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 | | | | |

Thursday 4 June 2020

Morning (Time: 1 hour 30 minutes) | Paper Reference **1MA1/2H**

Mathematics

Paper 2 (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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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

.CG Maths.

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) Write 84 as a product of its prime factors.

FACT B: Enter 84 in the calculator then press =. Then press SHIFT then the button on the left

$2^2 \times 3 \times 7$

(2)

(b) Find the lowest common multiple (LCM) of 60 and 84

$2^2 \times 3 \times 5$ ← FACT B: Enter 60 in the calculator then press =. Then press SHIFT then the button on the left

$2^2 \times 3 \times 5 \times 7$ ← Both 60 and 84 are expressed as a product of prime factors in index form. The LCM is the highest power of each prime multiplied together

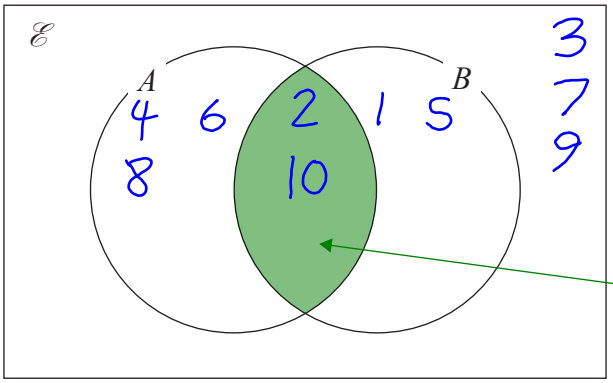
420

(2)

(Total for Question 1 is 4 marks)

2 $\mathscr{E}$ = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
A = {even numbers}
B = {factors of 10}

(a) Complete the Venn diagram for this information.



The intersection of A and B

(3)

A number is chosen at random from the universal set, $\mathscr{E}$

(b) Find the probability that this number is in the set $A \cap B$

2 out of the 10 numbers are in the intersection of A and B

$\frac{2}{10}$

(2)

(Total for Question 2 is 5 marks)

3 Carlo puts tins into small boxes and into large boxes.

He puts 6 tins into each small box.
He puts 20 tins into each large box.

Carlo puts a total of 3000 tins into the boxes so that

number of tins in small boxes : number of tins in large boxes = 2 : 3

Carlo says that less than 30% of the boxes filled with tins are large boxes.

Is Carlo correct?
You must show all your working.

$\frac{\frac{3000}{5} \times 2}{6} = 200$

There are 5 parts in total in the ratio and these represent a total of 3000 tins. Dividing 3000 by 5 works out what 1 part represents. Multiplying this by 2 works out what 2 parts represent and therefore works out how many tins are in small boxes. Dividing this by 6 works out how many lots of 6 go into this and therefore how many boxes are filled with small tins

$\frac{\frac{3000}{5} \times 3}{20} = 90$

There are 5 parts in total in the ratio and these represent a total of 3000 tins. Dividing 3000 by 5 works out what 1 part represents. Multiplying this by 3 works out what 3 parts represent and therefore works out how many tins are in large boxes. Dividing this by 20 works out how many lots of 20 go into this and therefore how many boxes are filled with large tins

$\frac{90}{290} \times 100 = 31\%$

There are 290 boxes of tins in total as 200 + 90 = 290. Out of these, 90 are filled with large tins. Writing this as a fraction then multiplying by 100 converts it into a percentage

No

31% is not less than 30%

(Total for Question 3 is 5 marks)

