Write your name here

Surname GeorgeMaths.Com | Other names

Pearson Edexcel
International GCSE

Centre Number | Candidate Number

Mathematics A

Level 1/2
Paper 2HR

Higher Tier

Thursday 7 June 2018 – Morning
Time: 2 hours

Paper Reference
4MA1/2HR

You must have:
Ruler graduated in centimetres and millimetres, protractor, 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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1/1/1/

P 5 9 0 1 4 A 0 1 2 4

Pearson

International GCSE Mathematics

Formulae sheet – Higher Tier

Arithmetic series

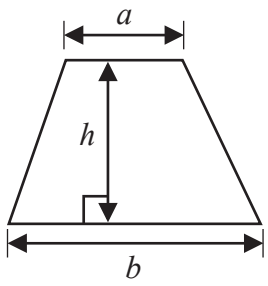
Sum to n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$

The quadratic equation

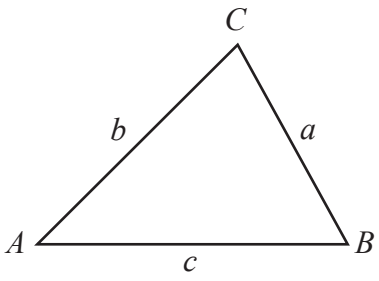
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:

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

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



Trigonometry



In any triangle *ABC*

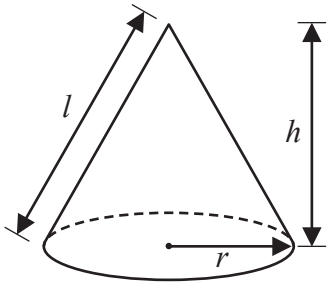
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

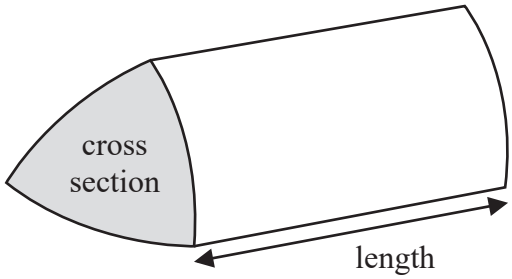
Area of triangle $= \frac{1}{2}ab\sin C$

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

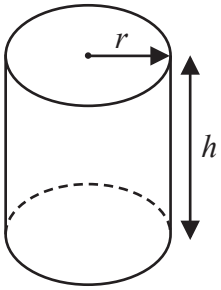
Curved surface area of cone $= \pi r l$



Volume of prism
= area of cross section × length

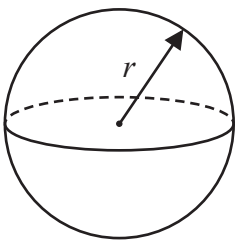


Volume of cylinder $= \pi r^2 h$
Curved surface area of cylinder $= 2\pi r h$



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

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



Answer ALL TWENTY FOUR questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 x, 10 and y are three integers written in order of size, starting with the smallest integer.

The mean of x, 10 and y is 11
The range of x, 10 and y is 7

Work out the value of x and the value of y.

$y - x = 7 \rightarrow (1)$

$\frac{x + 10 + y}{3} = 11$

$x + y = 23 \rightarrow (2)$

by adding (1) & (2)

$2y = 30$

$y = 15$

$x = 8$

$x =$ 8

$y =$ 15

(Total for Question 1 is 2 marks)

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

2 A box is put on a table.

The face of the box in contact with the table is in the shape of a rectangle, 2 m by 1.25 m.
The pressure on the table due to the box is 42 newtons/m^2

Work out the force exerted by the box on the table.

$42 = \frac{\text{Force}}{2 \times 1.25}$

$\text{Force} = 42 \times 2 \times 1.25$

$\text{Force} = 105$

105 newtons

(Total for Question 2 is 3 marks)

3 Behnaz makes candles.

She has 6.3 kilograms of wax and uses it all to make candles.
Each candle Behnaz makes uses 210 grams of wax.

Behnaz sells $\frac{2}{5}$ of the candles for \$13 each.

She then reduces this price by 20% and sells the rest of the candles.

Work out the total amount of money Behnaz gets by selling all the candles she made.

6.3 kg = 6300 grams.

No. of candles = $\frac{6300}{210}$ = 30 candles.

$\frac{2}{5} \times 30$ = 12 candles.

cost of 12 candles = 12 x 13 = \$156

reduced price = 0.8 x \$13 = \$10.4

cost of 18 candles = 18 x 10.4 = \$187.2

Total selling amount = \$156 + \$187.2

= \$343.2

\$ 343.2

(Total for Question 3 is 4 marks)

4 (a) Expand and simplify $3(c - 7) + 2(3c + 4)$

$3c - 21 + 6c + 8$

$9c - 13$

(2)

(b) Expand and simplify $(x + 7)(x - 2)$

$x^2 - 2x + 7x - 14$

$x^2 + 5x - 14$

(2)

(c) Factorise fully $28y^2 - 21y$

$7y(4y - 3)$

(2)

(d) Solve $\frac{7x - 2}{4} = 3x + 1$

Show clear algebraic working.

$7x - 2 = 4(3x + 1)$

$7x - 2 = 12x + 4$

$12x - 7x = -2 - 4$

$5x = -6$

$x = -\frac{6}{5}$

$x = \frac{-6}{5}$

(3)

(Total for Question 4 is 9 marks)

5 Abelie flew by plane from Dubai to Rome.

The flight time was 6 hours 42 minutes.
The average speed of the plane was 650 kilometres per hour.

Work out the distance the plane flew.

$t = 6\frac{42}{60} = 6.7$ hours.

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

$d = s \times t$

$d = 650 \times 6.7$

$d = 4355$

4355 kilometres

(Total for Question 5 is 3 marks)

6 Hiran invests 20 000 rupees in an account for 3 years at 1.5% per year compound interest.

Work out the total amount of money in the account at the end of 3 years.
Give your answer to the nearest rupee.

$\text{Total} = P \times \left(1 + \frac{r}{100}\right)^n$

$\text{Total} = 20000 \times \left(1 + \frac{1.5}{1000}\right)^3$

$\text{Total} = 20913.5675$

20914 rupees

(Total for Question 6 is 3 marks)

7 (a) Simplify fully $\frac{20x^2y^6}{4x^2y^2}$

$5y^4$

(2)

(b) Make e the subject of the formula $h = 3e + f$

$3e = h - f$

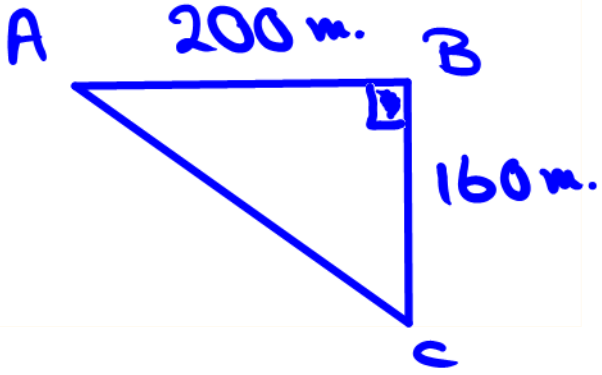
$e = \frac{h-f}{3}$

(2)

(Total for Question 7 is 4 marks)

8 From point A, Stanley walks 200 m due east to point B.
From B, he then walks 160 m due south to point C.

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



$Ac^2 = AB^2 + Bc^2$

$Ac = \sqrt{AB^2 + Bc^2}$

$Ac = \sqrt{200^2 + 160^2}$

$Ac = 256.12...$

256 metres

(Total for Question 8 is 3 marks)

9

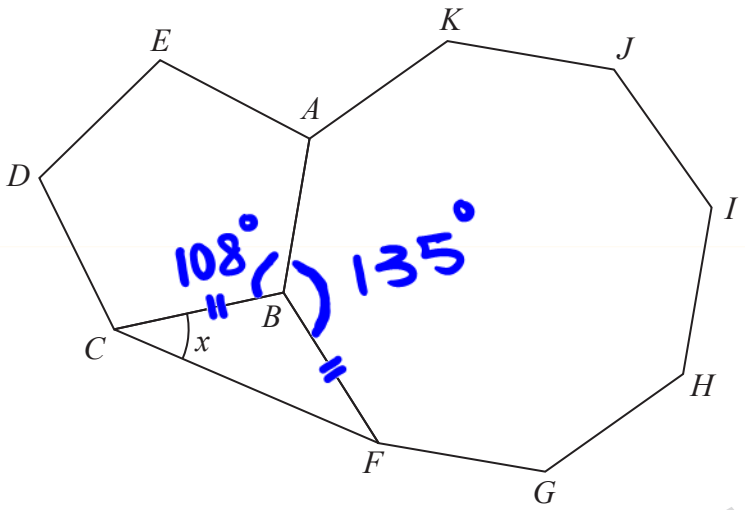


Diagram **NOT** accurately drawn

The diagram shows a regular pentagon, *ABCDE*, a regular octagon, *ABFGHIJK*, and an isosceles triangle, *BCF*.

Work out the size of angle *x*.

For Pentagon :-

each angle $= \frac{(n-2)\times 180^\circ}{n} = \frac{(5-2)\times 180^\circ}{5}$

$= 108^\circ$

For octagon :-

each angle $= \frac{(8-2)\times 180^\circ}{8} = 135^\circ$

In $\triangle BCF$:

angle $cBF = 360^\circ - (108^\circ + 135^\circ) = 117^\circ$

angle $x = \frac{180^\circ - 117^\circ}{2} = 31.5^\circ$

31.5 °

(Total for Question 9 is 4 marks)

10 *ABCD* is a trapezium.

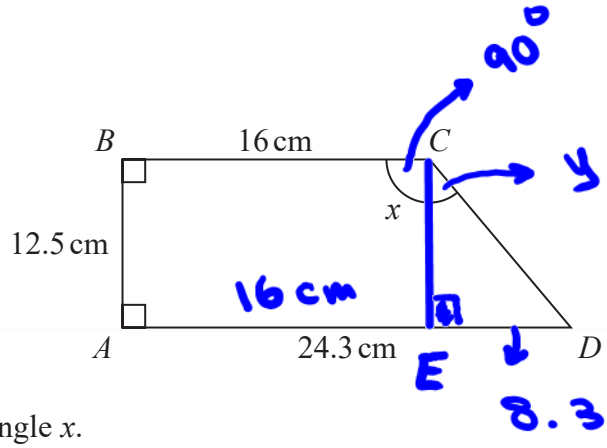


Diagram **NOT** accurately drawn

Work out the size of angle *x*.
Give your answer correct to 1 decimal place.

Draw CE ⊥ AD

ED = 24.3 − 16 = 8.3 cm.

In ΔCED, ∠DCE = y, CE = 12.5 cm.

$\text{Tan } y = \frac{\text{opp.}}{\text{Adj.}} = \frac{8.3}{12.5}$

$y = \text{Tan}^{-1}\left(\frac{8.3}{12.5}\right) = 33.584\ldots$

$x = 90° + 33.584\ldots = 123.584\ldots$

123.6 °

(Total for Question 10 is 4 marks)

11 The table shows information about the amount of money spent on holiday by each of 120 families.

Money spent (£m)	Frequency
$0 < m \leqslant 100$	10
$100 < m \leqslant 200$	36
$200 < m \leqslant 300$	34
$300 < m \leqslant 400$	20
$400 < m \leqslant 500$	15
$500 < m \leqslant 600$	5

(a) Write down the modal class.

$100 < m \leqslant 200$

(1)

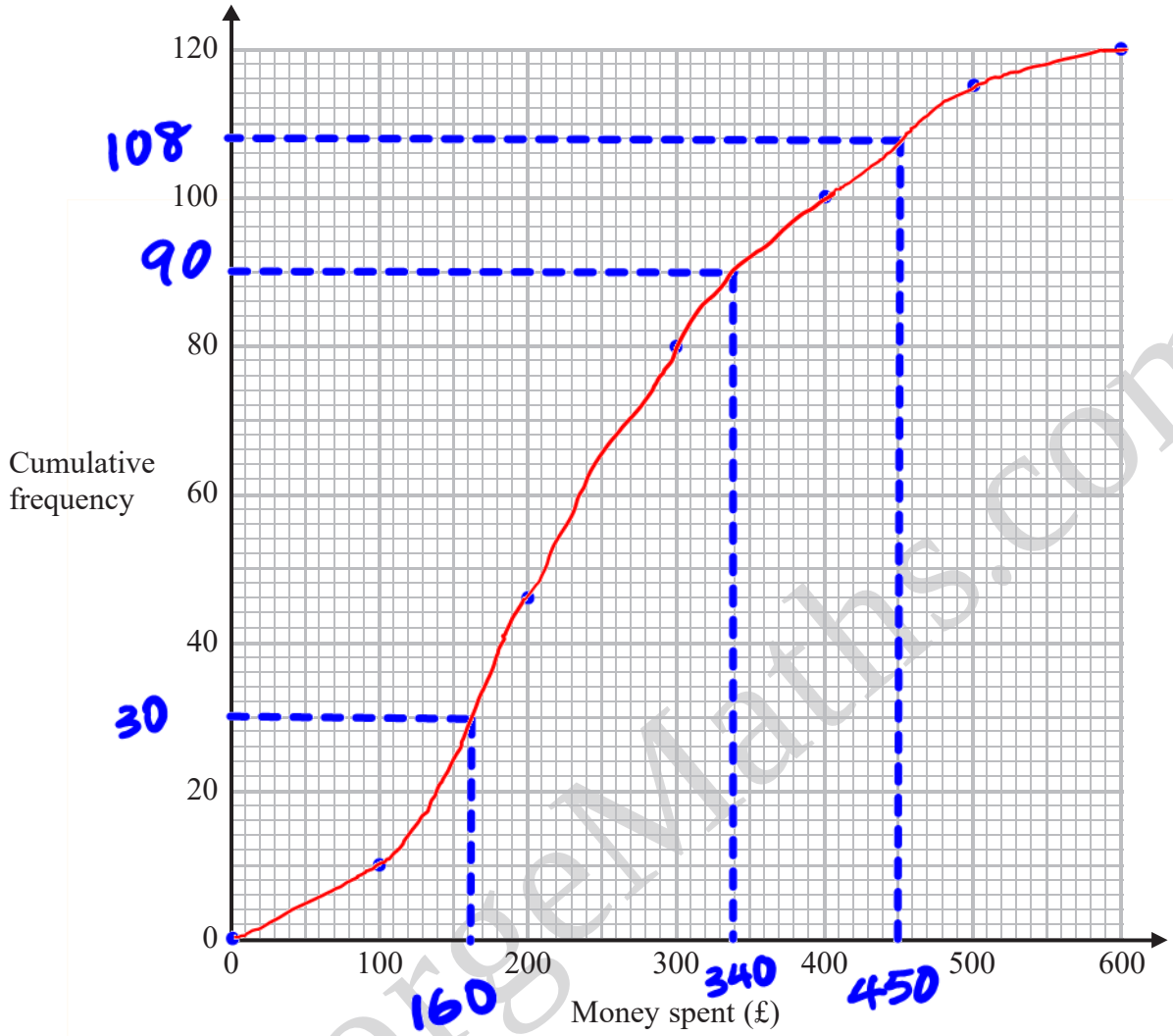
(b) Complete the cumulative frequency table for the information in the table.

Money spent (£m)	Cumulative frequency
$0 < m \leqslant 100$	10
$0 < m \leqslant 200$	46
$0 < m \leqslant 300$	80
$0 < m \leqslant 400$	100
$0 < m \leqslant 500$	115
$0 < m \leqslant 600$	120

(1)

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

(2)



(d) Use your graph to find an estimate for the interquartile range.

From graph:

UQR = $\frac{3}{4}$ x 120 = 90 ⟼ UQR = 340

LQR = $\frac{1}{4}$ x 120 = 30 ⟼ LQR = 160

IQR = 340 − 160 = 180

£ 180

(2)

(e) Use your graph to find an estimate for the number of families that spent more than £450 on holiday.

From graph:

120 − 108 = 12

12 families

(2)

(Total for Question 11 is 8 marks)

12

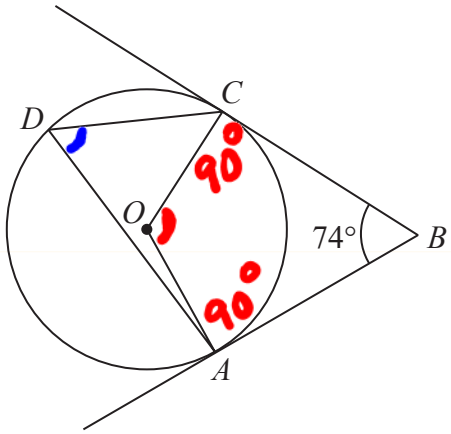


Diagram **NOT** accurately drawn

A, *C* and *D* are points on a circle, centre *O*.
AB and *CB* are tangents to the circle.

Angle *ABC* = 74°

Work out the size of angle *ADC*.
Show your working clearly.

OCB = OAB = 90° "angle between radius and tangent is 90°"

∠COA = 360° − (90° + 90° + 74°) = 106°

"sum of angles in any quadrilateral is 360°"

Angle ADC = $\frac{106^\circ}{2}$ = 53°

"Angle at the circumference is half the measure of the angle at the centre".

53°

(Total for Question 12 is 3 marks)

13 The straight line $\mathbf{L}_1$ has equation $y = 6 - 2x$
The straight line $\mathbf{L}_2$ is perpendicular to $\mathbf{L}_1$ and passes through the point (4, 7)

Find the coordinates of the point where the line $\mathbf{L}_2$ crosses the x-axis. → on x-axis $y = 0$

$L_1 \longmapsto y = -2x + 6 \longmapsto m_1 = -2$.

$L_2 \perp L_1 \longmapsto m_2 = \frac{1}{2}$

Line L_2 has gradient $\frac{1}{2}$ and Passing through $(4, 7)$.

Eq. of L_2:

$y = mx + c$

$y = \frac{1}{2}x + c$

$7 = \frac{1}{2}(4) + c$

$7 = 2 + c$

$c = 5$

$y = \frac{1}{2}x + 5$

$0 = \frac{1}{2}x + 5$

$\frac{1}{2}x = -5$

$x = -10$

(−10 , 0)

(Total for Question 13 is 4 marks)

14 $128 = 4^{2x} \times 2^x$

Work out the value of x.

$128 = 2^7$, $4 = 2^2$

$2^7 = (2^2)^{2x} \times 2^x$

$2^7 = 2^{4x} \times 2^x$

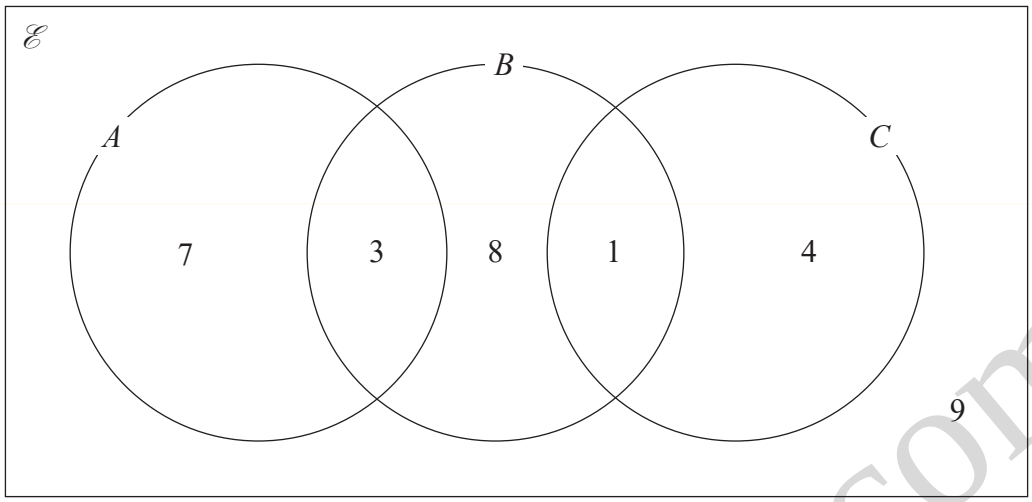
$2^7 = 2^{5x}$

$5x = 7 \longmapsto x = \frac{7}{5}$

$x =$ $\frac{7}{5}$

(Total for Question 14 is 3 marks)

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



7, 3, 8, 1, 4 and 9 represent the **numbers** of elements.

Find

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

$7+3+8+1 = 19$

19

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

5

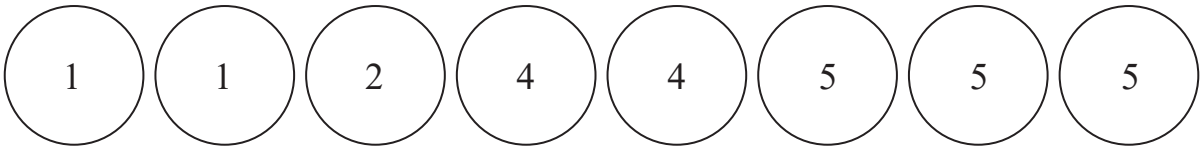
(iii) $n(A' \cup B')$ $= (A \cap B)'$

$7+8+1+4+9 = 29$

29

(Total for Question 15 is 3 marks)

16 There are 8 counters in a bag.
There is a number on each counter.



Fiona takes at random **three** of the counters.
She adds the numbers on the **three** counters to get her total.

Work out the probability that her total is an odd number.

even : E
odd : O

even + even + odd = odd
or:
odd + odd + odd = odd

$P(E\&E\&O)\times 3 + P(O\&O\&O)$

$\left(\frac{3}{8}\times\frac{2}{7}\times\frac{5}{6}\times 3\right)+\left(\frac{5}{8}\times\frac{4}{7}\times\frac{3}{6}\right)$

$= \frac{15}{56} + \frac{5}{28} = \frac{25}{56}$

$\frac{25}{56}$

(Total for Question 16 is 4 marks)

17 (a) Use algebra to show that $0.4\dot{3}\dot{6} = \frac{24}{55}$

let $x = 0.43636\ldots$ $\times 10$

$10x = 4.3636\ldots$ $\times 10$

$100x = 43.636\ldots$ $\times 10$

$1000x = 436.3636\ldots$

$1000x - 10x = 436.3636 - 4.3636$

$990x = 432$

$\hookrightarrow x = \frac{432}{990} = \frac{24}{55}$

(2)

(b) Show that $\frac{\sqrt{20} + \sqrt{80}}{\sqrt{3}}$ can be expressed in the form $\sqrt{a}$ where a is an integer.

Show your working clearly.

$\sqrt{20} = \sqrt{4 \times 5} = 2\sqrt{5}$

$\sqrt{80} = \sqrt{16 \times 5} = 4\sqrt{5}$

$\frac{2\sqrt{5} + 4\sqrt{5}}{\sqrt{3}} = \frac{6\sqrt{5}}{\sqrt{3}} \times \sqrt{3} \times \sqrt{3}$

$= \frac{6\sqrt{15}}{3}$

$= 2\sqrt{15} = \sqrt{2^2 \times 15}$

$= \sqrt{60}$

Remember:

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

(3)

(Total for Question 17 is 5 marks)

18 Solve the simultaneous equations

$$2x^2 + 3y^2 = 14$$

$$x = 2y - 3$$

Show clear algebraic working.

substitute $x = 2y - 3$ in $2x^2 + 3y^2 = 14$

$2(2y-3)^2 + 3y^2 = 14$

$2(4y^2 - 12y + 9) + 3y^2 = 14$

$8y^2 - 24y + 18 + 3y^2 = 14$

$11y^2 - 24y + 18 - 14 = 0$

$11y^2 - 24y + 4 = 0$

$(11y - 2)(y - 2) = 0$

$11y - 2 = 0$ | $y - 2 = 0$

$y = \frac{2}{11}$ | $y = 2$

substitute in $x = 2y - 3$

$x = 2\left(\frac{2}{11}\right) - 3$ | $x = 2(2) - 3$

$x = -\frac{29}{11}$ | $x = 1$

$x = 1, y = 2$ & $x = -\frac{29}{11}, y = \frac{2}{11}$

(Total for Question 18 is 5 marks)

19 $a = \dfrac{p - q}{t}$

$p = 8.4$ correct to 2 significant figures.
$q = 6.3$ correct to 2 significant figures.
$t = 0.27$ correct to 2 significant figures.

2 s.f. for p, q & t is 1 d.P.

0.1 ÷ 2 = 0.05

Work out the upper bound for the value of a.
Show your working clearly.
Give your answer correct to 1 decimal place.

$p_{UB} = 8.4 + 0.05 = 8.45$

$q_{LB} = 6.3 - 0.05 = 6.25$

$t_{LB} = 0.27 - 0.05 = 0.265$

$$a_{UB} = \frac{p_{UB} - q_{LB}}{t_{LB}}$$

$$a = \frac{8.45 - 6.25}{0.265}$$

$a = 8.3018\ldots$

8.3

(Total for Question 19 is 3 marks)

20 Solve the inequality $4x^2 - 5x - 6 > 0$

$(4x + 3)(x - 2) > 0$

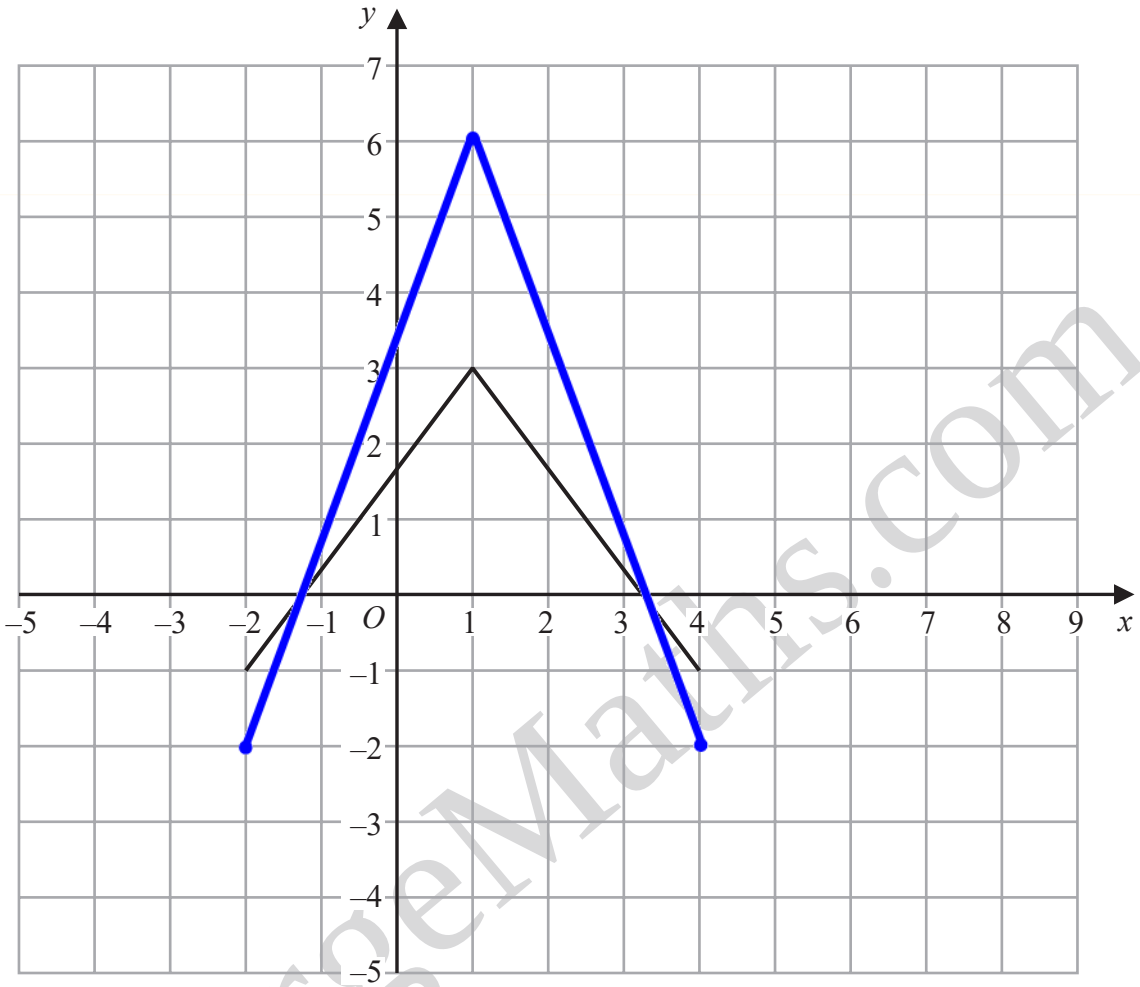
$x = -\frac{3}{4}$ & $x = 2$

$x > 2$ & $x < -\frac{3}{4}$

$x > 2$ & $x < -\frac{3}{4}$

(Total for Question 20 is 4 marks)

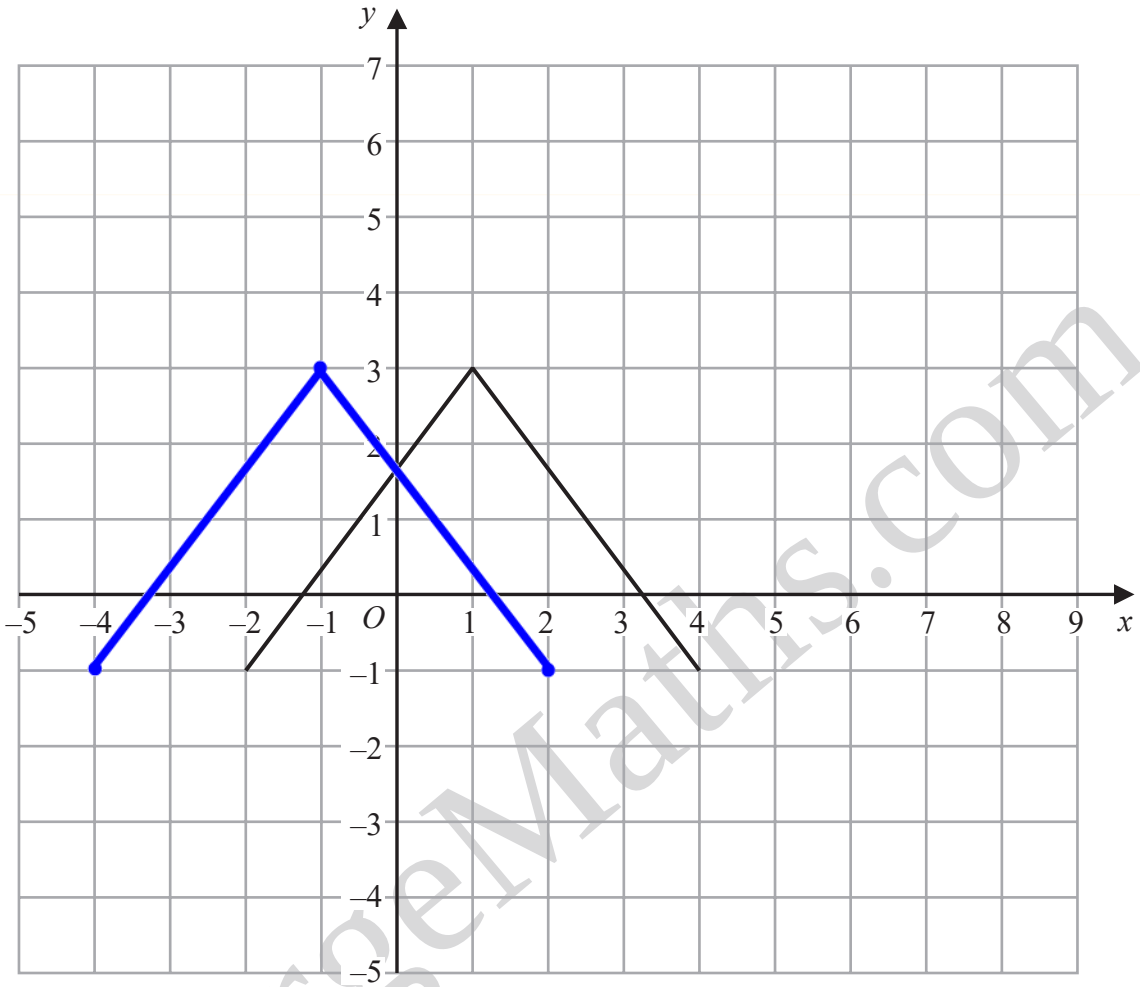
21 Here is the graph of $y = f(x)$



(a) On the grid above, draw the graph of $y = 2f(x)$

(2)

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



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

(2)

(Total for Question 21 is 4 marks)

22 Express $\dfrac{4x^2 - 25}{5x^2 + 2x - 7} \times \left(\dfrac{2}{x - 3} - \dfrac{3}{2x - 5} \right)$ as a single fraction in its simplest form.

$$\frac{(2x-5)(2x+5)}{(5x+7)(x-1)} \times \left(\frac{2(2x-5) - 3(x-3)}{(x-3)(2x-5)} \right)$$

$$\frac{(2x-5)(2x+5)}{(5x+7)(x-1)} \times \frac{4x - 10 - 3x + 9}{(x-3)(2x-5)}$$

$$\frac{2x+5}{(5x+7)(x-1)} \times \frac{(x-1)}{(x-3)}$$

$$\frac{2x+5}{(5x+7)(x-3)}$$

$$\frac{2x+5}{(5x+7)(x-3)}$$

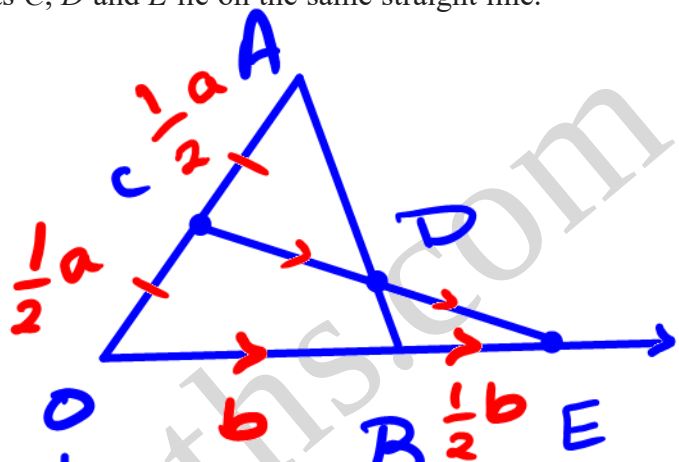
(Total for Question 22 is 4 marks)

23 OAB is a triangle.

$\overrightarrow{OA} = \mathbf{a}$ $\overrightarrow{OB} = \mathbf{b}$

C is the midpoint of OA.
D is the point on AB such that $AD : DB = 3 : 1$
E is the point such that $\overrightarrow{OB} = 2\overrightarrow{BE}$

Using a vector method, prove that the points C, D and E lie on the same straight line.



$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$

$\overrightarrow{AB} = -a + b$

So, $\overrightarrow{AD} = \frac{3}{4}\overrightarrow{AB}$

$\overrightarrow{AD} = \frac{3}{4}(-a + b)$

$\overrightarrow{AD} = -\frac{3}{4}a + \frac{3}{4}b$

$\overrightarrow{CD} = \overrightarrow{CA} + \overrightarrow{AD}$

$\overrightarrow{CD} = \frac{1}{2}a - \frac{3}{4}a + \frac{3}{4}b$

$\overrightarrow{CD} = -\frac{1}{4}a + \frac{3}{4}b$

$\overrightarrow{DB} = \frac{1}{4}\overrightarrow{AB}$

$\overrightarrow{DB} = \frac{1}{4}(-a + b)$

$\overrightarrow{DB} = -\frac{1}{4}a + \frac{1}{4}b$

$\overrightarrow{DE} = \overrightarrow{DB} + \overrightarrow{BE}$

$\overrightarrow{DE} = -\frac{1}{4}a + \frac{1}{4}b + \frac{1}{2}b$

$\overrightarrow{DE} = -\frac{1}{4}a + \frac{3}{4}b$

$\overrightarrow{CD} + \overrightarrow{DE} =$

$-\frac{1}{4}a + \frac{3}{4}b - \frac{1}{4}a + \frac{3}{4}b$

$\overrightarrow{CD} + \overrightarrow{DE} = -\frac{1}{2}a + \frac{3}{2}b$

$\overrightarrow{CE} = \overrightarrow{CO} + \overrightarrow{OE}$

$\overrightarrow{CE} = -\frac{1}{2}a + \frac{3}{2}b$

As: $\overrightarrow{CD} + \overrightarrow{DE} = \overrightarrow{CE}$

Therefore C, D & E lie on the same st. line.

(Total for Question 23 is 5 marks)

24 (a) Express $7 - 4x - x^2$ in the form $p - (x + q)^2$ where p and q are constants.

$-x^2 - 4x + 7$

$-(x^2 + 4x) + 7$

$-[(x+2)^2 - (2)^2] + 7$

$-(x+2)^2 + 4 + 7$

$11 - (x+2)^2$

(2)

(b) Use your answer to part (a) to solve the equation $7 - 4(y + 3) - (y + 3)^2 = 0$

Give your solutions in the form $e \pm \sqrt{f}$ where e and f are integers.

let $y + 3 = x$

$11 - (x+2)^2 = 0$

$(x+2)^2 = 11$

$x + 2 = \pm\sqrt{11}$

$x = -2 \pm \sqrt{11}$

$y = x - 3$

$y = -2 \pm \sqrt{11} - 3$

$y = -5 \pm \sqrt{11}$

$y = -5 \pm \sqrt{11}$

(3)

The curve **C** has equation $y = 3 - 5(x + 1)^2$
The point A is the maximum point on **C**.

(c) Write down the coordinates of A.

(-1 , 3)

(1)

(Total for Question 24 is 6 marks)

TOTAL FOR PAPER IS 100 MARKS