Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number

Candidate Number

Pearson Edexcel International GCSE

Time 2 hours

Paper reference **4MA1/1HR**

Mathematics A
PAPER 1HR
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.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- **Calculators may be used.**
- You must **NOT** write anything on the formulae page. Anything you write on the formulae page will gain NO credit.

Information

- The total mark for this paper is 100.
- 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.
- Check your answers if you have time at the end.

Turn over

L:1/1/1/

P 6 8 7 2 7 A 0 1 3 2

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International GCSE Mathematics
Formulae sheet – Higher Tier

Arithmetic series

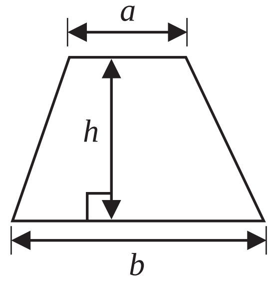
Sum to n terms, $S_n = \frac{n}{2}\,[2a + (n-1)d]$

The quadratic equation

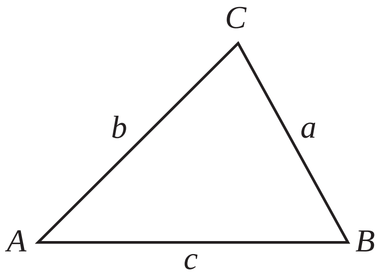
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:

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

Area of trapezium $= \frac{1}{2}(a + b)h$



Trigonometry



In any triangle ABC

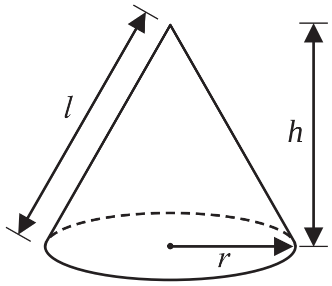
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine Rule $a^2 = b^2 + c^2 - 2bc\cos A$

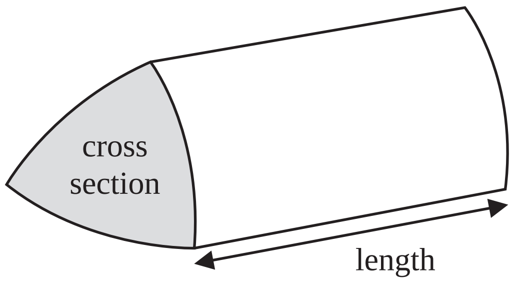
Area of triangle $= \frac{1}{2}ab\sin C$

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

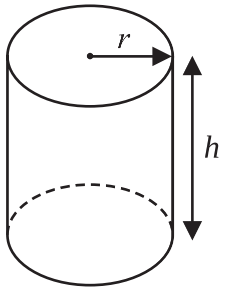
Curved surface area of cone $= \pi r l$



Volume of prism
= area of cross section × length

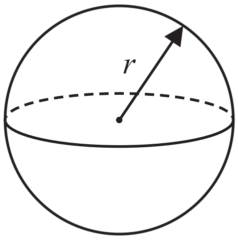


Volume of cylinder $= \pi r^2 h$
Curved surface area of cylinder $= 2\pi r h$



Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$



P 6 8 7 2 7 A 0 2 3 2

Answer ALL TWENTY FOUR questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

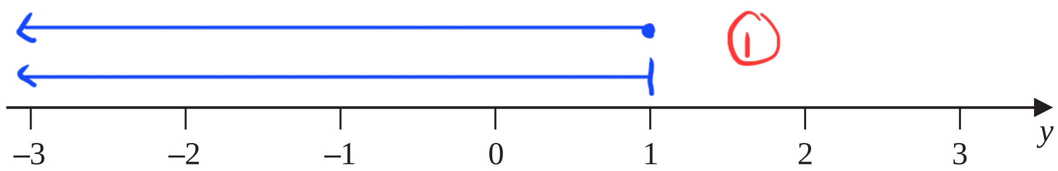
1 n is an integer.

(a) Write down all the values of n such that $-2 \leqslant n < 3$

$-2, -1, 0, 1, 2$ 2

(2)

(b) On the number line, represent the inequality $y \leqslant 1$



(1)

(Total for Question 1 is 3 marks)

P 6 8 7 2 7 A 0 3 3 2

2 Each time John plays a game, the probability that he wins the game is 0.65

John is going to play the game 300 times.

Work out an estimate for the number of games that John wins.

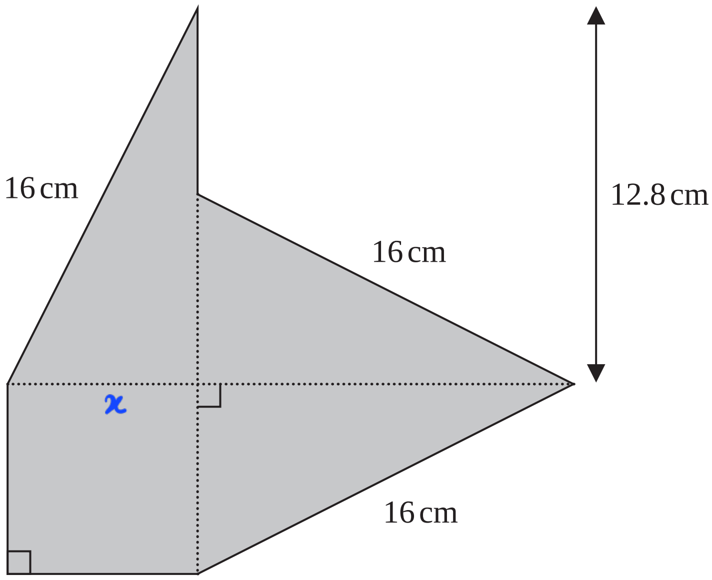
$0.65 \times 300 = 195$

1 1

195

(Total for Question 2 is 2 marks)

3 The shaded shape is made using three identical right-angled triangles and a square.



Work out the perimeter of the shaded shape.

$x^2 = 16^2 - 12.8^2$ (1)

$= 92.16$

$x = \sqrt{92.16}$ (1)

$= 9.6$

Perimeter $= 16 + 9.6 + 9.6 + 16 + 16 + (12.8 - 9.6)$ (1)

$= 70.4$ (1)

70.4 .... cm

(Total for Question 3 is 4 marks)

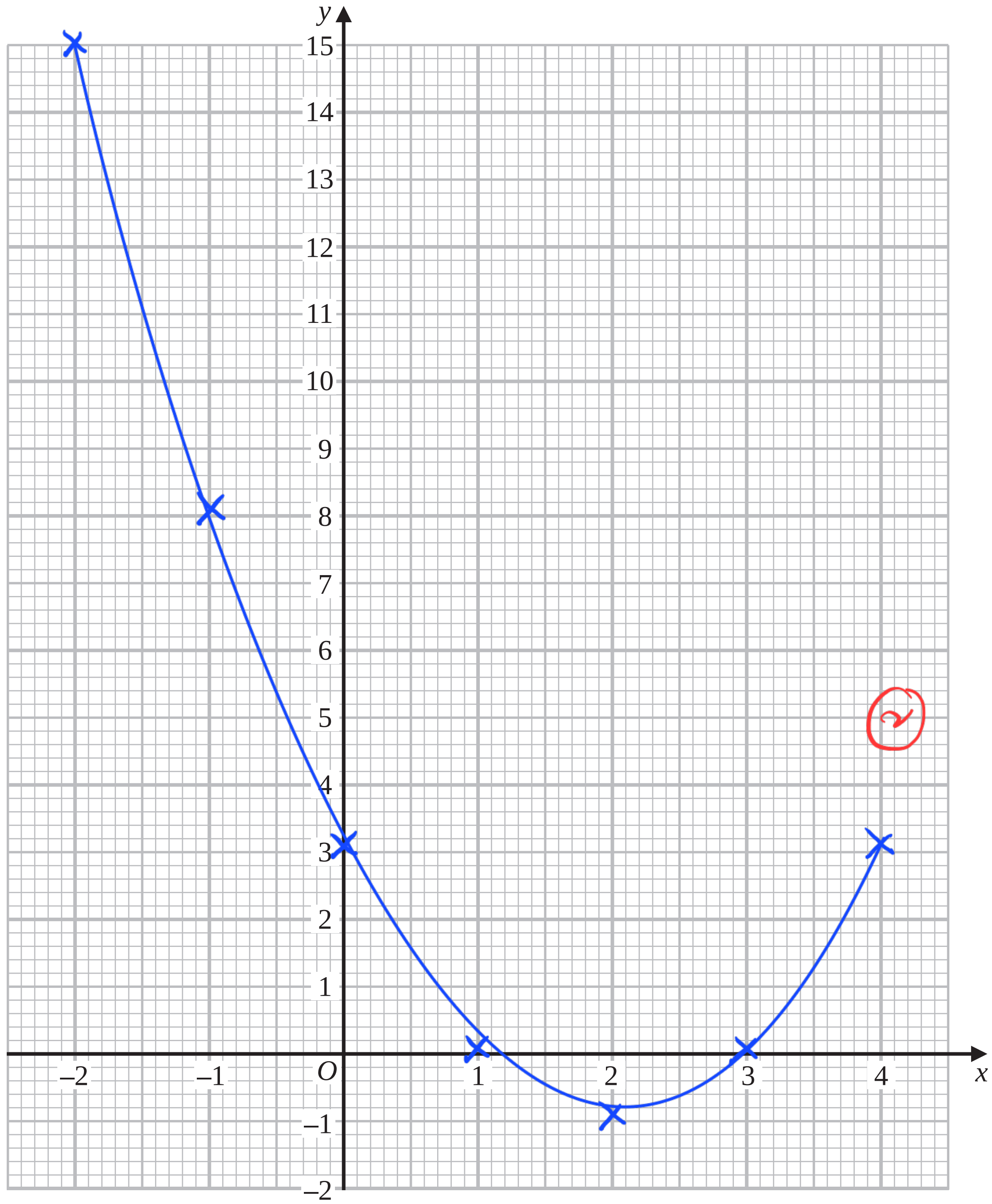
4 (a) Complete the table of values for $y = x^2 - 4x + 3$

x	–2	–1	0	1	2	3	4
y	15	8	3	0	-1	0	3

2

(2)

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



(2)

(Total for Question 4 is 4 marks)

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5 Yusuf sat 8 examinations.

Here are his marks for 5 of the examinations.

64 68 72 75 77 80 80

For his results in all 8 examinations

the mode of his marks is 80
the median of his marks is 74
the range of his marks is 16

Find Yusuf's marks for each of the other 3 examinations.

$a = 80$ (1)

b : range, $16 = 80 - b$

$b = 64$ (1)

median, $74 = \dfrac{75 + c}{2}$

$c = 73$ (1)

64

(1) 73

80

(Total for Question 5 is 4 marks)

6 (a) Work out the lowest common multiple (LCM) of 36 and 120

multiples of 36 : 36 , 72 , 108 , 144 , 180 , 216 , 252 , 288 , 324 , 360

multiples of 120 : 120 , 240 , 360 (1)

360 (1)

....

(2)

$A = 5^2 \times 7^4 \times 11^p$
$B = 5^m \times 7^{n-5} \times 11$

m, n and p are integers such that
$m > 2$
$n > 10$
$p > 1$

(b) Find the highest common factor (HCF) of A and B
Give your answer as a product of powers of its prime factors.

HCF of A and B : $5^2 \times 7^4 \times 11$

$5^2 \times 7^4 \times 11$ (2)

....

(2)

(Total for Question 6 is 4 marks)

7 Milly went on a car journey.
She travelled from Anesey to Breigh to Clando and then to Duckbridge.

For Anesey to Breigh, Milly drove the 245 km in 2.5 hours.
For Breigh to Clando, Milly drove the 220 km at an average speed of 80 km/h
For Clando to Duckbridge, Milly drove at an average speed of 72 km/h in 50 minutes.

Work out Milly's average speed, in km/h, for the journey from Anesey to Duckbridge.
Give your answer correct to one decimal place.

Breigh to Clando : $\frac{220 \text{ km}}{80 \text{ km/h}} = 2.75 \text{ h}$ (1)

Clando to Duckbridge: $72 \text{ km/h} \times \frac{50}{60} \text{ h}$

$= 60 \text{ km}$ (1)

Total : $\frac{245 + 220 + 60}{2.5 + 2.75 + \frac{50}{60}}$ (1) $= \frac{525}{73/12}$

$= 86.3$ (1)

86.3 .... km/h

(Total for Question 7 is 4 marks)

8 (a) Write 5×10^4 as an ordinary number.

50 000 1

....

(1)

(b) Write 0.000 06 in standard form.

6×10^{-5} 1

....

(1)

(c) Work out $(4 \times 10^{512}) \div (1.6 \times 10^{700})$

Give your answer in standard form.

$\frac{4}{1.6} \times 10^{512-700}$ 1

$= 2.5 \times 10^{-188}$ 1

2.5×10^{-188}

....

(2)

(Total for Question 8 is 4 marks)

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9 (a) Simplify $x^4 \times x^5$

$x^{4+5} = x^9$

x^9 ①

(1)

(b) Simplify $(4y^2)^3$

$4^3 \times y^{2\times3}$ ①

$= 64y^6$ ①

$64y^6$

(2)

(c) Factorise $n^2 - 7n + 12$

$(n-3)(n-4)$ ②

$(n-3)(n-4)$

(2)

(Total for Question 9 is 5 marks)

10 Jonty has a storage container in the shape of a cuboid, as shown in the diagram.

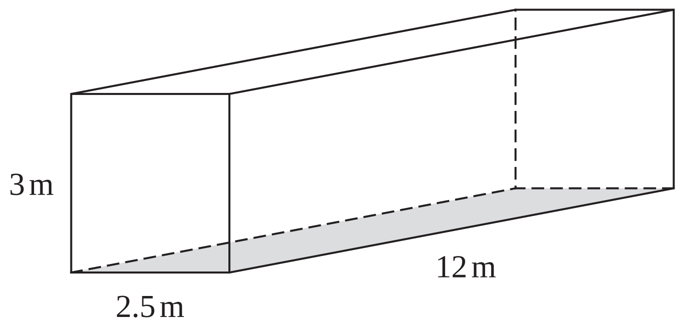

Diagram **NOT** accurately drawn

Jonty is going to paint the outside of his storage container, apart from the base which is shown shaded in the diagram.
He needs enough paint to cover the four sides and the top.

Each tin of paint covers an area of 15 m^2

The cost of each tin of paint recently increased by 10%
After the increase, the cost of each tin of paint is £26.95

Jonty says

"**Before** the increase, I could have bought enough paint for less than £200"

Show that Jonty is correct.
Show your working clearly.

Area : $3 \times 2.5 = 7.5$ (1)

$12 \times 3 = 36$

$12 \times 2.5 = 30$

Total area : $(2 \times 7.5) + (2 \times 36) + 30$

$= 15 + 72 + 30$ (1)

$= 117$

Tin of paint needed $= \dfrac{117}{15} = 7.8$ (1)

$\approx$ 8 tins are needed

P 6 8 7 2 7 A 0 1 2 3 2

100% + 10% = 110% which is £26.95 (1)

Price at 100% : $x = \frac{26.95}{110} \times 100$

$= 24.5$ (1)

24.5 x 8 tins = 196

Yes. Jonty is correct. (1)

(Total for Question 10 is 6 marks)

11 The diagram shows sector *OPQ* of a circle, centre *O*

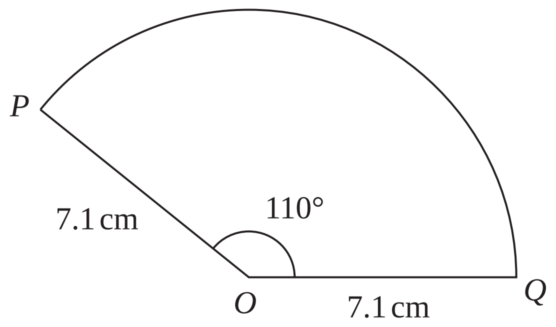

Diagram **NOT** accurately drawn

$OP = OQ = 7.1$ cm
Angle $POQ = 110°$

Calculate the area of sector *OPQ*
Give your answer correct to one decimal place.

