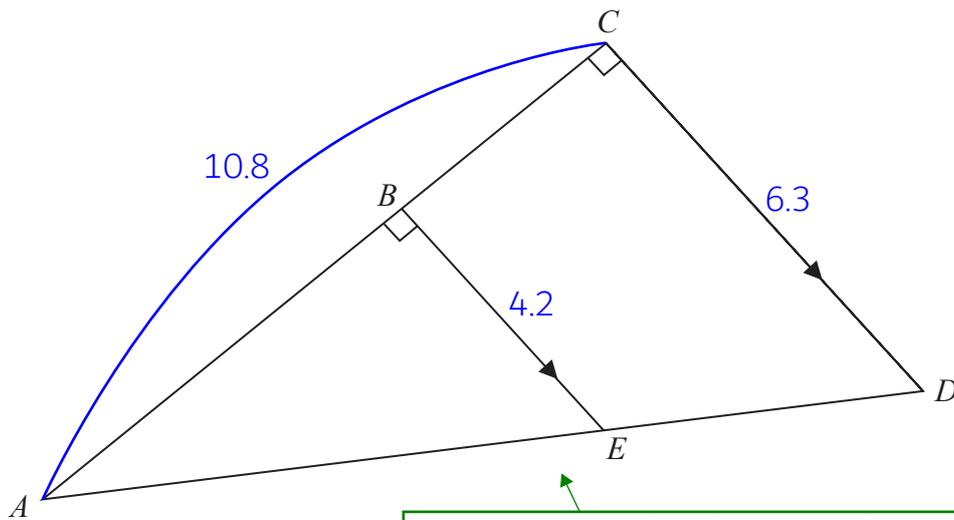
$x = 26$

(3)

(Total for Question 12 is 6 marks)

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- 13  $ABC$  and  $AED$  are straight lines.  
 $BE$  and  $CD$  are parallel.



$BE = 4.2$  cm  
 $CD = 6.3$  cm  
 $AC = 10.8$  cm

Drawing the given lengths on to make it easier to visualise what is going on. Triangle  $ABE$  is similar to triangle  $ACD$  as all the angles in both triangles are the same

Work out the area of trapezium  $BCDE$ .

- $6.3 \div 4.2$  ← BE is the smaller version of CD. So dividing CD by BE works out that the scale factor from the smaller triangle to the larger triangle is 1.5
- $10.8 \div 1.5$  ← Dividing AC by the scale factor works out that AB is 7.2 cm
- $10.8 - 7.2$  ← Subtracting AB from AC works out that BC is 3.6 cm
- $\frac{1}{2}(4.2 + 6.3) \times 3.6$  ← Area of trapezium =  $\frac{1}{2}(a + b) \times h$ , where a and b are the parallel sides and h is the distance between them

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.....18.9.....  $\text{cm}^2$

(Total for Question 13 is 3 marks)



14 Prove algebraically that  $0.4\dot{6}\dot{2}$  can be written as  $\frac{229}{495}$

$$x = 0.4\dot{6}\dot{2} \quad \leftarrow \text{Let } x \text{ be the recurring decimal}$$

$$100x = 46.2\dot{6}\dot{2} \quad \leftarrow \text{There are 2 recurring digits so multiplying by 10 twice allows the decimal to be rewritten in a different way with the recurring digits in the same decimal places}$$

$$99x = 45.8 \quad \leftarrow \text{Subtracting } x \text{ from } 100x \text{ cancels out the recurring digits}$$

$$x = \frac{45.8}{99} = \frac{229}{495} \quad \leftarrow \text{Dividing both sides by 99 to get } x \text{ on its own. Then putting the fraction into the calculator to simplify it gives } 229/495$$

(Total for Question 14 is 3 marks)

15 Make  $p$  the subject of the formula  $t = \frac{2(2p - 3)}{5 - 2p}$

$$t(5 - 2p) = 2(2p - 3) \quad \leftarrow \text{Multiplying both sides by } 5 - 2p \text{ to eliminate } p \text{ as a denominator}$$

$$5t - 2pt = 4p - 6 \quad \leftarrow \text{Expanding the brackets}$$

$$5t + 6 = 4p + 2pt \quad \leftarrow \text{Adding } 2pt \text{ to both sides to get all the terms involving } p \text{ on the same side and adding } 6 \text{ to both sides to get all the terms not involving } p \text{ on the other side}$$

