Write your name here

Surname maths made easy | Other names

Pearson Edexcel
International GCSE

Centre Number | Candidate Number

Mathematics A

Level 1/2
Paper 2H

Higher Tier

Sample assessment material for first teaching September 2016
Time: 2 hours

Paper Reference
4MA1/2H

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

International GCSE Mathematics

Formulae sheet – Higher Tier

Arithmetic series

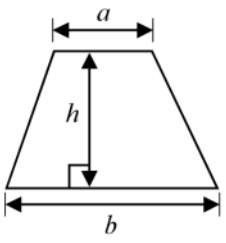
Sum to n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$

The quadratic equation

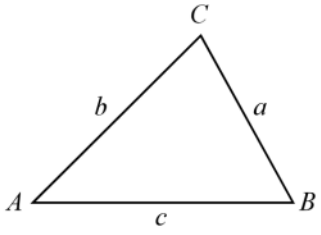
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:

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

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



Trigonometry



In any triangle *ABC*

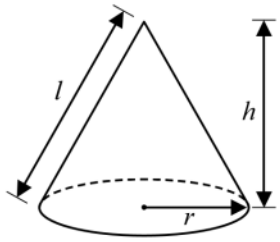
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

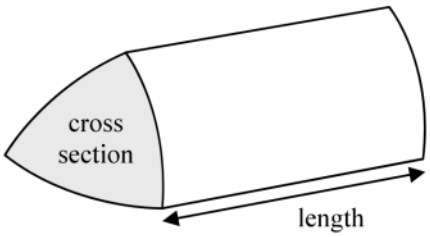
Area of triangle $= \frac{1}{2}ab\sin C$

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

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

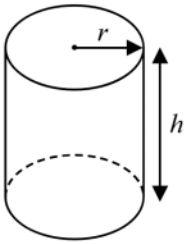


Volume of prism
= area of cross section × length



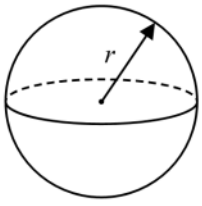
Volume of cylinder $= \pi r^2 h$

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 FIVE questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1 Find the lowest common multiple (LCM) of 20, 30 and 45

$20 = 2 \times 2 \times 5$

$30 = 2 \times 3 \times 5$

$45 = 3 \times 3 \times 5$

$LCM = 2^2 \times 3^2 \times 5$

$= 4 \times 9 \times 5$

$= 180$

180

(Total for Question 1 is 3 marks)

2 The first four terms of an arithmetic sequence are

2 , 9 , 16 , 23 (+7, +7, +7)

Write down an expression, in terms of n, for the nth term.

+5

Compare to $7n$: 7 14 21 28

so $7n - 5$

$7n - 5$

(Total for Question 2 is 2 marks)

3

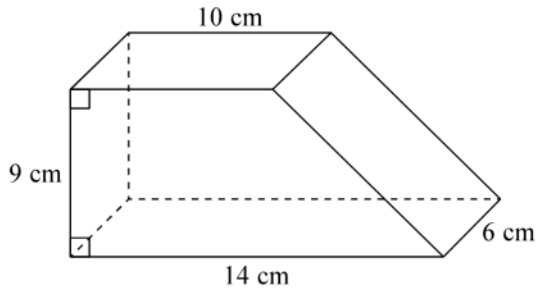


Diagram **NOT** accurately drawn

The diagram shows a solid prism.
The cross section of the prism is a trapezium.

The prism is made from wood with density 0.7 g/cm^3

Work out the mass of the prism.

mass = volume × density

Volume = area of cross section × depth

$= \left(\frac{10+14}{2}\right) \times 9 \times 6 = 758 \text{cm}^3$

$758 \times 0.7 =$

453.6

..... g

(Total for Question 3 is 4 marks)

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4 (a) Simplify $p^5 \times p^4$

$p^a \times p^b = p^{a+b}$

p^9

(1)

(b) Simplify $(m^4)^{-3}$

$(m^a)^b = m^{ab}$

m^{-12}

(1)

(c) Write down the value of c^0

$a^0 = 1$

1

(1)

(d) Write $\sqrt[3]{2}$ as a power of 2

$\sqrt[b]{a} = a^{\frac{1}{b}}$

$2^{\frac{1}{3}}$

(1)

(e) Solve $5(x + 7) = 2x - 10$
Show clear algebraic working.