$\frac{110}{360} \times \pi \times 7.1^2$ 1

$= 48.4 \text{ cm}^2$ 1

48.4 cm²

(Total for Question 11 is 2 marks)

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12 (a) Expand and simplify $n(n-4)(3n+5)$

$(n-4)(3n+5) = 3n^2 + 5n - 12n - 20$

$= 3n^2 - 7n - 20$ (1)

$n(3n^2 - 7n - 20)$

$= 3n^3 - 7n^2 - 20n$ (1)

$3n^3 - 7n^2 - 20n$

(2)

(b) Express

$$\frac{3}{x} + \frac{x+2}{2x} + \frac{1}{4}$$

as a single fraction in its simplest form.

$\frac{3(4)}{4x} + \frac{2(x+2)}{4x} + \frac{x}{4x}$ (1)

$= \frac{12 + 2x + 4 + x}{4x}$ (1)

$= \frac{16 + 3x}{4x}$ (1)

$\frac{3x + 16}{4x}$

(3)

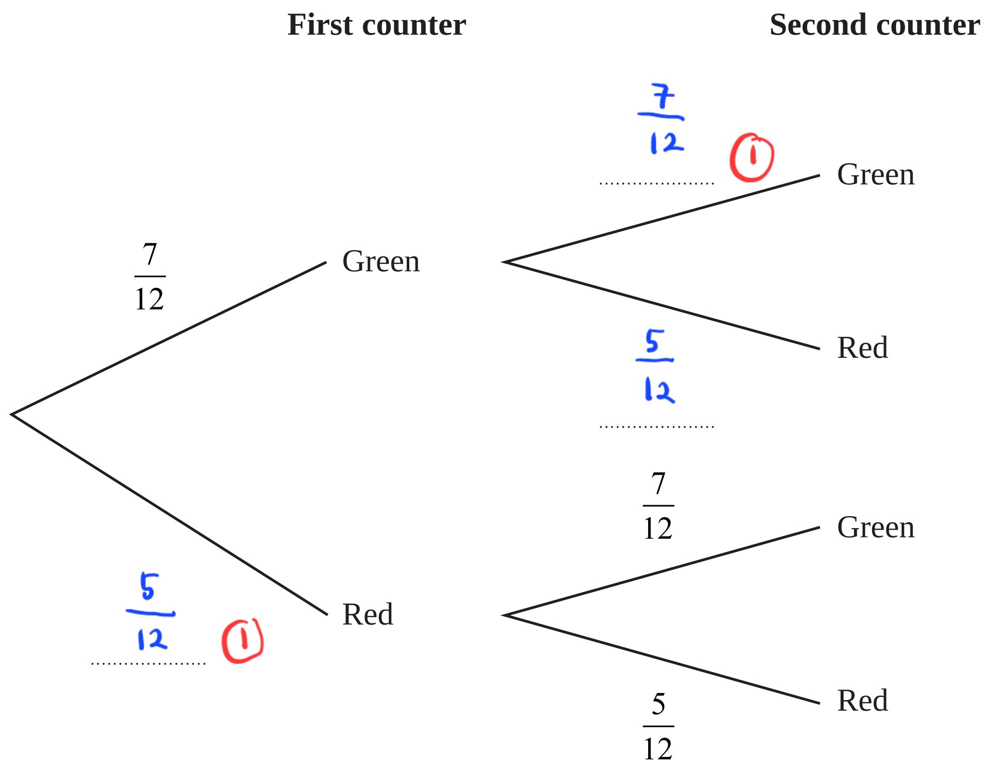
(Total for Question 12 is 5 marks)

13 Hector has a bag that contains 12 counters.
There are 7 green counters and 5 red counters in the bag.

Hector takes at random a counter from the bag.
He looks at the counter and puts the counter back into the bag.

Hector then takes at random a second counter from the bag.
He looks at the counter and puts the counter back into the bag.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that both counters are red.

$$\frac{5}{12} \times \frac{5}{12} = \frac{25}{144} \quad (1)$$

(1)

$\frac{25}{144}$

(2)

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Meghan has a jar containing 15 counters.
There are only blue counters, green counters and red counters in the jar.

Hector is going to take at random one of the counters from his bag of 12 counters.
He will look at the counter and put the counter back into the bag.

Hector is then going to take at random a second counter from his bag.
He will look at the counter and put the counter back into the bag.

Meghan is then going to take at random one of the counters from her jar of counters.
She will look at the counter and put the counter back into the jar.

The probability that the 3 counters each have a different colour is $\frac{7}{24}$

(c) Work out how many blue counters there are in the jar.