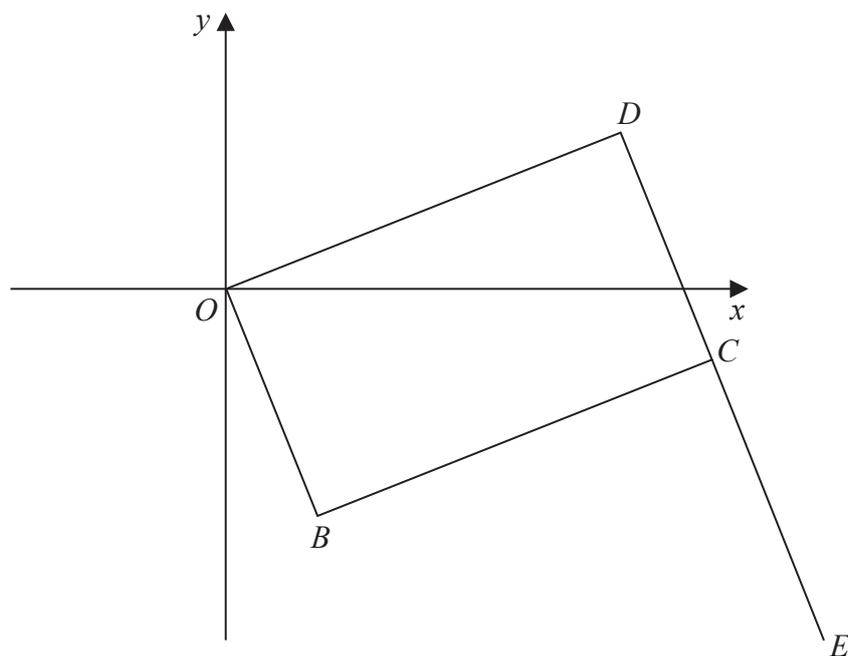
$$= p(4 + 2t) \quad \leftarrow \text{Bringing } p \text{ out as a factor on the right}$$

Dividing both sides by  $4 + 2t$  gets  $p$  on its own

$$p = \frac{5t + 6}{4 + 2t}$$

(Total for Question 15 is 4 marks)

- 16  $OBCD$  is a rectangle.  
 $DCE$  is a straight line.



$B$  has coordinates  $(2, -4)$

$E$  has coordinates  $(12, -6.5)$

Work out the coordinates of  $D$ .

You must show all your working.

$$\frac{-4 - 0}{2 - 0} = -2$$

Working out that the gradient of  $OB$  is  $-2$ . Gradient = (change in  $y$ )/(change in  $x$ ).  $y$  changes from  $0$  to  $-4$  from  $O$  to  $B$  and  $x$  changes from  $0$  to  $2$  from  $O$  to  $B$

$$-1 \div -2 = 0.5$$

$OD$  is perpendicular to  $OB$  so its gradient is the negative reciprocal of the gradient of  $OB$ . Dividing  $-1$  by the gradient of  $OB$  works out that this is  $0.5$

$$-6.5 = -2(12) + c$$

The general equation of a straight line is  $y = mx + c$ , where  $m$  is the gradient and  $c$  is the  $y$ -intercept. The gradient of  $DC$  is also  $-2$  as it is parallel to  $OB$ , and as  $DCE$  is a straight line the gradient of  $-2$  continues for the line  $DE$ . Substituting in the  $x$  and  $y$ -coordinate from  $E$

$$c = 17.5$$

Adding  $2(12)$  to both sides finds that  $c$  is  $17.5$

$$y = -2x + 17.5$$

So substituting in the gradient of  $-2$  for  $m$  and  $17.5$  for  $c$  into  $y = mx + c$  expresses the equation of the straight line  $DE$

$$y = 0.5x$$

Substituting in the gradient of  $0.5$  for  $m$  and  $0$  for  $c$  (as the  $y$ -intercept is  $0$ ) into  $y = mx + c$  expresses the equation of the straight line  $OD$

$$0 = 2.5x - 17.5$$

$D$  is where the lines  $DE$  and  $OD$  meet. Doing simultaneous equations with the equations of lines  $DE$  and  $OD$  works out where this is. Subtracting the equation of  $DE$  from the equation of  $OD$  cancels out the  $y$  and gets an equation just in terms of  $x$

$$17.5 = 2.5x$$

Adding  $17.5$  to both sides to get the  $x$  term on its own

$$x = 7$$

Dividing both sides by  $2.5$ . So the  $x$ -coordinate of  $D$  is  $7$

$$y = 0.5(7)$$

Substituting  $7$  for  $x$  in the equation  $y = 0.5x$

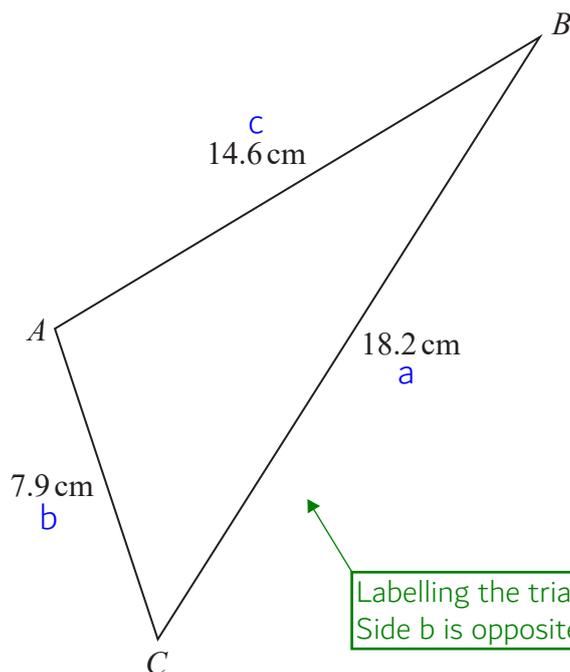
$$= 3.5$$

This is the  $y$ -coordinate of  $D$

( ..... 7 ..... , ..... 3.5 ..... )

(Total for Question 16 is 5 marks)

17 Here is triangle  $ABC$ .



Labelling the triangle. Side a is opposite angle A. Side b is opposite angle B. Side c is opposite angle C

Work out the area of triangle  $ABC$ .

Give your answer correct to 3 significant figures.

$$18.2^2 = 7.9^2 + 14.6^2 - 2 \times 7.9 \times 14.6 \times \cos A$$

There are not two opposite pairs of sides and angles so the sine rule cannot be used. So using the cosine rule.  $a^2 = b^2 + c^2 - 2bccosA$ . Substituting in the values from the diagram

$$55.67 = -230.68\cos A$$

Subtracting  $7.9^2$  and  $14.6^2$  from both sides.  $-2 \times 7.9 \times 14.6 = -230.68$

$$\cos A = -0.24\dots$$

Dividing both sides by -230.68

$$A = 103.9\dots$$

Doing the inverse cos of both sides works out angle A

$$\frac{1}{2} \times 14.6 \times 7.9 \times \sin 103.9\dots$$

Area of triangle =  $\frac{1}{2} ab\sin C$ . Ignoring the labelling on the diagram and substituting 14.6 cm for a, 7.9 cm for b and 103.9... for C

55.96... is rounded to 3 significant figures

$$\dots\dots\dots 56.0 \dots\dots\dots \text{cm}^2$$

(Total for Question 17 is 4 marks)

18 Maria wants to find an estimate for the number of frogs in a lake.

On Saturday she catches 40 of the frogs.  
She puts a tag on each frog and releases them.

On Monday she catches 55 of the frogs.  
11 of the frogs have tags.

- (a) Work out an estimate for the total number of frogs in the lake.  
You must show all your working.

$$\frac{11}{40} T = 55$$

11/40 of the original frogs on Saturday have been caught on Monday. We can assume that this is the same fraction of the total number of frogs. Let T be the total number of frogs. 11/40 of the total number of frogs would be the 55 frogs caught on Monday

Dividing both sides by 11/40 finds T, the total number of frogs

200

(3)

- (b) State one assumption you have made.

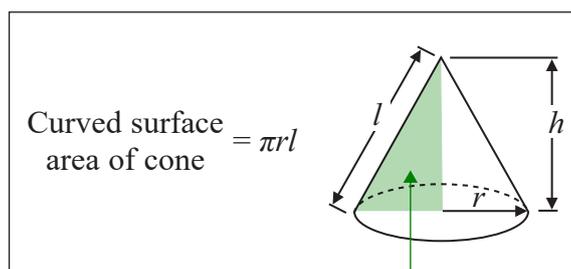
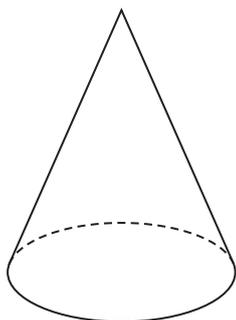
The sample is representative

Not all the frogs are caught so those caught on Monday is just a sample of the population. The 11/40 of the frogs caught in the sample may not necessarily be the same fraction of the total number of frogs

(1)

(Total for Question 18 is 4 marks)

19 The diagram shows a cone.



L, h and r form a right-angled triangle

The radius of the base of the cone is  $\frac{3}{4}$  of the height of the cone.  $\leftarrow r = 0.75h$

The total surface area of the cone is  $54\pi \text{ cm}^2$

Work out the height of the cone.

$$h^2 + (0.75h)^2 = L^2 \leftarrow \begin{array}{l} \text{Pythagoras' Theorem can be used to express L in terms of h.} \\ a^2 + b^2 = c^2, \text{ where a and b are the shorter sides and c is the longest} \\ \text{side. Substituting h for a, } 0.75h \text{ (which is r) for b and L for c} \end{array}$$

$$L^2 = 1.5625h^2 \leftarrow (0.75h)^2 = 0.75^2 h^2. 1 + 0.75^2 = 1.5625. \text{ Collecting the } h^2 \text{ terms}$$

$$L = 1.25h \leftarrow \text{Square rooting both sides to express L in terms of h}$$

$$\pi \times 0.75h \times 1.25h + \pi(0.75h)^2 \leftarrow \begin{array}{l} \text{Expressing the surface area of the cone. Substituting } 0.75h \text{ for r and} \\ 1.25h \text{ for L into the formula for the curved surface area of a cone.} \\ \text{Adding the area of the circular base. Area of circle} = \pi \times \text{radius}^2 \end{array}$$

$$0.9375\pi h^2 + 0.5625\pi h^2 \leftarrow \text{Simplifying}$$

$$1.5\pi h^2 = 54\pi \leftarrow \text{Collecting like terms and setting equal to the value of the surface area}$$

$$h^2 = 36 \leftarrow \text{Dividing both sides by } 1.5\pi$$

Square rooting both sides finds h

6 ..... cm

(Total for Question 19 is 4 marks)

## 20 Solve the simultaneous equations

$$y^2 = 3x^2 + 4 \leftarrow \text{1st equation}$$

$$y + 2x = 7 \leftarrow \text{2nd equation}$$

Give your solutions correct to 3 significant figures.

$$y = 7 - 2x \leftarrow \text{Subtracting } 2x \text{ from both sides of the 2nd equation to make } y \text{ the subject}$$

$$(7 - 2x)(7 - 2x) \leftarrow \text{Expressing } y^2 \text{ in terms of } x$$

$$49 - 14x - 14x + 4x^2 \leftarrow \text{Expanding the brackets}$$

$$4x^2 - 28x + 49 = 3x^2 + 4 \leftarrow \text{Collecting like terms then substituting the expression of } y^2 \text{ in terms of } x \text{ into the 2nd equation}$$

$$x^2 - 28x + 45 = 0 \leftarrow \text{Subtracting } 3x^2 \text{ and } 4 \text{ from both sides to put it into the quadratic form } ax^2 + bx + c = 0$$

$$x = \frac{-28 \pm \sqrt{(-28)^2 - 4 \times 1 \times 45}}{2 \times 1} \leftarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \leftarrow \text{Solved using the quadratic formula. Storing the exact values of } x \text{ on the calculator}$$

$$y = 7 - 2(26.2...) \leftarrow \text{Substituting the exact values of } x \text{ into } y = 7 - 2x$$

$$y = 7 - 2(1.7...) \leftarrow \text{Substituting the exact values of } x \text{ into } y = 7 - 2x$$