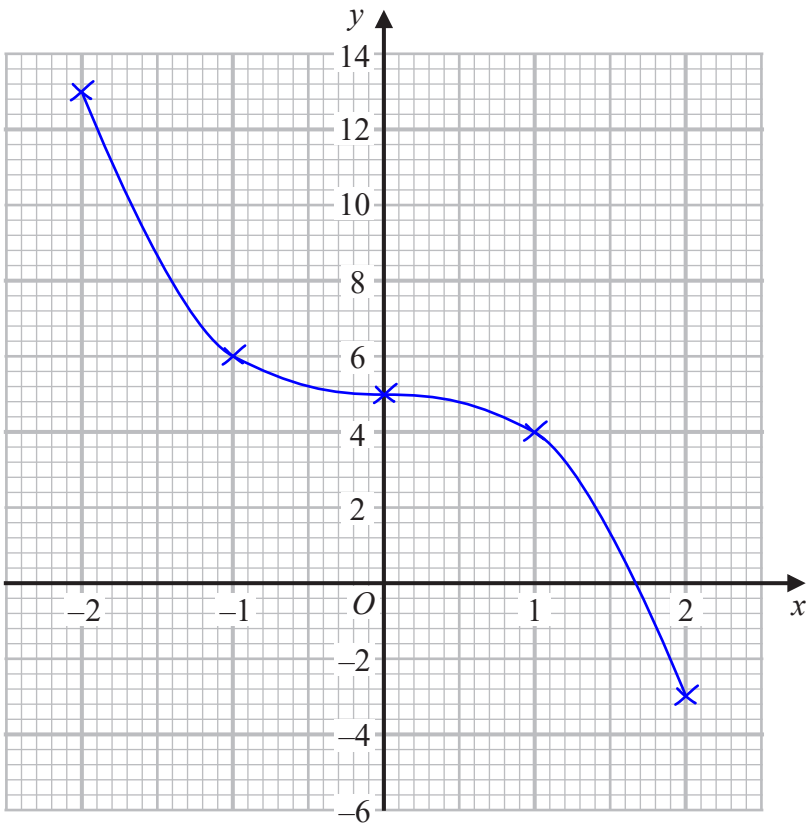
4 (a) Complete the table of values for $y = 5 - x^3$

Press MENU then 3 to enter table mode. Enter f(x) = 5 - x^3 then press =. Ignore g(x) by pressing =. Start: -2, End: 2, Step: 1. Enter the number and press = to set each of these

x	–2	–1	0	1	2
y	13	6	5	4	-3

(2)

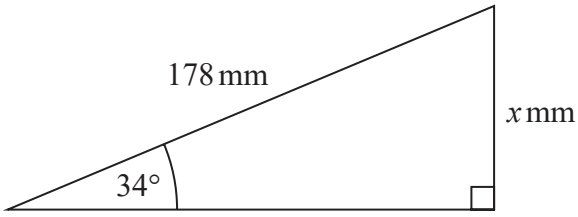
(b) On the grid below, draw the graph of $y = 5 - x^3$ for values of x from –2 to 2



(2)

(Total for Question 4 is 4 marks)

5



Work out the value of x.
Give your answer correct to 1 decimal place.

SOH CAH TOA

Writing SOH CAH TOA as formula triangles. Ticking O as we are finding the opposite and H as we have the hypotenuse. There are two ticks on SOH so we can use this formula triangle

Sin34 × 178

By covering O, what we are trying to find, the formula triangle tells us that the opposite, x, is equal to sin of the angle x hypotenuse

99.5

(Total for Question 5 is 2 marks)

6 $\mathbf{a} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$

Find $2\mathbf{a} - 3\mathbf{b}$ as a column vector.

$\begin{pmatrix} 6 \\ 8 \end{pmatrix} - \begin{pmatrix} 15 \\ -6 \end{pmatrix}$

Multiplying the x and y component by 3 in b gives this

Multiplying the x and y component by 2 in a gives this

Subtracting the x and y components separately.
6 - 15 = -9
8 - -6 = 14

$\begin{pmatrix} -9 \\ 14 \end{pmatrix}$

(Total for Question 6 is 2 marks)

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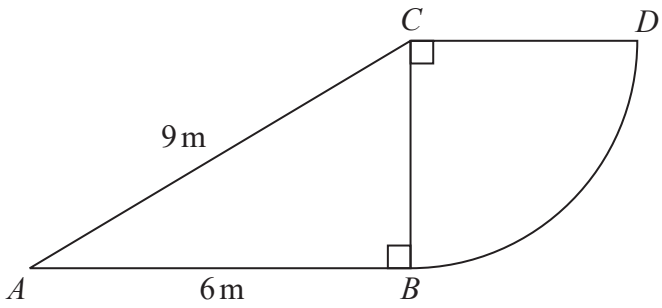
7 The diagram shows a right-angled triangle and a quarter circle.



The right-angled triangle ABC has angle $ABC = 90°$
The quarter circle has centre C and radius CB.

Work out the area of the quarter circle.
Give your answer correct to 3 significant figures.
You must show all your working.

$a^2 + b^2 = c^2$

CB can be found using Pythagoras' Theorem. c is the longest side, a and b are the shorter sides

$a = \sqrt{c^2 - b^2}$

Rearranged to make a the subject by subtracting b^2 from both sides then square rooting both sides

$\frac{1}{4}\left(\pi \times \left(\sqrt{9^2 - 6^2}\right)^2\right)$

Area of circle = πr^2, where r is the radius. r is side CB, which is found by substituting in 9 for c and 6 for b in the rearranged Pythagoras' Theorem. Doing 1/4 of the area of the circle as it is a quarter circle

35.3 ..... m^2

(Total for Question 7 is 4 marks)

8 Tariq buys a laptop.

He gets a discount of 5% off the normal price.
Tariq pays £551 for the laptop.

(a) Work out the normal price of the laptop.

$\frac{551}{0.95}$

Let x be the normal price. Multiplying it by 0.95 works out 95% of it, which is a 5% reduction. 0.95x = 551. So x = 551/0.95

£ 580

(2)

Joan invests £6000 in a savings account.
The savings account pays compound interest at a rate of

2.4% for the first year
1.7% for each extra year.

(b) Work out the value of Joan's investment at the end of 3 years.

$6000 \times \frac{100+2.4}{100} \times \left(\frac{100+1.7}{100}\right)^2$

100 + 2.4 works out the percentage it increases to after increasing by 2.4%. Dividing by 100 converts it into a multiplier which increases the £6000 by 2.4% when multiplied by it

100 + 1.7 works out the percentage it increases to after increasing by 1.7%. Dividing by 100 converts it into a multiplier which increases the it by 1.7% when multiplied by it. The multiplier is squared as it is increased by 1.7% twice

£ 6354.67

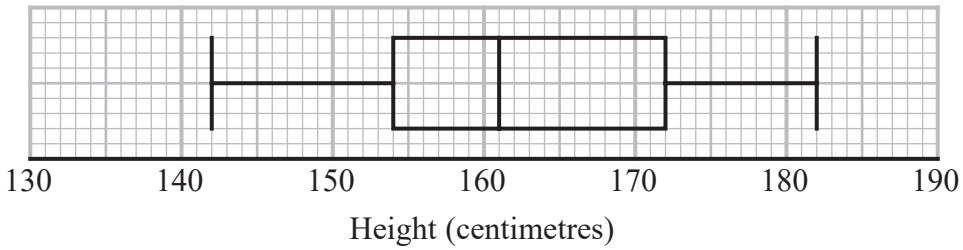
(3)

(Total for Question 8 is 5 marks)

9 Aisha recorded the heights, in centimetres, of some girls.
She used her results to work out the information in this table.

Least height	142 cm
Lower quartile	154 cm
Interquartile range	17 cm
Median	162 cm
Range	40 cm

Aisha drew this box plot for the information in the table.
The box plot is **not** fully correct.



Write down the two things Aisha should do to make the box plot fully correct.

1 Plot median at 162 It is plotted at 161

2 Plot upper quartile at 171 As the interquartile range is 17, the upper quartile should be 17 above the lower quartile. 154 + 17 = 171

(Total for Question 9 is 2 marks)

10 (a) Simplify $\left(\frac{1}{m^2}\right)^0$

Anything to the power of 0 is 1

1

(1)

(b) Simplify $\frac{8(x-4)}{(x-4)^2}$

To simplify a fraction, divide both the numerator and denominator by a common factor. (x - 4) is a common factor

$\frac{8}{x-4}$

(1)

(c) Simplify $(3n^4w^2)^3$

Raise everything in the bracket to the power of 3 as it is all one term. $(a^x)^y = a^{xy}$

$27n^{12}w^6$

(2)

(Total for Question 10 is 4 marks)

11 Jack is in a restaurant.
There are 5 starters, 8 main courses and some desserts on the menu.

Jack is going to choose one starter, one main course and one dessert.
He says there are 240 ways that he can choose his starter, his main course and his dessert.

Could Jack be correct?
You must show how you get your answer.

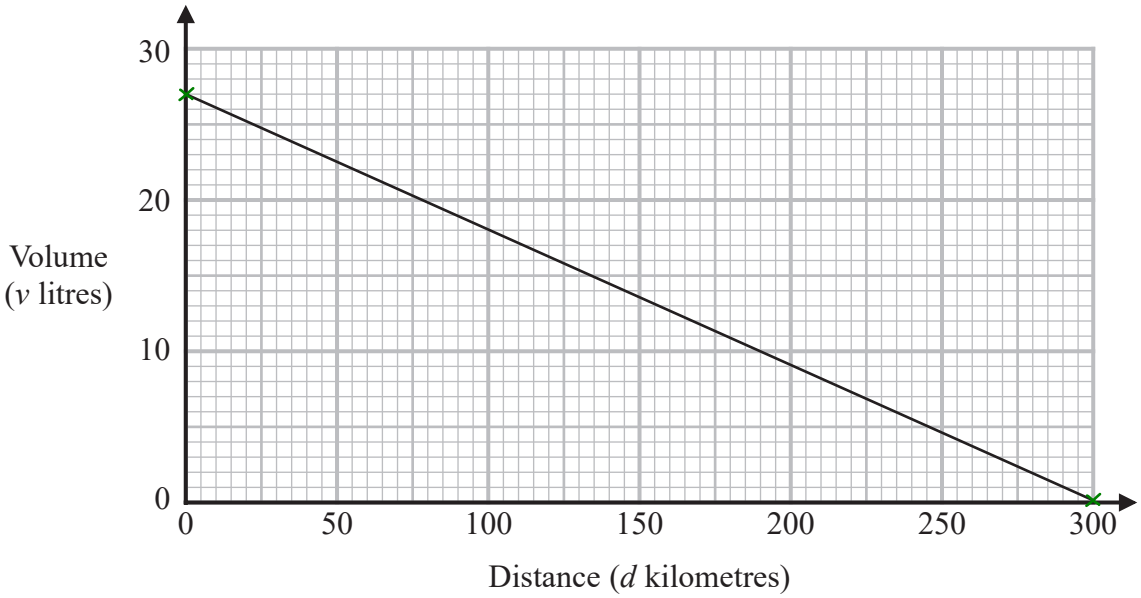
$\frac{240}{5 \times 8} = 6$

Yes

Let D be the number of deserts. Using the product rule for counting: 5 x 8 x D = the total number of options. So D = 240/(5 x 8). There would be 6 deserts if there are 240 options, so Jack could be correct as this is a whole number

(Total for Question 11 is 2 marks)

12 The graph gives information about the volume, v litres, of petrol in the tank of Jim's car after it has travelled a distance of d kilometres.



(a) Find the gradient of the graph.

Gradient = (change in y)/(change in x). y has changed from 27 to 0 so has changed by -27. x has changed from 0 to 300 so has changed by 300

$\frac{-27}{300}$

(2)

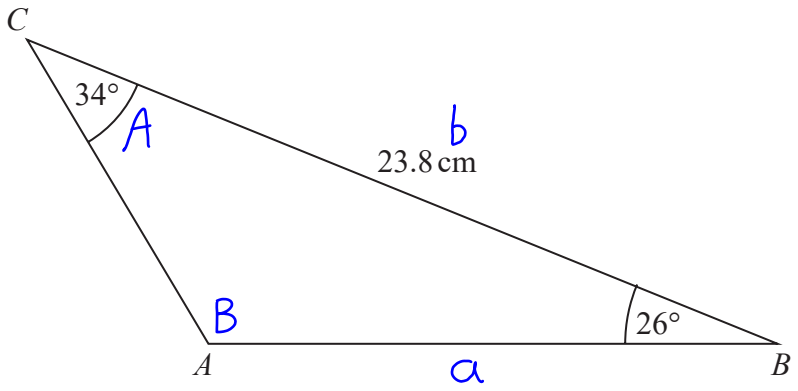
(b) Interpret what the gradient of the graph represents.

Volume of petrol used per kilometre

(1)

(Total for Question 12 is 3 marks)

13 Here is triangle ABC.



Work out the length of AB.
Give your answer correct to 1 decimal place.

$\frac{a}{\sin A} = \frac{b}{\sin B}$ ← The missing angle can be found. There are then two pairs of opposite sides and angles so the sine rule can be used

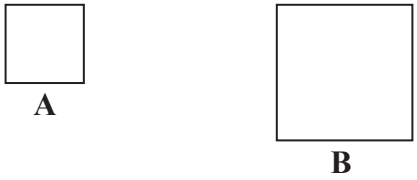
$180 - 34 - 26 = 120$ ← Angles in triangle add to 180 so this works out angle B

$a = \frac{23.8}{\sin 120} \times \sin 34$ ← Rearranged to make side a the subject by multiplying both sides by sinB. Then substituted in the angles and sides from the diagram

15.4 cm

(Total for Question 13 is 3 marks)

14 Here are two squares, **A** and **B**.



The length of each side of square **B** is 4 cm greater than the length of each side of square **A**.
The area of square **B** is 70 cm^2 greater than the area of square **A**.

Find the area of square **B**.
Give your answer correct to 3 significant figures.
You must show all your working.

$(x+4)^2 = x^2 + 70$ ← Let x be the side length of A. The length of B must be x + 4. Squaring this gives the area of B, which is equal to the area of A + 70. The area of A = x^2

$x^2 + 8x + 16 - x^2 = 70$ ← Expanding the square bracket: square the first term, double the product of the two terms, square the last term. Subtracting x^2 from both sides

$x = \frac{70-16}{8} = 6.75$ ← The x^2 terms cancel out as $x^2 - x^2 = 0$. The equation can then be rearranged to make x the subject by subtracting 16 from both sides then dividing them by 8

$(6.75+4)^2$ ← The side length of A, x, is 6.75cm. B is 4cm greater than this so is 6.75 + 4. Squaring this gives the area of B

116 cm^2

(Total for Question 14 is 4 marks)

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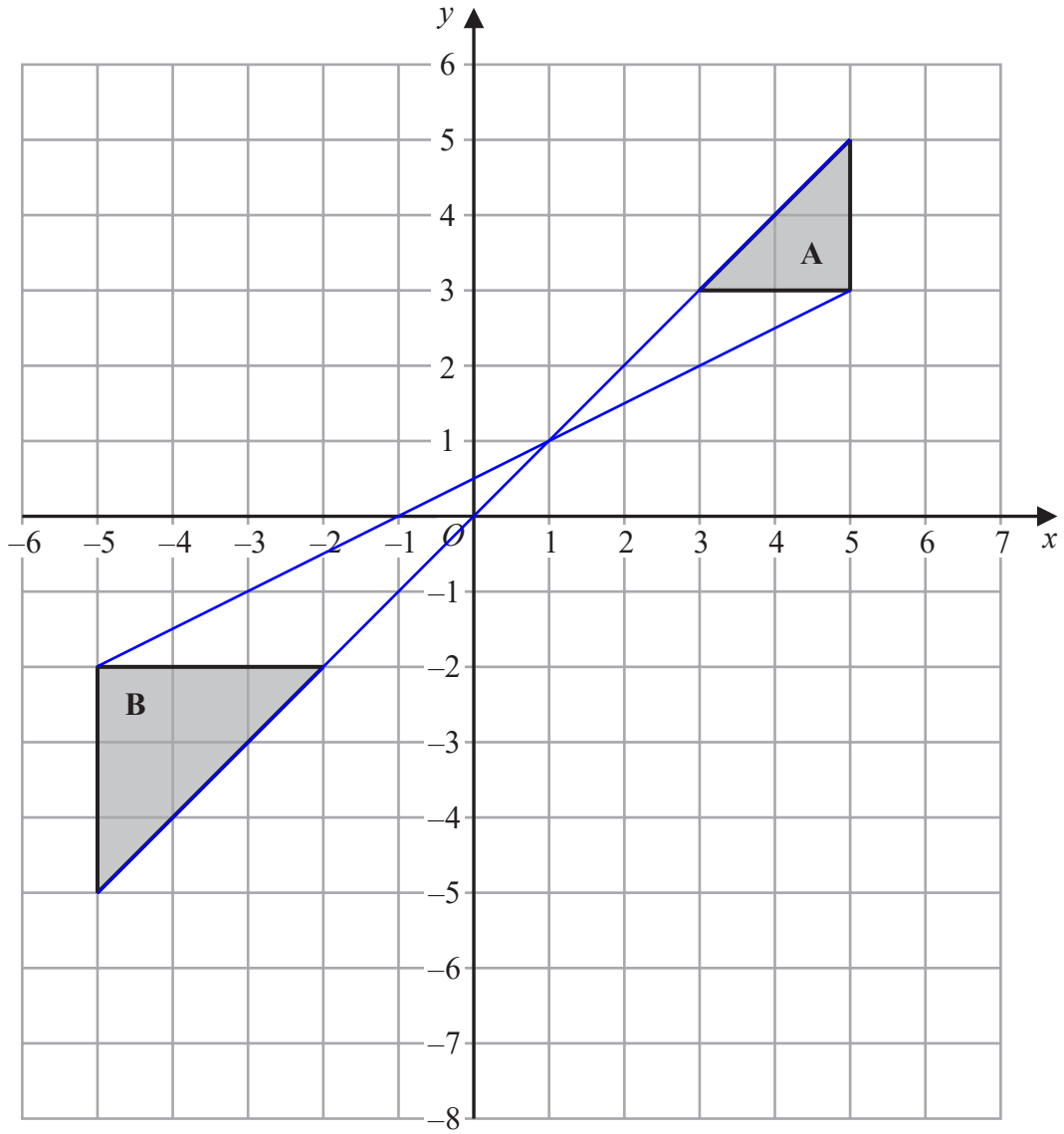
15



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

Enlargement by scale factor -1.5 from (1 , 1)

(Total for Question 15 is 2 marks)

It must be an enlargement as it has changed size. The scale factor is negative as the shape has inverted. The sides are 1.5 time as large. The centre of enlargement is found by drawing lines connecting the corresponding corners and seeing where they all cross

16 Here are the first five terms of a quadratic sequence.

10 11 21 17 38 61 90

6

Listing the differences then the second difference, which is the difference of the differences

Find an expression, in terms of n, for the nth term of this sequence.

3 12

The sequence is in the form $an^2 + bn + c$. a is half of the second difference, so is 3. Listing out the sequence of $3n^2$

7 9

Listing the sequence which needs to be added to $3n^2$ to get the original sequence. This must be $2n + 5$ as it goes up by 2 each term and the 0th term would be 5

Adding the sequences of $3n^2$ and $2n + 5$ gives the original sequence

$3n^2+2n+5$

(Total for Question 16 is 3 marks)

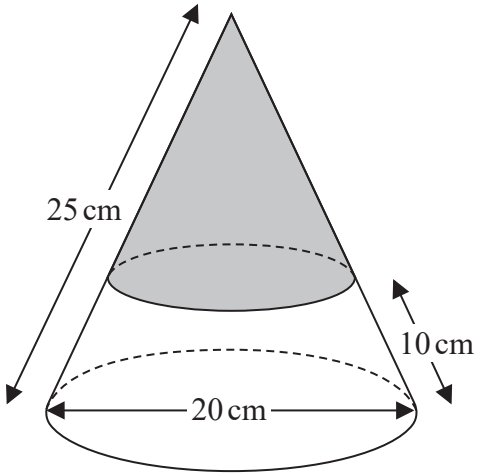
17 Write down the coordinates of the turning point on the graph of $y = (x + 12)^2 - 7$

The turning point occurs when the square bracket is equal to 0 as this is the smallest a squared number can be. When x + 12 = 0, x = -12. When the bracket is 0, y = -7

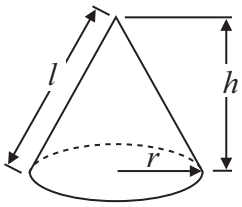
(-12 , -7)

(Total for Question 17 is 1 mark)

18 The diagram represents a solid cone.



Curved surface area of cone = πrl



The cone has a base diameter of 20 cm and a slant height of 25 cm.

A circle is drawn around the surface of the cone at a slant height of 10 cm above the base.
The curved surface of the cone above the circle is painted grey.

Work out the area of the curved surface of the cone that is **not** painted grey.
Give your answer as a multiple of π
You must show all your working.

$\pi \times 10 \times 25 - \pi \times \frac{15}{25} \times 10 \times 15$

Subtracting the curved surface area of the grey cone from the curved surface area of the whole cone leaves the curved surface area which is not painted grey

Curved surface area of the whole cone. The radius is half of the diameter so is 10cm. The slant height is 25cm

Curved surface area of the grey cone. The slant height is 25 - 10 = 15cm. So the scale factor between the whole cone and the grey cone is 15/25. Multiplying the radius of 10cm by 15/25 works out the radius of the grey cone

160π ..... cm^2

(Total for Question 18 is 4 marks)

19 A hot air balloon is descending.
The height of the balloon n minutes after it starts to descend is h_n metres.

The height of the balloon $(n+1)$ minutes after it starts to descend, h_{n+1} metres, is given by

$$h_{n+1} = K \times h_n + 20 \quad \text{where } K \text{ is a constant.}$$

The balloon starts to descend from a height of 1200 metres at 09 15
At 09 16 the height of the balloon is 1040 metres.

Work out the height of the balloon at 09 18

$K = \frac{1040-20}{1200}$ ← Rearranged the formula to find K by subtracting 20 from both sides then dividing both sides by h_n. Substituting 1040 for h_{n+1} and 1200 for h_n

$h_2 = \frac{17}{20} \times 1040 + 20$ ← The height at 09 17. Substituting h_n for the height at 19 16

$h_3 = \frac{17}{20} \times 904 + 20$ ← The height at 09 18. Substituting h_n for the height at 19 17

788.4 m

(Total for Question 19 is 4 marks)

20 There are only red sweets and yellow sweets in a bag.

There are n red sweets in the bag.
There are 8 yellow sweets in the bag.

Sajid is going to take at random a sweet from the bag and eat it.

He says that the probability that the sweet will be red is $\frac{7}{10}$

(a) Show why the probability cannot be $\frac{7}{10}$

$\frac{n}{n+8} = \frac{7}{10}$ ← Expressing the probability of getting red in terms of n, which must equal to 7/10

$10n = 7n + 56$ ← Multiplying both sides by (n + 8) and by 10 to eliminate the fractions

$3n = 56$ ← Subtracting 7n from both sides to get the n terms on the same side

$n = \frac{56}{3}$ ← Dividing both sides by 3 to find n. This is not possible as the number of red sweets is not a whole number

(3)

After Sajid has taken the first sweet from the bag and eaten it, he is going to take at random a second sweet from the bag.

Given that the probability that both the sweets he takes will be red is $\frac{3}{5}$

(b) work out the number of red sweets in the bag.
You must show all your working.

$\frac{n}{n+8} \times \frac{n-1}{n+7} = \frac{3}{5}$ ← Red AND red. AND means to multiply the probabilities. There is one fewer red sweet and one fewer sweet in total after the first red sweet is taken

$n(n-1) \times 5 = 3(n+8)(n+7)$ ← Multiplying both sides by (n + 8), (n + 7) and 5 to eliminate the denominators

$5n^2 - 5n = 3n^2 + 21n + 24n + 168$ ← Expanding the brackets

$2n^2 - 50n - 168 = 0$ ← Collecting like terms and bringing into the quadratic form $ax^2 + bx + c$ so it can be solved

$n = \frac{-(-50) \pm \sqrt{(-50)^2 - 4(2)(-168)}}{2(2)}$ ← Using the quadratic formula as this is easier than factorising on a calculator paper when there are large numbers

$n = 28, n = -3$

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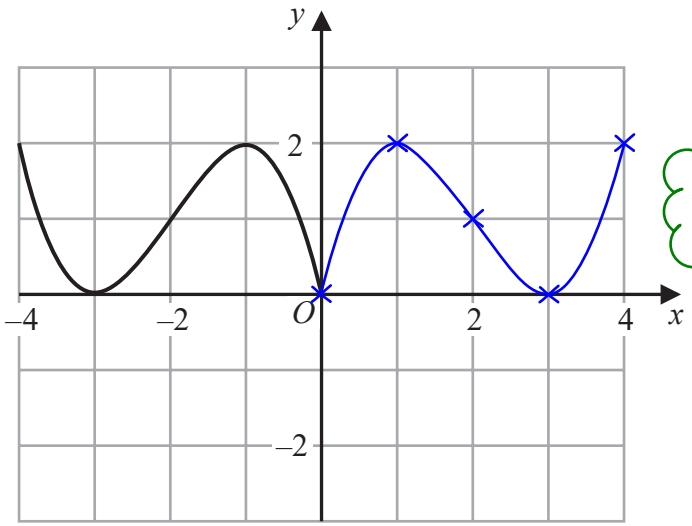
n cannot be negative so the solution of -3 is ignored

28

(5)

(Total for Question 20 is 8 marks)

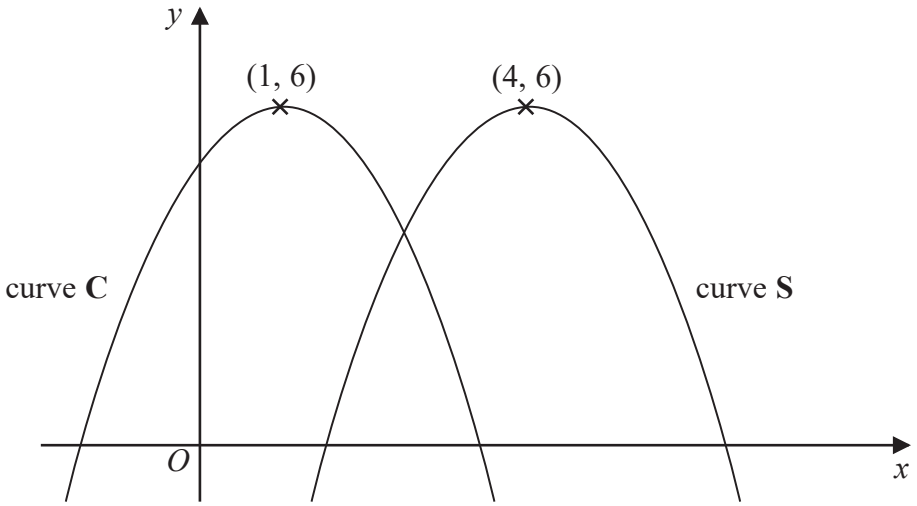
21 The graph of the curve with equation $y = f(x)$ is shown on the grid below.



x has become negative so it is a reflection in the y-axis

(a) On the grid above, sketch the graph of the curve with equation $y = f(-x)$

(2)



The curve **C** with equation $y = 5 + 2x - x^2$ is transformed by a translation to give the curve **S** such that the point (1, 6) on **C** is mapped to the point (4, 6) on **S**.

(b) Find an equation for **S**.

Subtracting 3 from all of the x means that it gets to the same values 3 later, so translates 3 to the right

$y = 5 + 2(x-3) - (x-3)^2$

(2)

(Total for Question 21 is 4 marks)

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22 **C** is a circle with centre the origin.

A tangent to **C** passes through the points (–20, 0) and (0, 10)

Work out an equation of **C**.
You must show all your working.

$\frac{10-0}{0--20} = \frac{1}{2}$ ← (Change in y)/(change in x) works out the gradient of the tangent

$y = \frac{1}{2}x + 10$ ← The equation of the tangent in the form y = mx + c, where m is the gradient and c is the y-intercept

$y = -2x$ ← The equation of the radius. The gradient of the radius is the negative reciprocal of the gradient of the tangent as they are perpendicular. c is 0 as it passes through the origin

$-2x = \frac{1}{2}x + 10$ ← The radius and tangent meet on the circle. Solving the equations simultaneously to find the x and y coordinate where they meet

$-2\frac{1}{2}x = 10$ ← Subtracting 1/2 x from both sides to get the x terms on the same side

$x = -4$ ← Dividing both sides by $-2^{1}/_{2}$ to find x

$y = -2(-4) = 8$ ← Substituting in the x coordinate into the equation y = -2x to find the y coordinate

$(-4)^2 + 8^2 = 80$ ← The general equation of a circle with its centre at the origin is $x^2 + y^2 = r^2$. Substituting in the x and y value on the circle to find r^2

$x^2 + y^2 = 80$

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS