

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				
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Pearson Edexcel International GCSE

Time 2 hours

Paper
reference

4MA1/2H

Mathematics A

PAPER: 2H

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 ►

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International GCSE Mathematics

Formulae sheet – Higher Tier

Arithmetic series

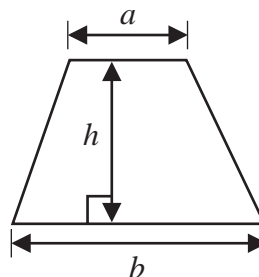
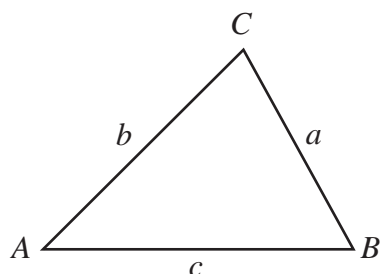
Sum to n terms, $S_n = \frac{n}{2} [2a + (n-1)d]$

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

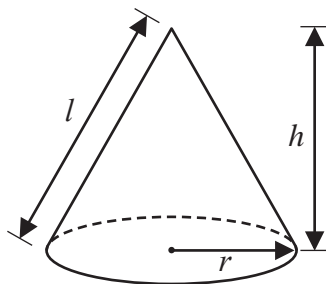
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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

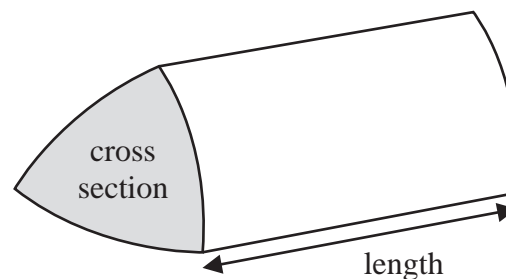
Volume of cone = $\frac{1}{3}\pi r^2 h$

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



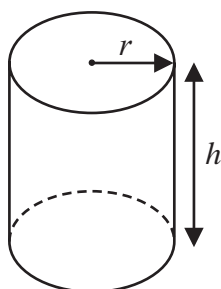
Volume of prism

= area of cross section \times length



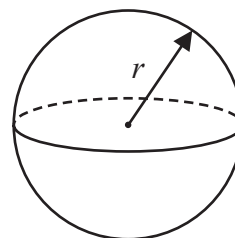
Volume of cylinder = $\pi r^2 h$

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



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

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



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Answer ALL TWENTY FOUR questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 Here are some integers where $a < b < c < d$

$a \quad b \quad c \quad d \quad d \quad d$

The mode of the integers is 9

The median of the integers is 8

The range of the integers is 4

Work out the value of a , the value of b , the value of c and the value of d

mode : $d = 9$ (1)

median : $8 = \frac{c + 9}{2}$

$c = 7$ (1)

range : $4 = 9 - a$

$a = 5$

$b = 6$

$a = \dots 5 \dots$ (1)

$b = \dots 6 \dots$

$c = \dots 7 \dots$

$d = \dots 9 \dots$

(Total for Question 1 is 3 marks)

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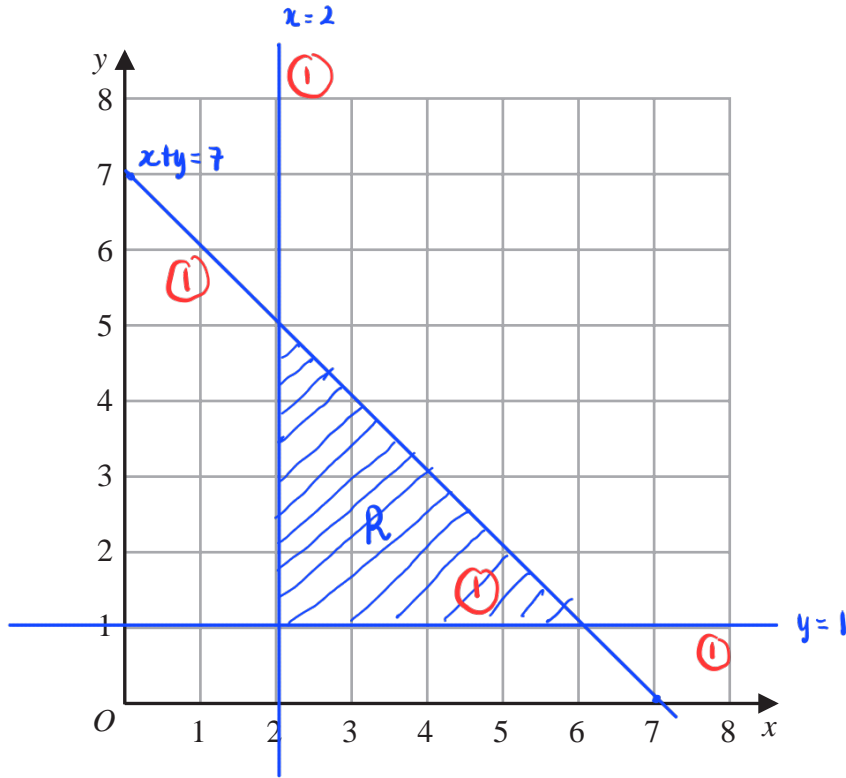
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2 (a) On the grid, draw and label with its equation the straight line with equation

- (i) $y = 1$ (ii) $x = 2$ (iii) $x + y = 7$



(3)

(b) Show, by shading on the grid, the region that satisfies **all three** of the inequalities

$$y \geq 1 \quad x \geq 2 \quad x + y \leq 7$$

Label the region **R**.

(1)

(Total for Question 2 is 4 marks)



- 3 An aeroplane travelled from New York City to Los Angeles.

The aeroplane travelled a distance of 3980 kilometres in 5 hours 24 minutes.

Work out the average speed of the aeroplane.

Give your answer in kilometres per hour correct to the nearest whole number.

$$5 \text{ hrs} + \left(\frac{24}{60}\right) \text{ hrs} = 5.4 \text{ hrs} \quad (1)$$

$$\begin{aligned} \text{Speed} &= \frac{3980 \text{ km}}{5.4 \text{ hr}} \quad (1) \\ &= 737 \text{ km/h} \quad (1) \end{aligned}$$

..... 737 kilometres per hour

(Total for Question 3 is 3 marks)

- 4 Show that $5\frac{1}{3} - 2\frac{6}{7} = 2\frac{10}{21}$

$$\frac{16 \times 7}{3 \times 7} - \frac{20 \times 3}{7 \times 3} \quad (1)$$

$$= \frac{112}{21} - \frac{60}{21} \quad (1)$$

$$= \frac{52}{21} = 2\frac{10}{21} \quad (\text{shown}) \quad (1)$$

(Total for Question 4 is 3 marks)



- 5 The diagram shows an 8-sided shape $ABCDEFGH$.

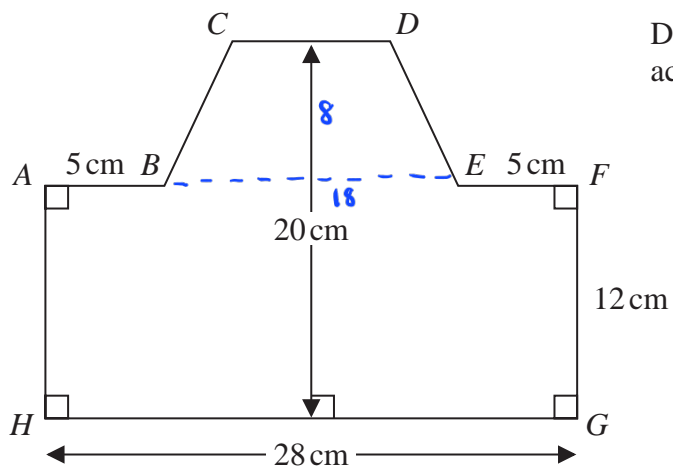


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$$HG = 28 \text{ cm} \quad FG = 12 \text{ cm} \quad AB = EF = 5 \text{ cm}$$

The height of the shape is 20 cm

CD is parallel to HG

The area of shape $ABCDEFGH$ is 434 cm^2

Find the length of CD .

$$\text{Area } AFGH : 28 \times 12 = 336 \text{ cm}^2 \quad (1)$$

$$\text{Area } BCDE : \frac{1}{2} \times 8 \times (18 + CD) \text{ cm}^2 \quad (1)$$

$$\text{Total area} : 434 = 336 + \frac{1}{2} \times 8 \times (18 + CD)$$

$$98 = 4(18 + CD) \quad (1)$$

$$24.5 - 18 = CD$$

$$CD = 6.5 \text{ cm} \quad (1)$$

6.5

..... cm

(Total for Question 5 is 4 marks)



- 6 The diagram shows triangle PQR .

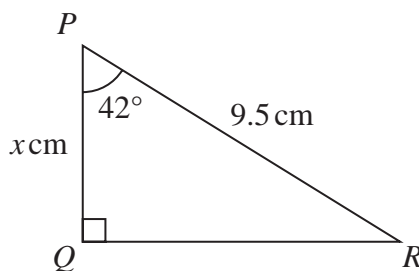


Diagram **NOT**
accurately drawn

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

$$\cos 42^\circ = \frac{x}{9.5} \quad (1)$$

$$x = 9.5 \cos 42^\circ \quad (1)$$

$$= 7.1 \quad (1)$$

$$x = \dots\dots\dots 7.1$$

(Total for Question 6 is 3 marks)

- 7 Change a speed of 81 kilometres per hour to a speed in metres per second.

$$\frac{81 \cancel{\text{ km}}}{\cancel{\text{ h}}} \times \frac{1000 \text{ m}}{1 \cancel{\text{ km}}} \times \frac{1 \cancel{\text{ h}}}{60 \times 60 \text{ s}} \quad (1)$$

$$= \frac{81000}{3600} \quad (1)$$

$$= 22.5 \quad (1)$$

$$\dots\dots\dots 22.5 \dots\dots\dots \text{metres per second}$$

(Total for Question 7 is 3 marks)

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8 Behnaz makes 300 celebration cards so that

number of birthday cards : number of anniversary cards : number of congratulations cards = 7:5:3

- ① $\frac{2}{5}$ of the birthday cards have numbers on them.
 ② 36% of the anniversary cards have numbers on them.
 None of the congratulations cards have numbers on them.

Work out what fraction of the 300 cards have numbers on them.
 Give your answer in its simplest form.

$$7 + 5 + 3 = 15$$

$$\frac{300}{15} = 20 \quad \text{①}$$

$$\text{①} \quad \frac{2}{5} \times 7 \times 20 = 56 \quad \text{①}$$

$$\text{②} \quad 0.36 \times 5 \times 20 = 36 \quad \text{①}$$

$$\frac{56 + 36}{300} = \frac{92}{300} \quad \text{①}$$

$$= \frac{23}{75} \quad \text{①}$$

$$\frac{23}{75}$$

(Total for Question 8 is 5 marks)



- 9 Pasha invests 50 000 dollars in a savings account for 4 years.
He gets 1.3% per year compound interest.

Work out how much money Pasha will have in his savings account at the end of 4 years.
Give your answer correct to the nearest dollar.

$$50\,000 \times 1.013 = 50\,650 \text{ (1)}$$

$$50\,650 \times 1.013 = 51\,308.45$$

$$51\,308.45 \times 1.013 = 51\,975.45 \text{ (1)}$$

$$51\,975.45 \times 1.013 = 52\,651 \text{ (1)}$$

..... 52 651 dollars

(Total for Question 9 is 3 marks)

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10 Solve the simultaneous equations

$$\begin{array}{l}
 7x + 3y = 3 \\
 3x - y = 7
 \end{array}
 \quad
 \begin{array}{l}
 \times 3 \\
 \curvearrowright \\
 21x + 9y = 9 \\
 21x - 7y = 49 \\
 \curvearrowleft \\
 \times 7
 \end{array}$$

Show clear algebraic working.

$$9y - (-7y) = 9 - 49 \quad (1)$$

$$16y = -40$$

$$y = \frac{-40}{16}$$

$$= -2.5$$

$$3x + 2.5 = 7 \quad (1)$$

$$3x = 4.5$$

$$x = \frac{4.5}{3} = 1.5$$

$$x = \dots\dots\dots 1.5 \quad (1)$$

$$y = \dots\dots\dots -2.5$$

(Total for Question 10 is 3 marks)

11 (i) Factorise $x^2 + 5x - 24$

$$(x-3)(x+8) \quad (2)$$

$$\dots\dots\dots (x-3)(x+8)$$

(2)

(ii) Hence, solve $x^2 + 5x - 24 = 0$

$$\dots\dots\dots 3, -8 \quad (1)$$

(1)

(Total for Question 11 is 3 marks)

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12 Larry is a delivery man.

He has 7 parcels to deliver.

The mean weight of the 7 parcels is 2.7 kg

Larry delivers 3 of the parcels.

Each of these 3 parcels has a weight of W kg

The mean weight of the other 4 parcels is 3.3 kg

Work out the value of W

$$7 \times 2.7 = 18.9 \quad (1)$$

$$4 \times 3.3 = 13.2$$

$$3W = 18.9 - 13.2$$

$$3W = 5.7 \quad (1)$$

$$W = \frac{5.7}{3}$$

$$= 1.9 \quad (1)$$

$$W = \dots\dots\dots 1.9$$

(Total for Question 12 is 3 marks)



13 The table gives information about the ages, in years, of 80 people in a train carriage.

Age (a years)	Frequency
$0 < a \leq 20$	7
$20 < a \leq 30$	25
$30 < a \leq 40$	20
$40 < a \leq 50$	14
$50 < a \leq 60$	8
$60 < a \leq 70$	6

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(a) Complete the cumulative frequency table.

Age (a years)	Cumulative frequency
$0 < a \leq 20$	7
$0 < a \leq 30$	32
$0 < a \leq 40$	52
$0 < a \leq 50$	66
$0 < a \leq 60$	74
$0 < a \leq 70$	80

(1)

(1)

(b) On the grid opposite, draw a cumulative frequency graph for your table.

(2)

(c) Use your graph to find an estimate for the median age of the 80 people.

33

(1)

..... years

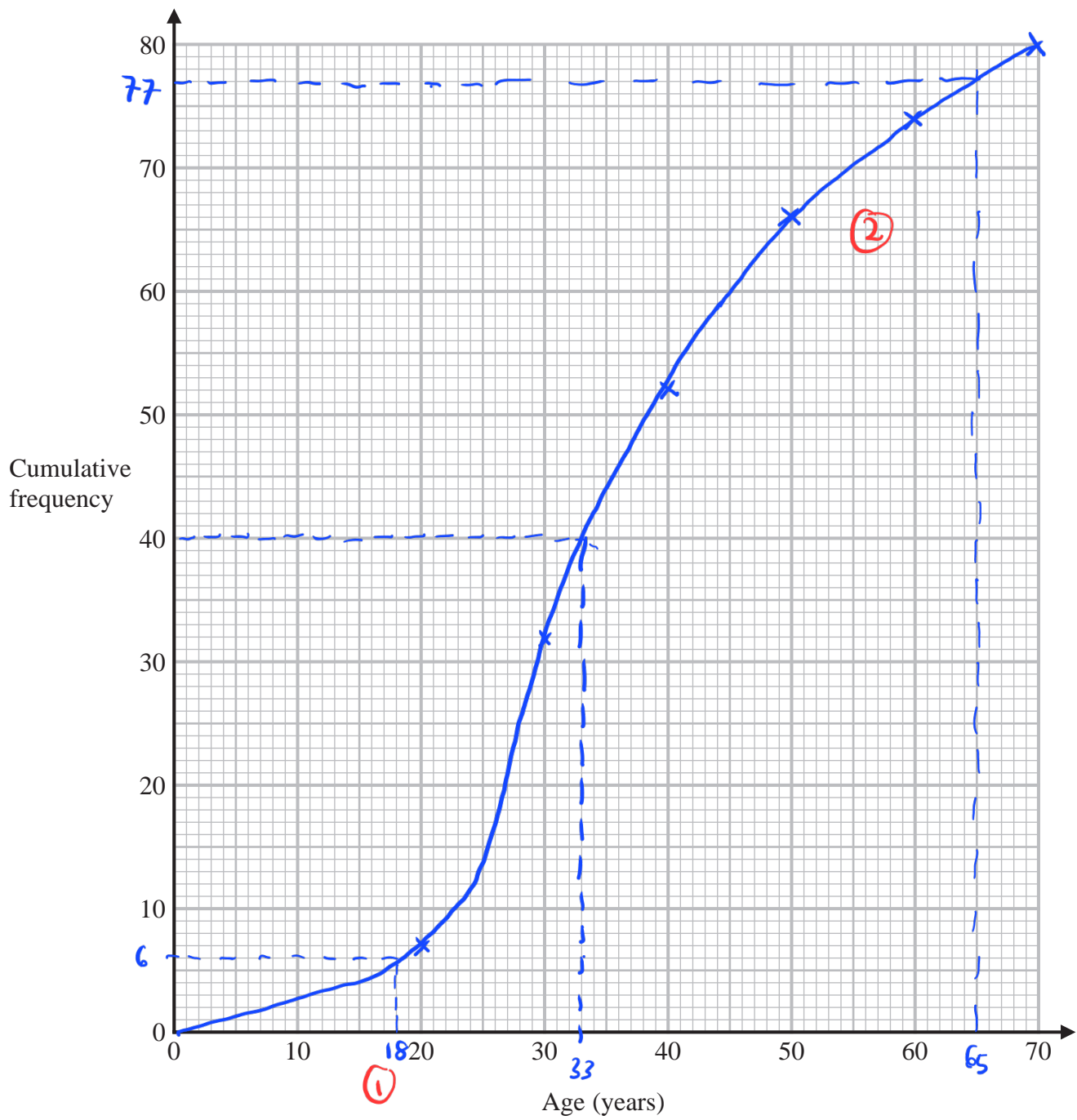
(1)



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Of the people in the train carriage, 60% of those who are aged between 18 and 65 are going to work. None of the other people in the train carriage are going to work.

(d) Use your graph to find an estimate for the number of people in the train carriage who are going to work.

$$\frac{60}{100} \times (77 - 6) = 42.6$$

$$\approx 43$$

43

(3)

(Total for Question 13 is 7 marks)



- 14 (a) Expand and simplify $(5-x)(2x+3)(x+4)$
Show your working clearly.

$$\begin{aligned}(5-x)(2x+3) &= 10x + 15 - 2x^2 - 3x \\ &= -2x^2 + 7x + 15\end{aligned}$$

$$\begin{aligned}(-2x^2 + 7x + 15)(x+4) &= -2x^3 - 8x^2 + 7x^2 + 28x + 15x + 60 \\ &= -2x^3 - x^2 + 43x + 60\end{aligned}$$

$$\begin{array}{r} \textcircled{3} \quad -2x^3 - x^2 + 43x + 60 \\ \hline (3) \end{array}$$

- (b) Make c the subject of $g = \frac{c+3}{4+c} - 7$

$$g+7 = \frac{c+3}{4+c} \quad \textcircled{1}$$

$$(g+7)(4+c) = c+3$$

$$4g + 9c + 28 + 7c = c + 3 \quad \textcircled{1}$$

$$9c + 7c - c = 3 - 28 - 4g \quad \textcircled{1}$$

$$c(g+6) = -4g - 25$$

$$c = \frac{-(4g+25)}{g+6} \quad \textcircled{1}$$

$$\begin{array}{r} c = \frac{-(4g+25)}{g+6} \\ \hline (4) \end{array}$$

(Total for Question 14 is 7 marks)



15 (a) Solve $\frac{4x+5}{3} - \frac{3-2x}{2} = 13$

Show clear algebraic working.

$$\frac{2(4x+5) - 3(3-2x)}{6} = 13 \quad (1)$$

$$8x + 10 - 9 + 6x = 78 \quad (1)$$

$$14x + 1 = 78$$

$$14x = 77 \quad (1)$$

$$x = \frac{77}{14}$$

$$= 5.5 \quad (1)$$

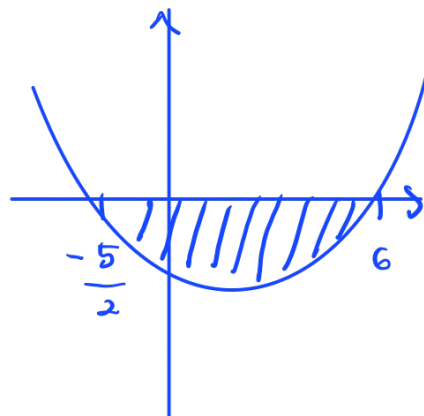
$$x = \frac{5.5}{\dots\dots\dots} \quad (4)$$

(b) Solve the inequality $2y^2 - 7y - 30 \leq 0$
Show your working clearly.

$$(2y+5)(y-6) \leq 0 \quad (1)$$

$$y = -\frac{5}{2}, y = 6 \quad (1)$$

$$-2.5 \leq y \leq 6 \quad (1)$$



$$\frac{-2.5 \leq y \leq 6}{\dots\dots\dots} \quad (3)$$

(Total for Question 15 is 7 marks)



16 100 farmers are asked if they have goats (G), sheep (S) or chickens (C) on their farms.

Of these farmers

31 have sheep

53 have chickens

6 have goats, sheep and chickens

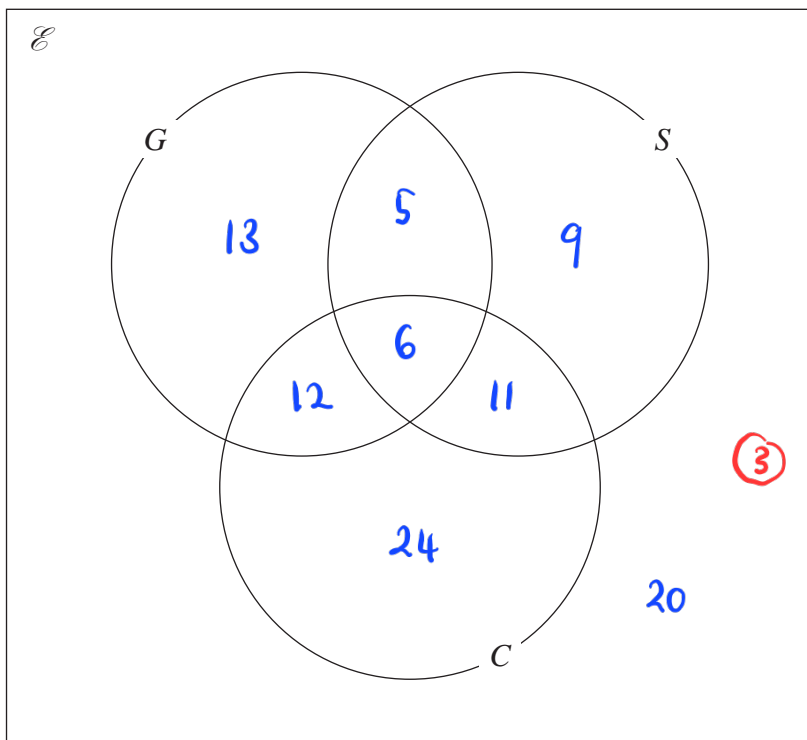
11 have sheep and goats

17 have sheep and chickens

18 have goats and chickens

20 do not have any goats, sheep or chickens

(a) Using this information, complete the Venn diagram to show the number of farmers in each appropriate subset.



(3)

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(b) Find

(i) $n(G)$

$$13 + 12 + 5 + 6 = 36$$

$$36 \text{ (1)}$$

(1)

(ii) $n([G \cup S]')$

$$24 + 20 = 44$$

$$44 \text{ (1)}$$

(1)

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

$$24 + 11 = 35$$

$$35 \text{ (1)}$$

(1)

One of the farmers who has chickens is chosen at random.

(c) Find the probability that this farmer also has goats.

$$\frac{12+6}{24+12+6+1} = \frac{18}{53}$$

$$\frac{18}{53} \text{ (2)}$$

(2)

(Total for Question 16 is 8 marks)

17 M varies directly as the cube of h $M = 4$ when $h = 0.5$ Find the value of h when $M = 500$

$$M \propto h^3$$

$$M = kh^3 \text{ (1)}$$

$$4 = k(0.5)^3$$

$$k = \frac{4}{0.5^3} = 32 \text{ (1)}$$

$$500 = 32h^3$$

$$h^3 = \frac{500}{32} = 15.625 \text{ (1)}$$

$$h = \sqrt[3]{15.625} = 2.5 \text{ (1)}$$

$$2.5$$

(Total for Question 17 is 4 marks)



$$18 \quad X = \frac{2a - b}{f}$$

$a = 7.5$ correct to 1 decimal place.

$b = 3.42$ correct to 2 decimal places.

$f = 2$ correct to the nearest whole number.

Work out the upper bound of the value of X

Show your working clearly.

$$a_{UB} = 7.55$$

$$a_{LB} = 7.45 \quad (1)$$

$$b_{UB} = 3.425$$

$$b_{LB} = 3.415$$

$$f_{UB} = 2.5$$

$$f_{LB} = 1.5$$

$$X_{UB} = \frac{2a_{UB} - b_{LB}}{f_{LB}} = \frac{2(7.55) - 3.415}{1.5} \quad (1)$$

$$= 7.79 \quad (1)$$

$$7.79$$

(Total for Question 18 is 3 marks)

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$$19 \quad a = \frac{14}{3x-7} \quad x = \frac{7}{4y-3}$$

Express a in the form $\frac{py+q}{ry+s}$ where p, q, r and s are integers.

Give your answer in its simplest form.

$$a = \frac{14}{3 \left(\frac{7}{4y-3} \right) - 7} \quad (1)$$

$$= \frac{14}{\frac{21}{4y-3} - 7}$$

$$= \frac{14(4y-3)}{21 - 7(4y-3)} \quad (1)$$

$$= \frac{56y - 42}{21 - 28y + 21}$$

$$= \frac{56y - 42}{42 - 28y}$$

$$= \frac{14(4y-3)}{14(3-2y)} \quad (1)$$

$$a = \frac{4y-3}{3-2y}$$

(Total for Question 19 is 3 marks)



20 The diagram shows four identical circles drawn inside a square.

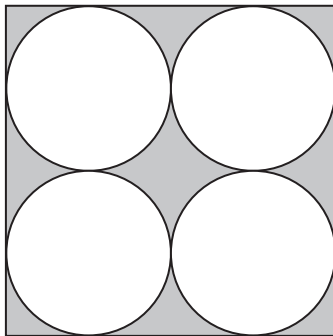


Diagram **NOT**
accurately drawn

Each circle touches two other circles and two sides of the square.

The region inside the square that is outside the circles, shown shaded in the diagram, has a total area of 40 cm^2

Work out the perimeter of the square.

Give your answer correct to 3 significant figures.

$$\text{Area of square} = 4r \times 4r = 16r^2 \quad (1)$$

$$\text{Area of 4 circles} = 4 \times \pi r^2 = 4\pi r^2$$

$$16r^2 - 4\pi r^2 = 40$$

$$r^2 = \frac{40}{16 - 4\pi}$$

$$r = \sqrt{\frac{40}{16 - 4\pi}} = 3.413 \dots \quad (1)$$

$$\text{Perimeter} = 16 \times 3.413 \dots \quad (1)$$

$$= 54.6 \quad (1)$$

54.6

..... cm

(Total for Question 20 is 4 marks)

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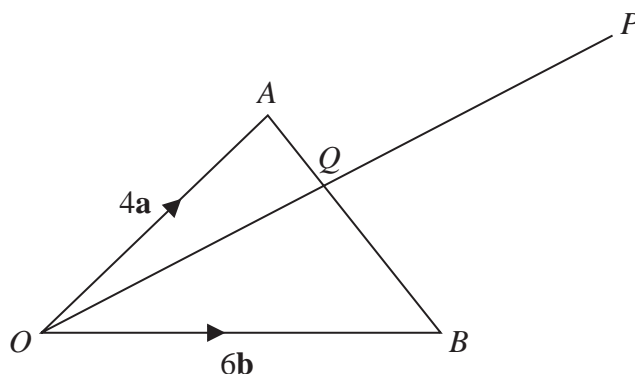


Diagram NOT accurately drawn

OAB is a triangle.

Q is the point on AB such that OQP is a straight line.

$\vec{OA} = 4\mathbf{a}$ $\vec{OB} = 6\mathbf{b}$ $\vec{AP} = 2\mathbf{a} + 8\mathbf{b}$

Using a vector method, find the ratio $AQ:QB$

$$\begin{aligned} \vec{OP} &= \vec{OA} + \vec{AP} \\ &= 4\mathbf{a} + 2\mathbf{a} + 8\mathbf{b} \quad \textcircled{1} \\ &= 6\mathbf{a} + 8\mathbf{b} \end{aligned}$$

$$\begin{aligned} \vec{AB} &= \vec{AO} + \vec{OB} \\ &= -4\mathbf{a} + 6\mathbf{b} \end{aligned}$$

$$\begin{aligned} \vec{AQ} &= \lambda \vec{AB} \\ &= \lambda(-4\mathbf{a} + 6\mathbf{b}) \quad \textcircled{1} \\ &= -4\lambda\mathbf{a} + 6\lambda\mathbf{b} \end{aligned}$$

$$\begin{aligned} \vec{AQ} &= \vec{AO} + \vec{OQ} \\ &= -4\mathbf{a} + \mu \vec{OP} \\ &= -4\mathbf{a} + \mu(6\mathbf{a} + 8\mathbf{b}) \quad \textcircled{1} \\ &= (-4 + 6\mu)\mathbf{a} + 8\mu\mathbf{b} \quad \textcircled{1} \end{aligned}$$

a terms: $-4\lambda = -4 + 6\mu$

b terms: $6\lambda = 8\mu$

$\mu = \frac{3}{4}\lambda$

$-4\lambda = -4 + 6\left(\frac{3}{4}\lambda\right)$

$-4\lambda = -4 + \frac{9}{2}\lambda$

$\lambda = \frac{8}{17} \quad \textcircled{1}$

$AQ:QB$

$\lambda : 1 - \lambda$

$\frac{8}{17} : \frac{9}{17}$

$8:9 \quad \textcircled{1}$

$AQ:QB = \dots\dots\dots$

(Total for Question 21 is 5 marks)



22 $ABCD$ is a kite, with diagonals AC and BD , drawn on a centimetre square grid, with a scale of 1 cm for 1 unit on each axis.

A is the point with coordinates $(-3, 4)$

The diagonals of the kite intersect at the point M with coordinates $(0, 2)$

Given that $AB = AD = 6.5$ cm and the x coordinate of B is positive,

find the coordinates of the points B and D .

$$m_{AM} = \frac{4-2}{-3} = -\frac{2}{3} \quad (1)$$

$$m_{BD} = \frac{3}{2}$$

$$\text{Equation of line } BD: y-2 = \frac{3}{2}x$$

$$y = \frac{3}{2}x + 2 \quad (1)$$

$$AM = \sqrt{(-3-0)^2 + (4-2)^2} = \sqrt{13}$$

$$BM = \sqrt{(x-0)^2 + (y-2)^2} = \sqrt{x^2 + (y-2)^2} \quad (1)$$

$$AB^2 = AM^2 + BM^2$$

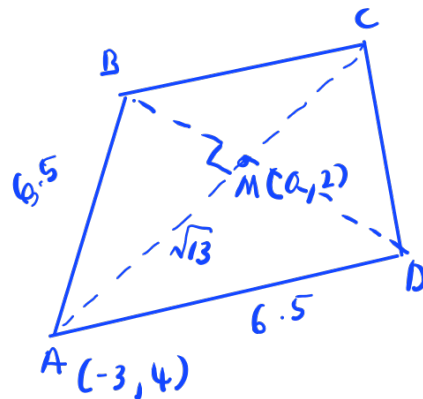
$$(6.5)^2 = 13 + x^2 + (y-2)^2 \quad (1)$$

$$\frac{117}{4} = x^2 + (y-2)^2$$

$$\frac{117}{4} = x^2 + \left(\frac{3}{2}x\right)^2 \quad (1)$$

$$\frac{117}{4} = \frac{13}{4}x^2 \quad (1)$$

$$x^2 = \frac{117}{13} = 9$$



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$x = \pm 3$

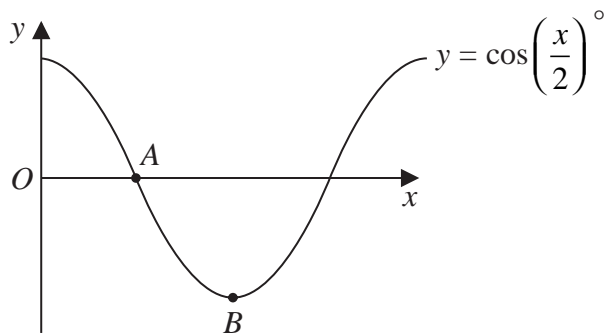
$x = 3, y = 6.5$

$x = -3, y = -2.5$

(1)
 (3 , 6.5)
 (-3 , -2.5)

(Total for Question 22 is 7 marks)

23 The diagram shows a sketch of the graph of $y = \cos\left(\frac{x}{2}\right)^\circ$



(i) Find the coordinates of the point A

180 0 (1)
 (..... ,)
 (1)

(ii) Find the coordinates of the point B

360 -1 (1)
 (..... ,)
 (1)

(Total for Question 23 is 2 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



24

$$\frac{18 \times (\sqrt{27})^{4n+6}}{6 \times 9^{2n+8}} = 3^x$$

Express x in terms of n

Show your working clearly and simplify your expression.

$$\frac{\cancel{2} \times \cancel{3} \times 3 \times (3^{\frac{3}{2}})^{4n+6}}{\cancel{2} \times \cancel{3} \times 3^{2(2n+8)}} \quad (1)$$

$$\frac{3 \times 3^{6n+9}}{3^{4n+16}} = \frac{3^2 \times 3^{6n+9}}{3 \times 3^{4n+16}} = 3^x \quad (1)$$

$$= \frac{3^{6n+11}}{3^{4n+17}} = 3^x$$

$$3^{6n+11} = 3^x \times 3^{4n+17}$$

$$6n+11 = x + 4n+17$$

$$x = 2n - 6 \quad (1)$$

$$x = \dots\dots\dots 2n - 6$$

(Total for Question 24 is 3 marks)

TOTAL FOR PAPER IS 100 MARKS