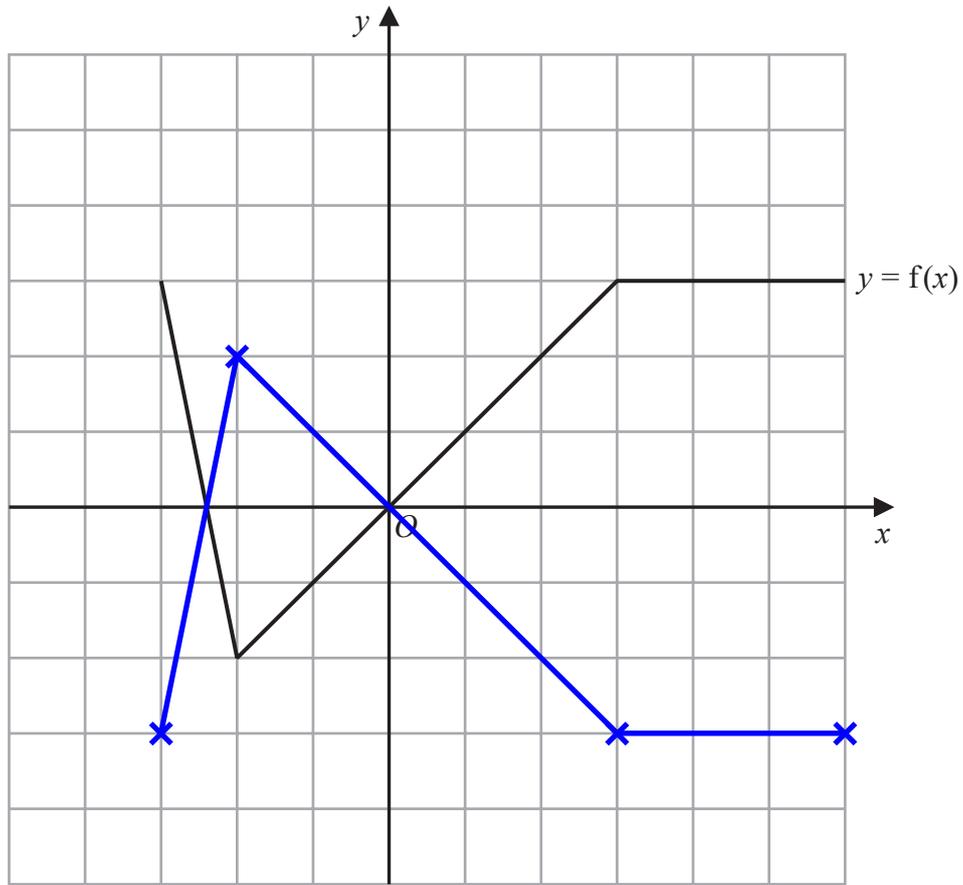
Rounding all the values to 3 significant figures

$$x = 26.3 \quad \text{or} \quad x = 1.71$$

$$y = -45.6 \quad \quad \quad y = 3.58$$

(Total for Question 20 is 4 marks)

21 Here is the graph of  $y = f(x)$



(a) On the grid, draw the graph of  $y = -f(x)$

Reflecting the graph in the x-axis

(1)

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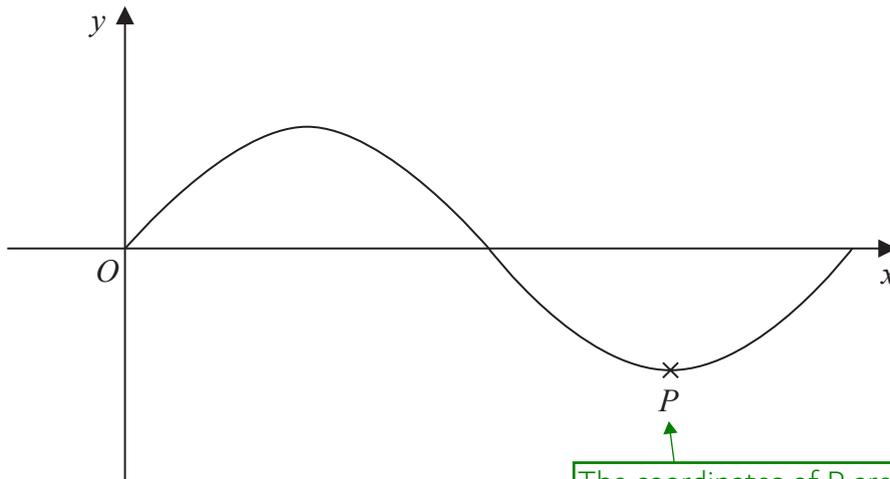


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Here is a sketch of the graph of  $y = \sin x^\circ$



The coordinates of P are (270, -1)

The point marked  $P$  is a turning point on the graph.