$5x + 35 = 2x - 10$ (expand)

$3x = -45$ $(-2x, -35)$

$x = \frac{-45}{3} = -15$

$x =$ -15

(3)

(Total for Question 4 is 7 marks)

5 On 1 May 2012, the cost of 5 grams of gold was 14 000 rupees.
The cost of gold decreased by 7.5% from 1 May 2012 to 1 May 2013

Work out the cost of 20 grams of gold on 1 May 2013

cost of 20g in 2012: 14000 × 4 = 56000

7·5% dec is a multiplier of 0·925

0·925 × 56000 = 51800

51800 rupees

(Total for Question 5 is 4 marks)

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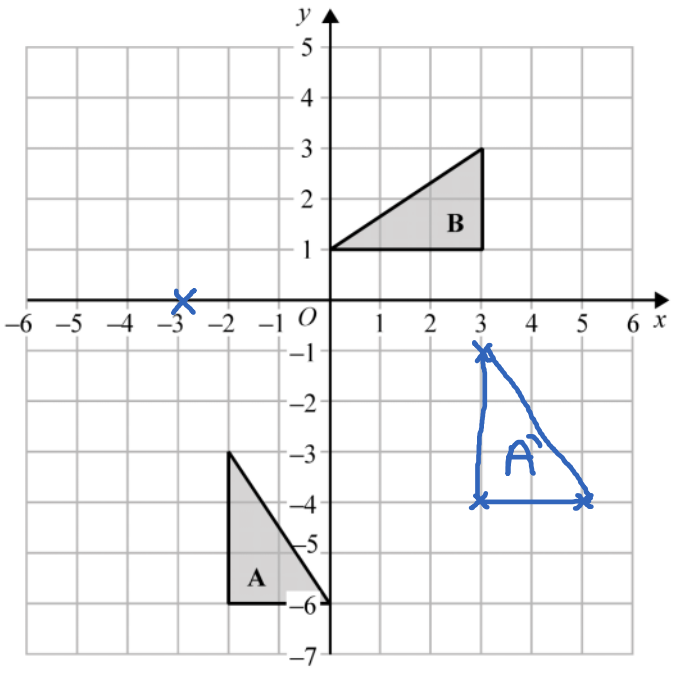
6



(a) On the grid, translate triangle **A** by the vector $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$ = A'

(1)

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

Rotation centre (-3,0), 90° anticlockwise

(3)

(Total for Question 6 is 4 marks)

7 a, b, c and d are 4 integers written in order of size, starting with the smallest integer.

The mean of a, b, c and d is 15
The sum of a, b and c is 39

(a) Find the value of d.

① $\frac{a+b+c+d}{4} = 15$

② $a+b+c = 39$

①' $a+b+c+d = 60$

so ①'-② : $60-39 = d$

$d =$ 21

(2)

Given also that the range of a, b, c and d is 10

(b) work out the median of a, b, c and d.

$d-a = 10$ (a is smallest)

$21-a = 10$

$a = 11$

$b+c = 39-11 = 28$

median is the average of two middle values.

$28 \div 2 = 14$

14

(2)

(Total for Question 7 is 4 marks)

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8 Kwo invests HK$40 000 for 3 years at 2% per year compound interest.
Work out the value of the investment at the end of 3 years.

1·02 ≡ 2% increase

$40000 × 1·02^3 = $42 448·32

3 years increase

HK$ 42448.32

(Total for Question 8 is 3 marks)

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9 Solve the simultaneous equations

$$3x + y = 13$$
$$x - 2y = 9$$

Show clear algebraic working.

① $3x + y = 13$

② $x - 2y = 9$

$3 \times$ ② $3x - 6y = 27$

$-$ ①: $0 - 7y = 14 \Rightarrow y = -\frac{14}{7} = -2$

if $y = -2$ then $x - 2(-2) = 9$

$x = 9 - 4 = 5$

$x =$ 5

$y =$ −2

(Total for Question 9 is 3 marks)

10 Show that $4\frac{2}{3} \div 3\frac{5}{9} = 1\frac{5}{16}$

Convert to top heavy.

$\frac{14}{3} \div \frac{32}{9} = \frac{14}{3} \times \frac{9}{32} = \frac{42}{32}$

simplify: $\frac{42}{32} = \frac{21}{16} = 1\frac{5}{16}$

(Total for Question 10 is 3 marks)

11

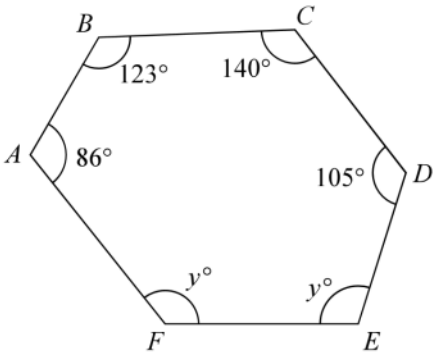

Diagram **NOT** accurately drawn

ABCDEF is a hexagon.

Work out the value of y.

Use $(n-2) \times 180$ to find the sum of angles in a hexagon.

$(6-2) \times 180 = 720$

$720 - (86+123+140+105) = 2y$

$266 = 2y$

so $y = 266 \div 2 =$

$y =$ 133

(Total for Question 11 is 4 marks)

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12 The table shows information about the amount of money that 120 people spent in a shop.

Amount of money (£m)	Frequency
$0 < m \leqslant 10$	8
$10 < m \leqslant 20$	17
$20 < m \leqslant 30$	25
$30 < m \leqslant 40$	40
$40 < m \leqslant 50$	22
$50 < m \leqslant 60$	8

(a) Complete the cumulative frequency table.

Amount of money (£m)	Cumulative frequency
$0 < m \leqslant 10$	8
$0 < m \leqslant 20$	25
$0 < m \leqslant 30$	50
$0 < m \leqslant 40$	90
$0 < m \leqslant 50$	112
$0 < m \leqslant 60$	120

(1)

Add each group in turn.

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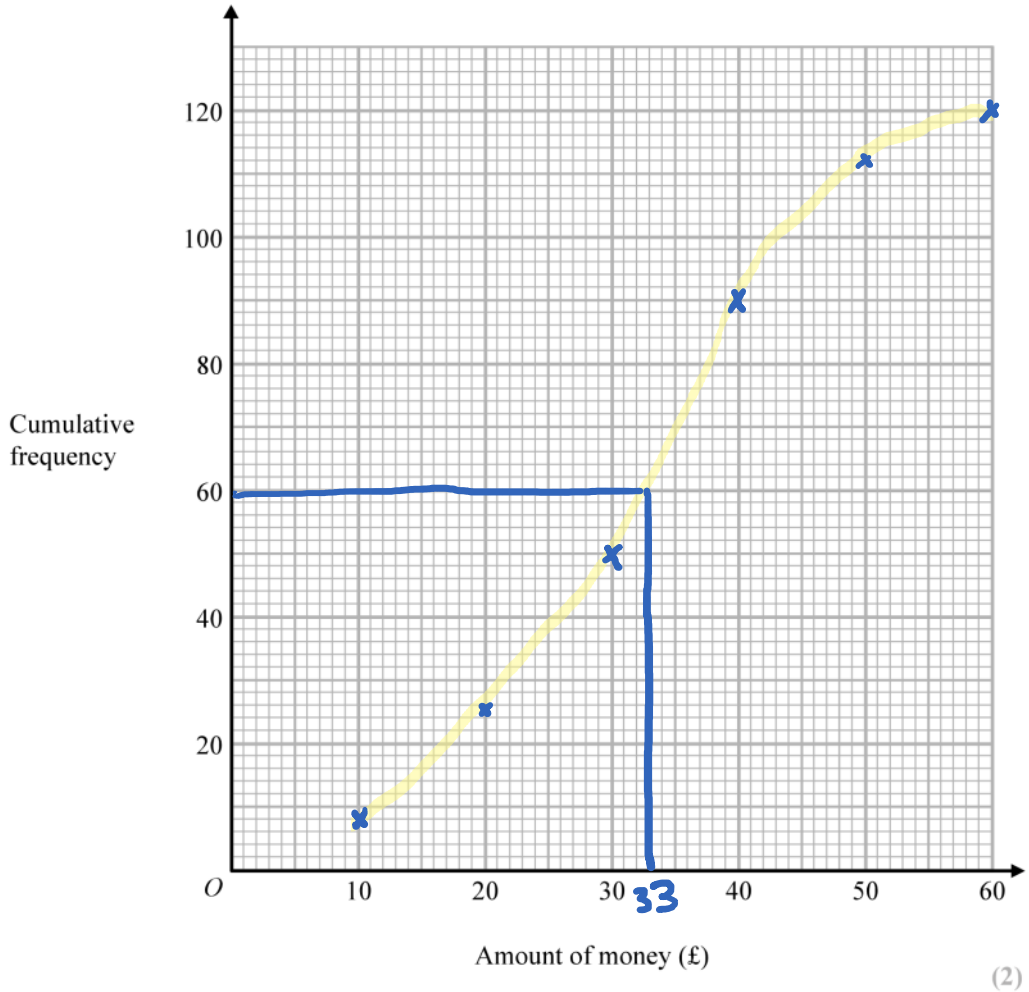
(b) On the grid, draw a cumulative frequency graph for your table.



(2)

(c) Use your graph to find an estimate for the median amount of money spent in the shop by these people.

median = $\frac{120}{2}$ (total)

= 60 (50% of data)

≈£33

£ 33

(2)

(Total for Question 12 is 5 marks)

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13 Make b the subject of $P = \frac{1}{2}ab^2 + c$ where b is positive.

$2P = ab^2 + 2c$ (x2)

$2P - 2c = ab^2$ (−2c)

$\frac{2P-2c}{a} = b^2$ (÷a)

$\sqrt{\frac{2P-2c}{a}} = b$ (√)

(Total for Question 13 is 3 marks)

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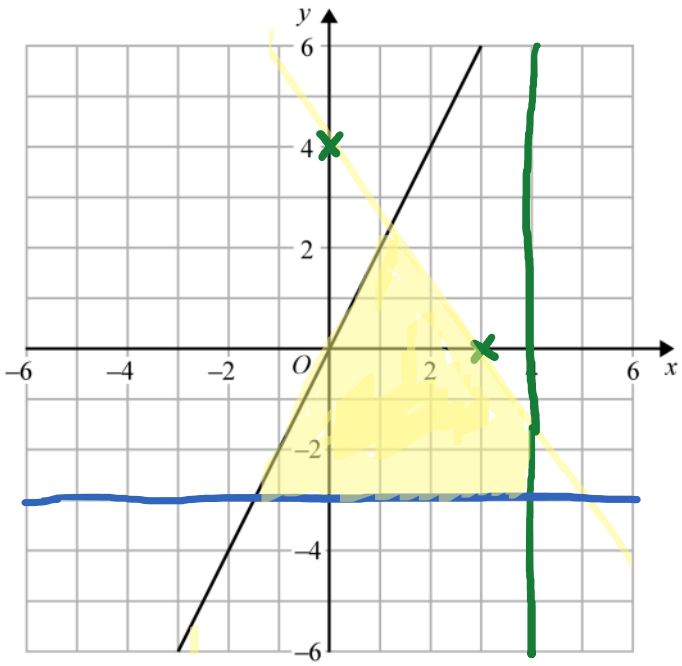
14 The line with equation $y = 2x$ is drawn on the grid.

(a) On the same grid, draw the line with equation $4x + 3y = 12$

(2)

x	y
0	4
1	$8/3$
2	$4/3$
3	0



(b) Show, by shading on the grid, the region defined by all four inequalities

$$y \leqslant 2x$$

$$4x + 3y \leqslant 12$$

$$y \geqslant -3$$

$$x \leqslant 4$$

(3)

(Total for Question 14 is 5 marks)

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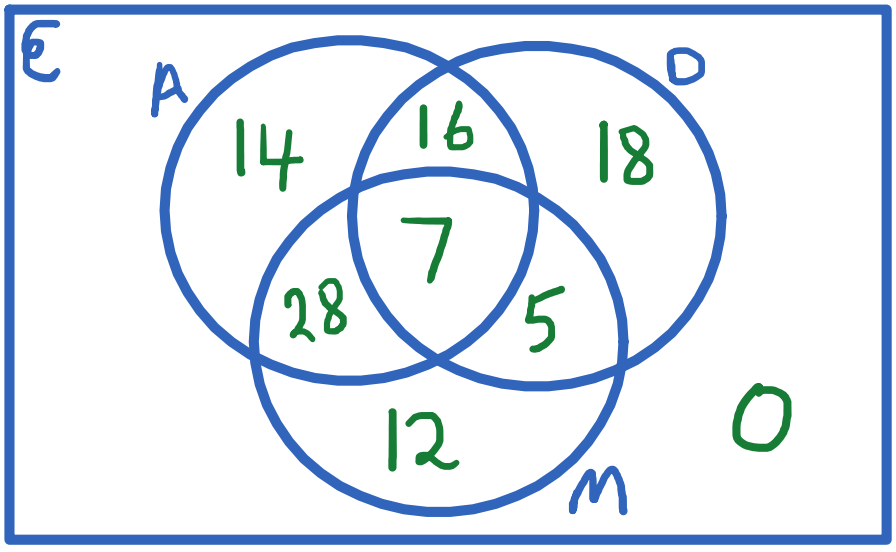
15 There are 100 students in Year 11

All 100 students study at least one of art, drama and music.

7 of the students study art and drama and music.
23 of the students study art and drama.
35 of the students study art and music.
12 of the students study music and drama.
65 of the students study art.
52 of the students study music.

(a) Draw a Venn diagram to show this information.



(3)

One of the 100 students is selected at random.

(b) Find the probability that this student studies Drama but not Music.

$\frac{16+18}{100} = \frac{34}{100}$ ← Drama not music
↖ Total

$\frac{34}{100}$

(1)

Given that the student studies Drama,

(c) find the probability that this student also studies Art.

$\frac{16+7}{46} = \frac{23}{46}$ ← Art + Drama
↖ Drama

$\frac{23}{46}$

(1)

(Total for Question 15 is 5 marks)

16 M is inversely proportional to g^3
$M = 24$ when $g = 2.5$

(a) Find a formula for M in terms of g

$M \propto \frac{1}{g^3}$ so $M = \frac{k}{g^3}$

$24 = \frac{k}{2.5^3}$ so $k = 24 \times 2.5^3 = 375$ $M = \frac{375}{g^3}$

(3)

(b) Work out the value of g when $M = \frac{1}{9}$

$\frac{1}{9} = \frac{375}{g^3}$ $\therefore g^3 = 375 \times 9$

$g = \sqrt[3]{375 \times 9} = 15$

$g =$ 15

(2)

(Total for Question 16 is 5 marks)

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17 The function f is such that $f(x) = \frac{3}{x-2}$

(a) Find f(1)

$f(1) = \frac{3}{1-2} = \frac{3}{-1} = -3$

-3

(1)

(b) State which value of x must be excluded from any domain of f

$x = 2$ as $f(2) = \frac{3}{2-2}$ division by zero

2

(1)

The function g is such that $g(x) = x + 4$

(c) Calculate fg(2)

$fg(x) = \frac{3}{x+4-2} = \frac{3}{x+2}$ $fg(2) = \frac{3}{2+2} = \frac{3}{4}$

3/4

(2)

(Total for Question 17 is 4 marks)

18 Solid **A** and solid **B** are mathematically similar.

Solid **A** has surface area 384 cm^2
Solid **B** has surface area 864 cm^2

Area sf $= \frac{864}{384} = \frac{9}{4}$

Solid **B** has a volume of 2457 cm^3

Calculate the volume of solid **A**.

so length sf $= \sqrt{\frac{9}{4}} = \frac{3}{2}$ (from A to B)

Volume of A $= \left(\frac{2}{3}\right)^3 \times 2457 = 728$

728 cm^3

(Total for Question 18 is 3 marks)

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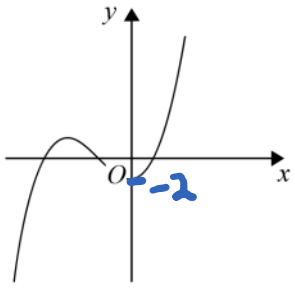
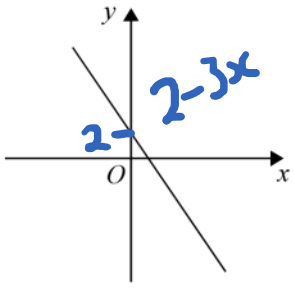
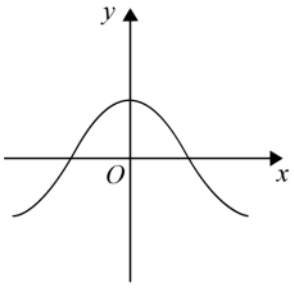
19 Here are nine graphs.



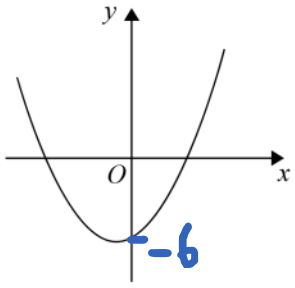
Graph A



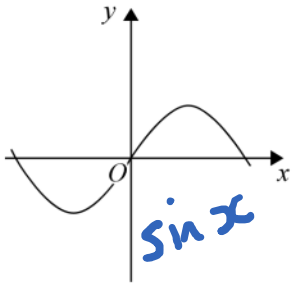
Graph B



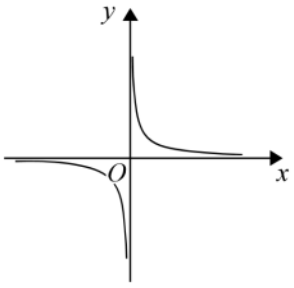
Graph C



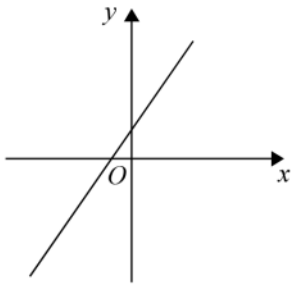
Graph D



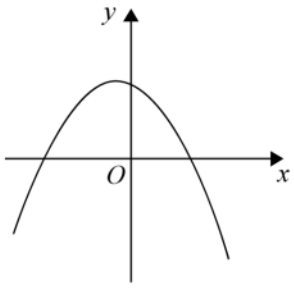
Graph E



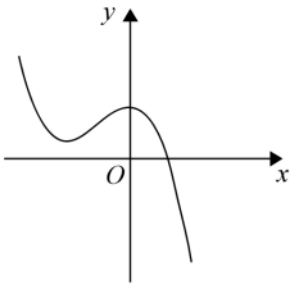
Graph F



Graph G



Graph H



Graph I

Complete the table below with the letter of the graph that could represent each given equation.

Equation	Graph
$y = \sin x$	E
$y = 2 - 3x$	B
$y = x^2 + x - 6$	D
$y = x^3 + 3x^2 - 2$	A

(Total for Question 19 is 3 marks)

20 Gemma has 9 counters.
Each counter has a number on it.

Gemma puts the 9 counters into a bag.
She takes at random two counters from the bag.

(a) Work out the probability that the number on each counter is an even number.

$P(\text{Even}) = \frac{4}{9}$ (one token)

$P(2\text{ even}) = \frac{4}{9} \times \frac{3}{8} = \frac{12}{72} = \frac{1}{6}$

$\frac{1}{6}$ **(2)**

(b) Work out the probability that the sum of the numbers on the two counters is an odd number.
Show your working clearly.

ODD = EVEN + ODD

$P(\text{Even then Odd}) = \frac{4}{9} \times \frac{5}{8} = \frac{20}{72}$

$P(\text{Odd then even}) = \frac{5}{9} \times \frac{4}{8} = \frac{20}{72}$

Now add : $\frac{20}{72} + \frac{20}{72} = \frac{40}{72} = \frac{5}{9}$

(3)

(Total for Question 20 is 5 marks)

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21 Here is triangle *LMN*, where angle *LMN* is an obtuse angle.

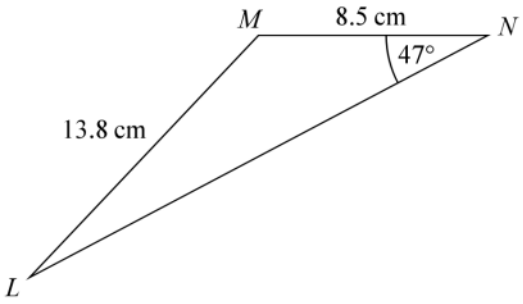

Diagram **NOT** accurately drawn

Work out the area of triangle *LMN*.
Give your answer correct to 3 significant figures.

We need $\angle LMN$ to use formula for area.

Sine rule: $\frac{\sin 47}{13.8} = \frac{\sin MLN}{8.5}$

$MLN = \sin^{-1}\left(8.5 \times \frac{\sin 47}{13.8}\right) \approx 26.8^\circ$

so $\angle LMN = 180 - 47 - 26.8 = 106.2^\circ$

Now use formula for area:

$\frac{1}{2}ab\sin C = \frac{1}{2} \times 8.5 \times 13.8 \times \sin 106.2$

$= 56.3 cm^2$

56.3 cm²

(Total for Question 21 is 6 marks)

22 (a) Write $2x^2 - 8x + 9$ in the form $a(x + b)^2 + c$

$2\left(x^2 - 4x + \frac{9}{2}\right)$ (factor of 2)

$2\left((x-2)^2 - 4 + \frac{9}{2}\right)$ (complete square)

$2(x-2)^2 - 8 + 9$ (multiply by 2)

$2(x-2)^2 + 1$

$2(x-2)^2 + 1$

(3)

(b) Hence, or otherwise, explain why the graph of the curve with equation $y = 2x^2 - 8x + 9 = 0$ does not intersect the x-axis.

From (a) the minimum point is at (2, 1)

(1)

(Total for Question 22 is 4 marks)

23 $ABCD$ is a parallelogram.

$$\overrightarrow{AB} = \begin{pmatrix} 2 \\ 3 \end{pmatrix} \quad \overrightarrow{AC} = \begin{pmatrix} 9 \\ 4 \end{pmatrix}$$

Find the magnitude of $\overrightarrow{BC}$

$\overrightarrow{BC} = \overrightarrow{BA} + \overrightarrow{AC}$

$= \begin{pmatrix} -2 \\ -3 \end{pmatrix} + \begin{pmatrix} 9 \\ 4 \end{pmatrix} = \begin{pmatrix} 7 \\ 1 \end{pmatrix}$

$|\overrightarrow{BC}| = \sqrt{7^2 + 1^2} = \sqrt{50}$

$\sqrt{50}$

(Total for Question 23 is 3 marks)

24 Show that $\frac{\sqrt{12}-1}{2-\sqrt{3}}$ can be written as $4+3\sqrt{3}$

Show your working clearly.

$\frac{(\sqrt{12}-1)}{(2-\sqrt{3})} \times \frac{(2+\sqrt{3})}{(2+\sqrt{3})} = \frac{2\sqrt{12}+\sqrt{36}-2-\sqrt{3}}{4+2\sqrt{3}-2\sqrt{3}-\sqrt{9}}$

$\frac{4\sqrt{3}+6-2-\sqrt{3}}{4-3} = \frac{3\sqrt{3}+4}{1} = 3\sqrt{3}+4$

(Total for Question 24 is 4 marks)

25 A particle moves along a straight line.
The fixed point O lies on this line.
The displacement of the particle from O at time t seconds, $t \geqslant 0$, is s metres, where

$$s = t^3 - 5t^2 - 8t + 3$$

Find the value of t for which the particle is instantaneously at rest.

$v = \frac{d}{dt}(s) = 3t^2 - 10t - 8$

$3t^2 - 10t - 8 = 0$

$(3t+2)(t-4) = 0$

$t = -\frac{2}{3}$ or 4

negative t not possible

$t =$ 4

(Total for Question 25 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS

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