1 RG and GR : $\frac{7}{12} \times \frac{5}{12} \times 2$ 1

P(B) from jar

1 and blue : $2 \times \frac{7}{12} \times \frac{5}{12} \times y = \frac{7}{24}$

$y = \dfrac{\frac{7}{24}}{2 \times \frac{7}{12} \times \frac{5}{12}} = \frac{3}{5}$ 1

$\frac{3}{5} \times 15$ counters = 9 blue counters 1

9

(3)

(Total for Question 13 is 7 marks)

14

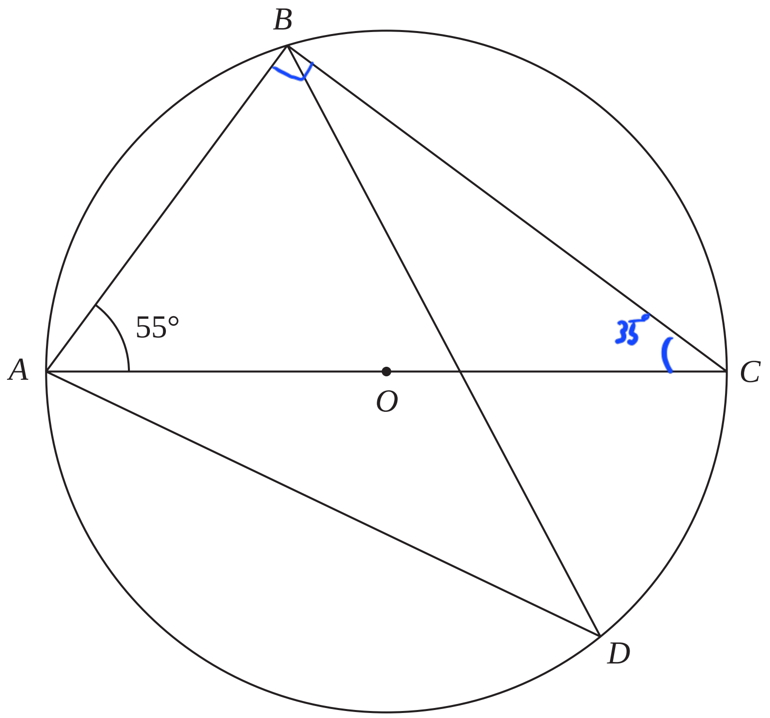

Diagram **NOT** accurately drawn

A, *B*, *C* and *D* are points on a circle, centre *O*
AOC is a diameter of the circle.

Angle *BAC* = 55°

Work out the size of angle *ADB*
Give a reason for each stage of your working.

ABC = 90° (1)
(angles in semicircle are 90°)

ACB = 180° − 90° − 55°
= 35° (1)
(angles in a triangle add up to 180°)
(1)

ADB = ACB = 35°
(angles in the same segment are equal)

35 (1) °

(Total for Question 14 is 4 marks)

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15 Using algebra, prove that, given any 3 consecutive whole numbers, the sum of the square of the smallest number and the square of the largest number is always 2 more than twice the square of the middle number.

let $n, n+1, n+2$ (1)

$n^2 = n^2$

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

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

(1)

$n^2 + n^2 + 4n + 4 = 2n^2 + 4n + 4$

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

$= 2n^2 + 4n + 4$ (proved)

(1)

(Total for Question 15 is 3 marks)

16 An arithmetic series has first term 1 and common difference 4

Find the sum of all terms of the series from the 41st term to the 100th term inclusive.

$S_{100} = \frac{100}{2} \times 2 + 99(4)$

$= 50 \times 398$

$= 19\,900$ (1)

$S_{40} = \frac{40}{2} \times 2 + 39(4)$

$= 20 \times 158$

$= 3160$ (1)

$S_{100} - S_{40} = 19900 - 3160$ (1)

$= 16\,740$ (1)

16 740

(Total for Question 16 is 4 marks)

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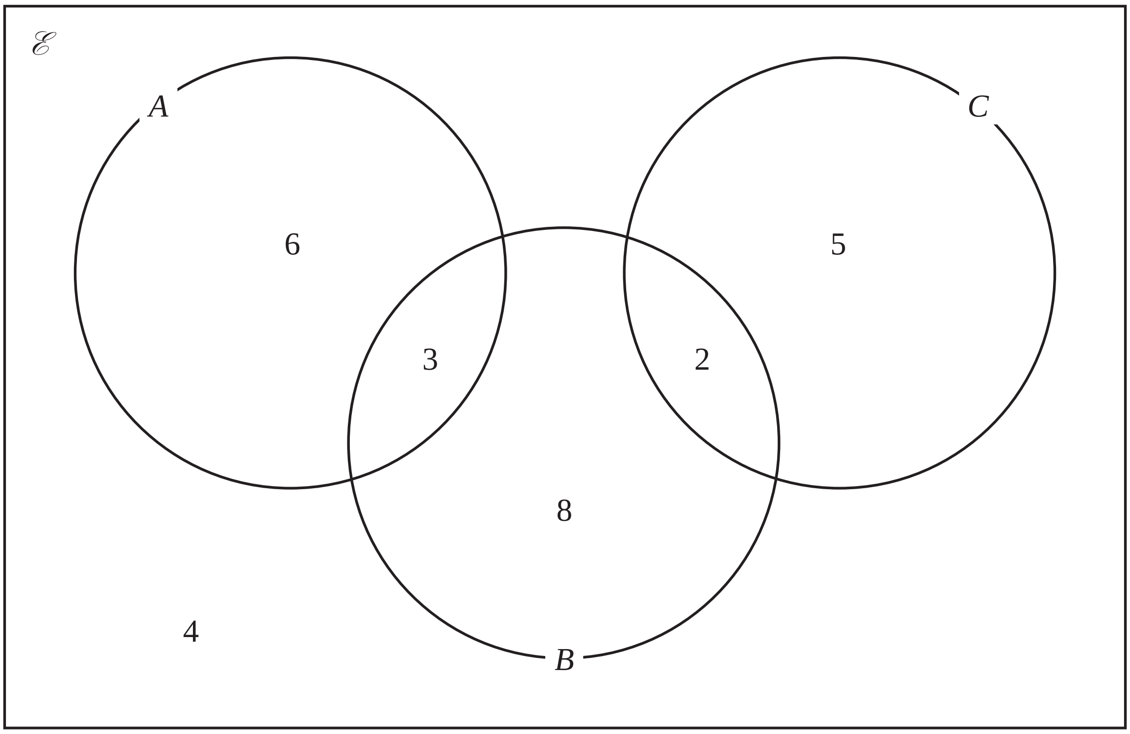
17 The Venn diagram shows a universal set $\mathscr{E}$ and three sets A, B and C.



6, 3, 8, 2, 5 and 4 represent the **numbers** of elements.

Find

(i) $n(A \cup B)$

$6 + 3 + 8 + 2 = 19$

19 (1)

(1)

(ii) $n(A \cap C)$

0 (1)

(1)

(iii) $n(B \cap C')$

$8 + 3 = 11$

11 (1)

(1)

(iv) $n(A' \cup B' \cup C')$

28 (1)

(1)

(Total for Question 17 is 4 marks)

18 The three solids **A**, **B** and **C** are similar such that

the surface area of **A** : the surface area of **B** = 4 : 9

and

the volume of **B** : the volume of **C** = 125 : 343

Work out the ratio

the height of **A** : the height of **C**

Give your ratio in its simplest form.

length A : B : $\sqrt{4}$: $\sqrt{9}$

: 2 : 3 1

length B : C : $\sqrt[3]{125}$: $\sqrt[3]{343}$

: 5 : 7 1

A : B : C

2×5 : 3×5

5×3 : 7×3

10 : 15 : 21 1

A : C = 10 : 21 1

10 : 21

(Total for Question 18 is 4 marks)

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19 Given that $\left(\sqrt[3]{\frac{1}{x}}\right)^4 = x^m$

(a) find the value of m

$(x^{-1})^{4/3} = x^{-\frac{4}{3}}$

$m = -\frac{4}{3}$

$m =$ $-\frac{4}{3}$ 1

(1)

Given that a, b and c are integers,

(b) express $3x^2 + 12x + 19$ in the form $a(x + b)^2 + c$

$3(x^2+4x)+19$ 1

$3[(x+2)^2-4]+19$

$3(x+2)^2-12+19$

$3(x+2)^2+7$ 1

$a=3, b=2, c=7$

$3(x+2)^2+7$

(2)

(Total for Question 19 is 3 marks)

20 The curve with equation $y = f(x)$ has one turning point.

The coordinates of this turning point are $(-6, -4)$

(a) Write down the coordinates of the turning point on the curve with equation

(i) $y = f(x) + 5$

$(-6, -4+5)$

$= (-6, 1)$

(-6 , 1) 1

(ii) $y = f(3x)$

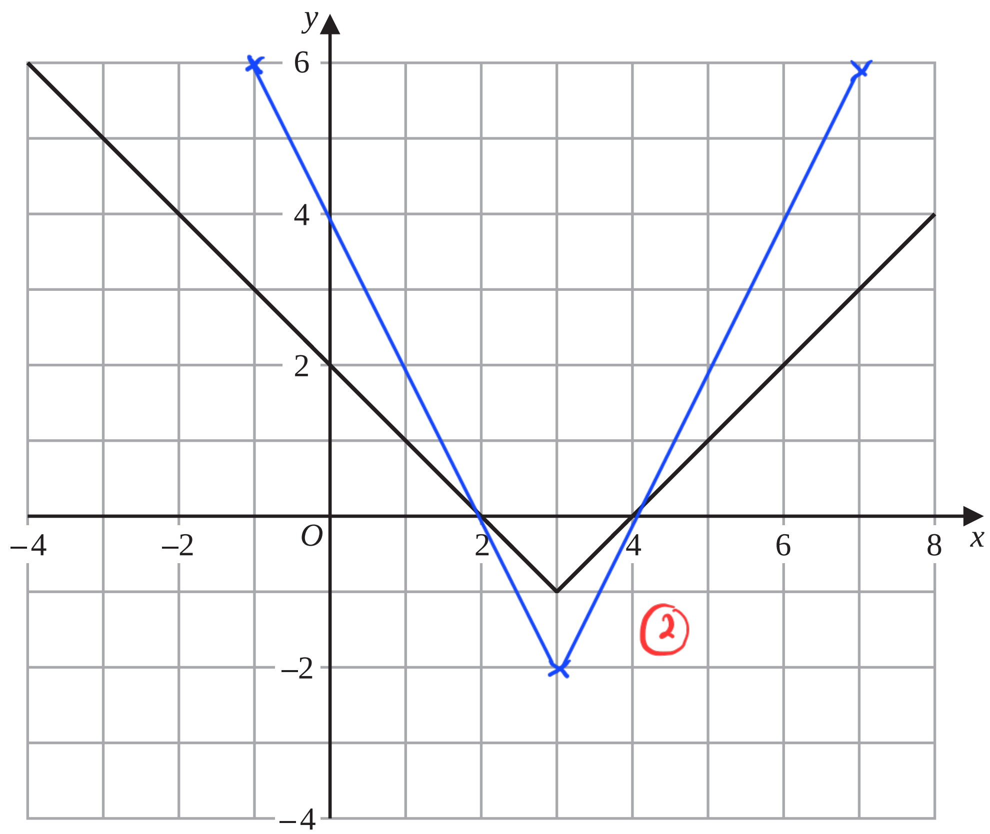
$\left(\frac{-6}{3}, -4\right)$

$= (-2, -4)$

(-2 , -4)

(2) 1

The graph of $y = g(x)$ is shown on the grid below.



(b) On the grid, sketch the graph of $y = 2g(x)$ for $-1 \leqslant x \leqslant 7$

(2)

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The graph of $y = h(x)$ intersects the x-axis at two points.
The coordinates of the two points are $(-1, 0)$ and $(6, 0)$

The graph of $y = h(x + a)$ passes through the point with coordinates $(2, 0)$, where a is a constant.

(c) Find the two possible values of a

$-1 - 2 = -3$

$6 - 2 = 4$

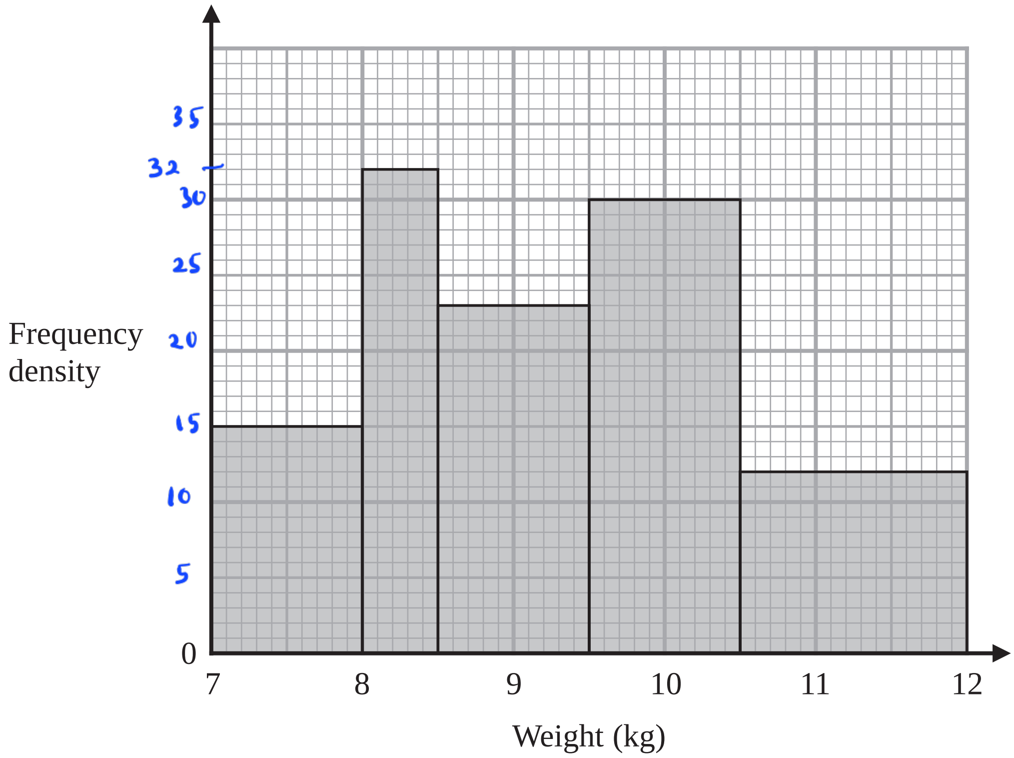
2

-3 , 4

(2)

(Total for Question 20 is 6 marks)

21



The histogram gives information about the weights, in kg, of all the watermelons in a field.

There are 16 watermelons with a weight between 8 kg and 8.5 kg

Work out the total number of watermelons in the field.

$$\frac{16}{8.5-8} = 32 \quad (1)$$

Total $: (1 \times 15) + (16) + (1 \times 23) + (1 \times 30) + (1.5 \times 12)$

$= 15 + 16 + 23 + 30 + 18 \quad (1)$

$= 102 \quad (1)$

.................102.................

(Total for Question 21 is 3 marks)

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22 The diagram shows triangle *ABC*

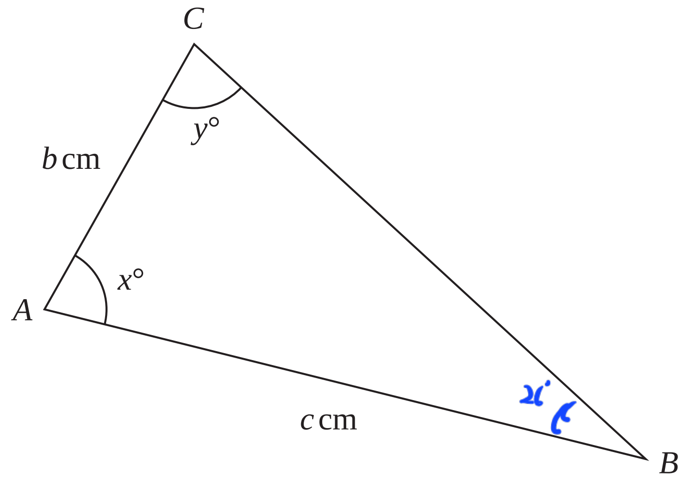

Diagram **NOT** accurately drawn

$c = 11.5$ correct to one decimal place
$x = 80$ correct to the nearest whole number
$y = 75$ correct to the nearest whole number

Calculate the upper bound for the value of b
Show your working clearly.
Give your answer correct to 3 significant figures.

$C_{UB} = 11.55$

$C_{LB} = 11.45$

$x_{UB} = 80.5$ (1)

$x_{LB} = 79.5$

$y_{UB} = 75.5$

$y_{LB} = 74.5$

$ABC = 180° - 79.5° - 74.5°$

$= 26°$ (1)

$\frac{AC_{UB}}{\sin 26} = \frac{11.55}{\sin 74.5}$ (1)

$AC_{UB} = \frac{11.55}{\sin 74.5} \times \sin 26$

$= 5.25$ (1)

5.25

(Total for Question 22 is 4 marks)

23 Two particles, P and Q, move along a straight line.
The fixed point O lies on this line.

The displacement of P from O at time t seconds is s metres, where

$$s = t^3 - 4t^2 + 5t \quad \text{for } t > 1$$

The displacement of Q from O at time t seconds is x metres, where

$$x = t^2 - 4t + 4 \quad \text{for } t > 1$$

Find the range of values of t where $t > 1$ for which both particles are moving in the same direction along the straight line.

$\frac{ds}{dt} = 3t^2 - 8t + 5$ (1)

$\frac{ds}{dt} = 0$, $3t^2 - 8t + 5 = 0$ (1)

$(3t - 5)(t - 1)$

$t = \frac{5}{3}$ or $t = 1$

since $t > 1$, $t = \frac{5}{3}$ (1)

$\frac{dx}{dt} = 2t - 4$

$\frac{dx}{dt} = 0$, $2t - 4 = 0$ (1)

$t = 2$ (1)

$t > 1$, $t < \frac{5}{3}$, $t > 2$

(1)

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$t > 1$, $t > \frac{5}{3}$, $t > 2$

(Total for Question 23 is 6 marks)

Turn over for Question 24

24 *OXYZ* is a trapezium.

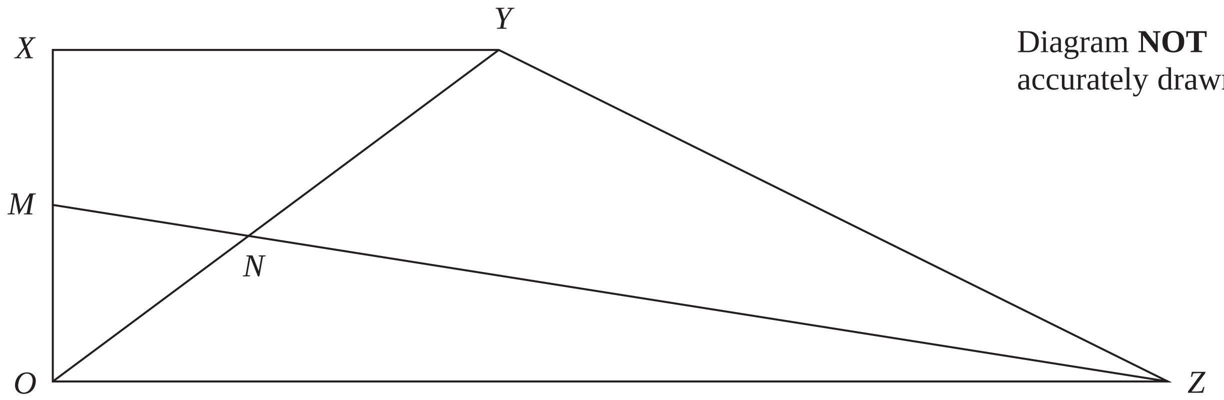

Diagram **NOT** accurately drawn

$\overrightarrow{OX} = \mathbf{a}$

$\overrightarrow{XY} = \mathbf{b}$

$\overrightarrow{OZ} = 3\mathbf{b}$

M is the midpoint of *OX*
N is the point such that *MNZ* and *ONY* are straight lines.

Given that $ON : OY = \lambda : 1$

use a vector method to find the value of λ

$\overrightarrow{ON} = \lambda(\overrightarrow{OY})$ 1

$= \lambda(\overrightarrow{OX} + \overrightarrow{XY})$

$= \lambda(\underline{a} + \underline{b})$

$\overrightarrow{MN} = \overrightarrow{MO} + \overrightarrow{ON}$ 1

$= -0.5\,\underline{a} + \lambda\underline{a} + \lambda\underline{b}$

$\overrightarrow{MN} = \mu(\overrightarrow{MZ})$ 1

$= \mu(\overrightarrow{MO} + \overrightarrow{OZ})$

$= \mu(-0.5\underline{a} + 3\underline{b})$

$(\lambda - 0.5)\underline{a} + \lambda\underline{b} = (-0.5\mu)\underline{a} + (3\mu)\underline{b}$

$\underline{a}$ term : $\lambda - 0.5 = -0.5\mu$ — (1)

1

$\underline{b}$ term : $\lambda = 3\mu$ — (2)

Substitute 2 into 1 :

$3\mu - 0.5 = -0.5\mu$

$3.5\mu = 0.5$

$\mu = \frac{1}{7}$

$\lambda = 3\left(\frac{1}{7}\right)$

$= \frac{3}{7}$ 1

$\lambda =$ $\frac{3}{7}$

(Total for Question 24 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS

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