The graph of  $y = \sin x^\circ$  is translated to give the graph of  $y = \sin(x + 180)^\circ + 4$

Following the translation the point  $P$ , shown on the graph above, moves to point  $R$ .

(b) Find the coordinates of  $R$ .

270 - 180 ← Adding 180 to x moves the graph 180 to the left

-1 + 4 ← Adding 4 to the whole of the right side moves the graph 4 up

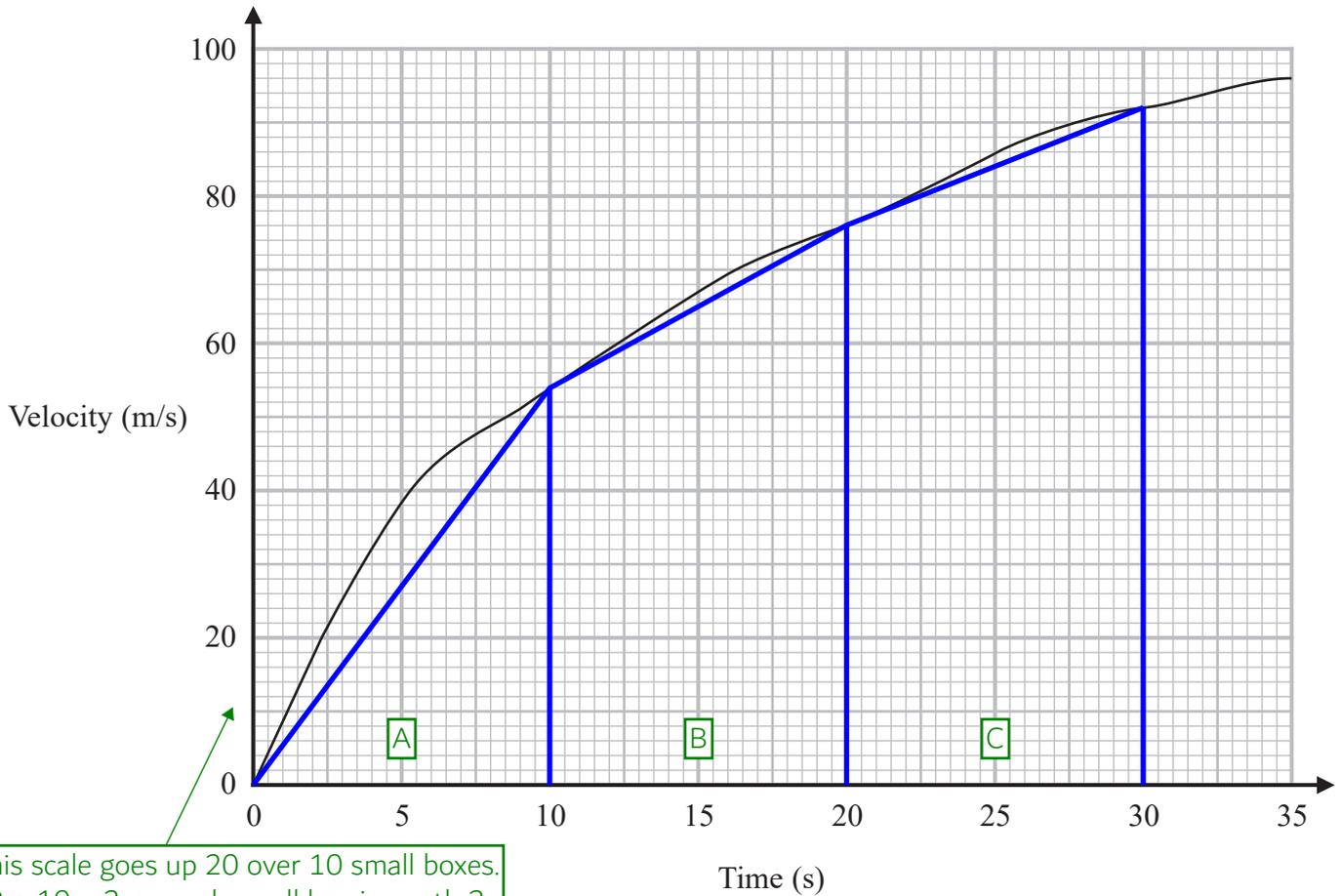
( 90 , 3 )  
(3)

(Total for Question 21 is 4 marks)



22 Here is a velocity-time graph for an aeroplane.

Distance on a velocity-time graph is the area under the line.  $30 \div 3 = 10$ , so each strip should be 10 wide



This scale goes up 20 over 10 small boxes.  $20 \div 10 = 2$ , so each small box is worth 2

Work out an estimate for the distance the aeroplane travelled in the first 30 seconds. Use 3 strips of equal width.

$\frac{1}{2} \times 10 \times 54 = 270$  ← Area of triangle A. Area of triangle =  $\frac{1}{2} \times \text{base} \times \text{height}$

$\frac{1}{2} (54 + 76) \times 10 = 650$  ← Area of trapezium B. Area of trapezium =  $\frac{1}{2} (a + b) \times h$ , where a and b are the parallel sides and h is the distance between them

$\frac{1}{2} (76 + 92) \times 10 = 840$  ← Area of trapezium C. Area of trapezium =  $\frac{1}{2} (a + b) \times h$ , where a and b are the parallel sides and h is the distance between them

$270 + 650 + 840$  ← Adding the areas of A, B and C estimates the distance

..... 1760 ..... m

(Total for Question 22 is 3 marks)



23 Sketch the graph of

$$y = x^2 - 6px - 7 \quad \text{where } p > 0$$

showing the coordinates of the turning point, in terms of  $p$ , and the coordinates of the intercept with the  $y$ -axis.

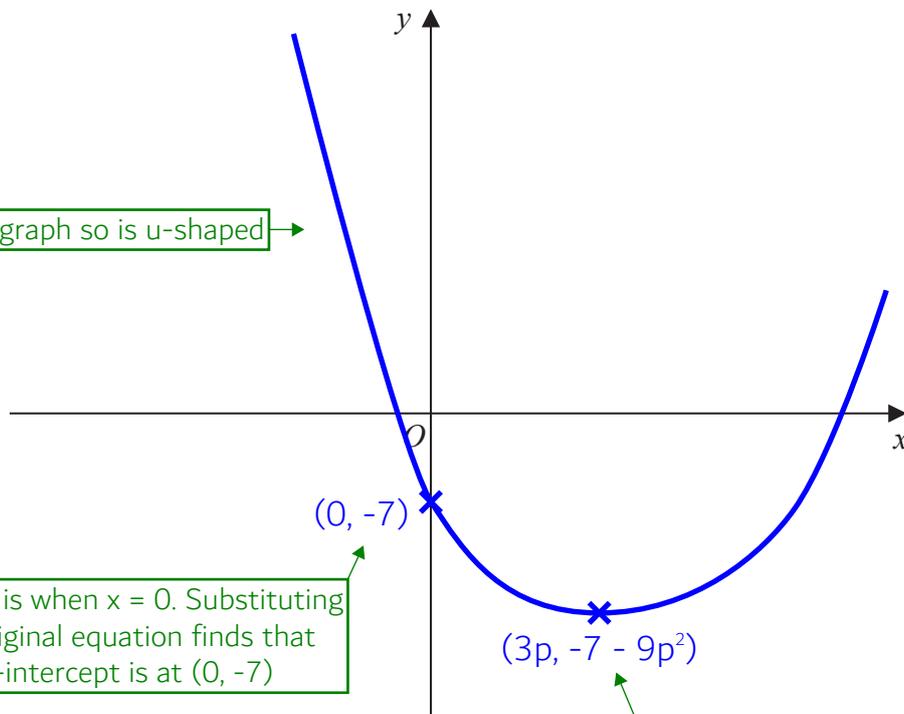
You must show all your working.

$$y = (x - 3p)^2 - 7 - (-3p)^2$$

Completing the square by halving the coefficient of  $x^2$ , putting this in a bracket with  $x$  and squaring the bracket. Subtracting the the square of half the coefficient of  $x^2$  from the end

$$y = (x - 3p)^2 - 7 - 9p^2$$

Simplifying



It is a positive  $x^2$  graph so is u-shaped

The  $y$ -intercept is when  $x = 0$ . Substituting 0 for  $x$  in the original equation finds that  $y = -7$ . So the  $y$ -intercept is at  $(0, -7)$

The turning point can be found from the completed the square form. The square bracket is 0 when  $x = 3p$ .  $y = -7 - 9p^2$  when this happens. As  $p > 0$ , the  $x$ -coordinate must be positive and the  $y$ -coordinate must be less than  $-7$

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS