

Write your name here

Surname

Other names

**Pearson Edexcel
International GCSE**

Centre Number

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Candidate Number

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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 ►

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PEARSON

International GCSE Mathematics

Formulae sheet – Higher Tier

Arithmetic series

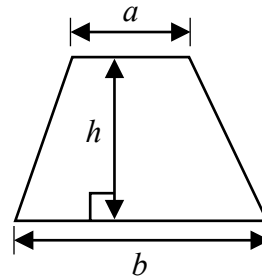
Sum to n terms, $S_n = \frac{n}{2} [2a + (n - 1)d]$

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

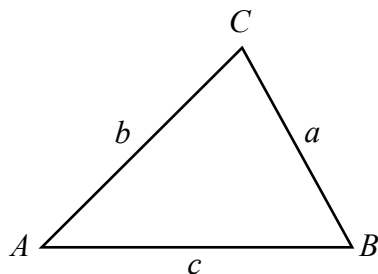
The quadratic equation

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

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



Trigonometry



In any triangle ABC

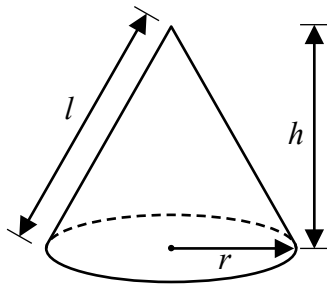
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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

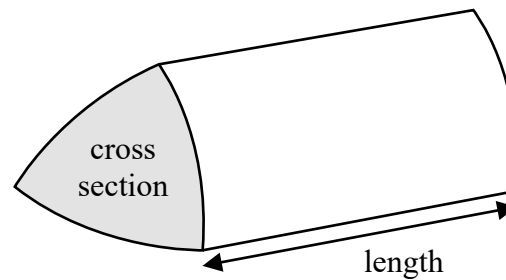
Volume of cone = $\frac{1}{3}\pi r^2 h$

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



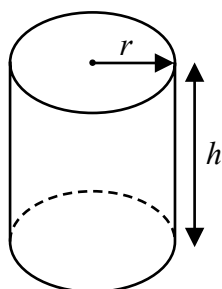
Volume of prism

= area of cross section \times length



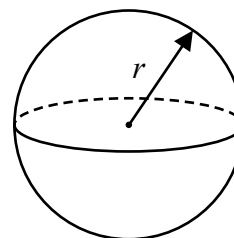
Volume of cylinder = $\pi r^2 h$

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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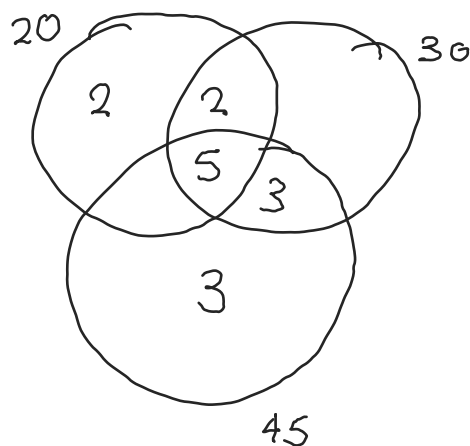
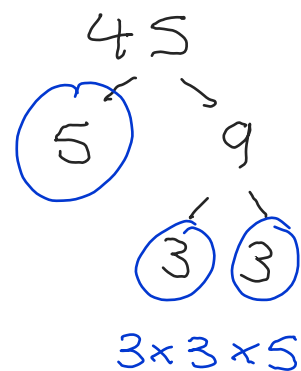
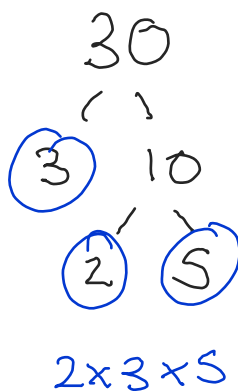
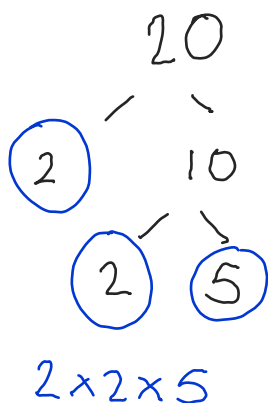
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Answer ALL TWENTY FIVE questions.

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



$$\begin{aligned} \text{LCM} &= \\ &2 \times 2 \times 3 \times 3 \times 5 \\ &= 4 \times 9 \times 5 \\ &= 180 \end{aligned}$$

(Total for Question 1 is 3 marks)

- 2 The first four terms of an arithmetic sequence are

$$-5 \xleftarrow{-7} 2 \xrightarrow{+7} 9 \xrightarrow{+7} 16 \xrightarrow{+7} 23$$

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

d : Difference 7
 n : place n n
 a : 0th term -5

$$7n - 5$$

(Total for Question 2 is 2 marks)

3

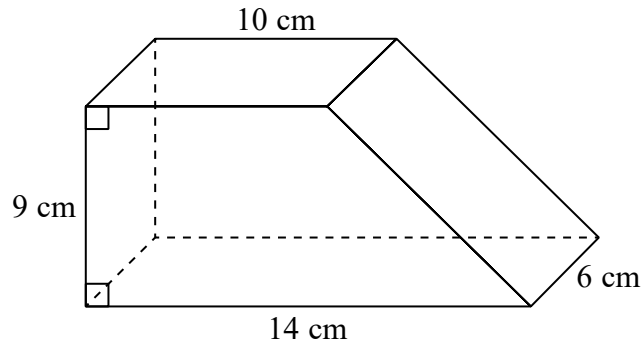


Diagram **NOT**
accurately drawn

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

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Work out the mass of the prism.

$$\text{Volume} = \text{Area of cross section} \times \text{depth}$$

$$= \frac{1}{2}(10+14) \times 9 \times 6$$

$$= 12 \times 9 \times 6 = 648$$

$$\begin{aligned} \text{Mass} &= \text{Density} \times \text{Vol} \\ &= 0.7 \times 648 \end{aligned}$$

$$= 453.6 \text{ g}$$

(Total for Question 3 is 4 marks)

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

$$p^{5+4}$$

$$p^9 \quad (1)$$

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

$$m^{4 \times -3}$$

$$m^{-12} \quad (1)$$

(c) Write down the value of c^0 — *power rule*

$$1 \quad (1)$$

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

$$\sqrt[3]{2} = 2^{1/3}$$

$$2^{1/3} \quad (1)$$

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

$$\begin{aligned}
 & \text{expand bracket} \\
 5x + 35 &= 2x - 10 \\
 -2x & \\
 3x + 35 &= -10 \\
 -35 & \\
 3x &= -45 \\
 \div 3 & \\
 x &= -15
 \end{aligned}$$

$$x = -15 \quad (3)$$

(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

$$\begin{aligned} \text{Decrease } 7.5\% &= 100\% - 7.5\% = 92.5\% \\ &= \times 0.925 \end{aligned}$$

$$5\text{g} = 14,000$$

$$20\text{g} = 56,000$$

$$\text{In 2013, } 20\text{g} = 56000 \times 0.925$$

$$= \underline{51800} \text{ rupees}$$

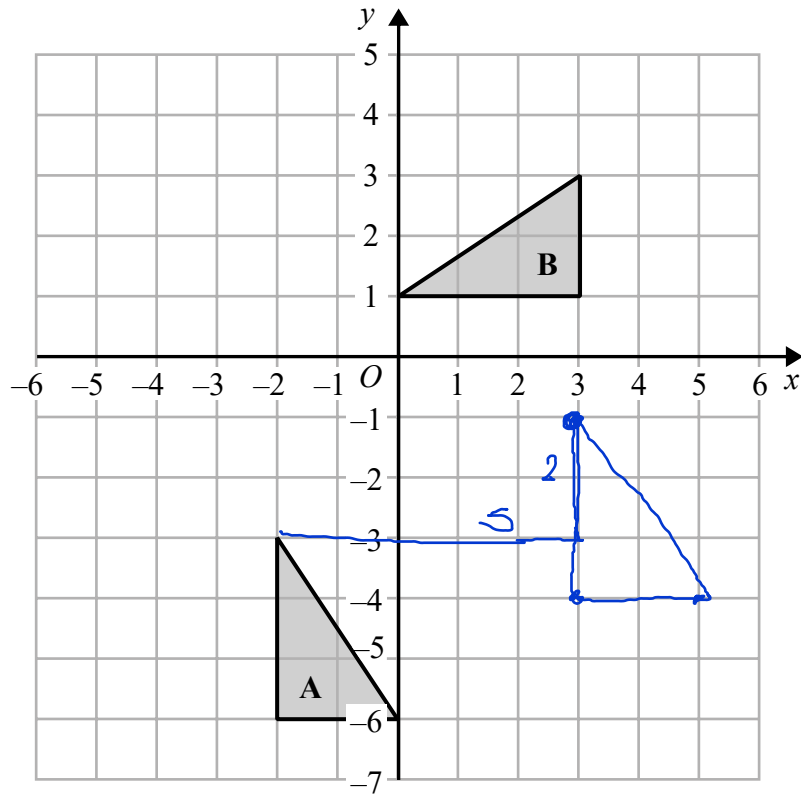
(Total for Question 5 is 4 marks)

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6



- (a) On the grid, translate triangle A by the vector $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$ *5 right* *2 up* (1)

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

Rotation 90° anticlockwise at (-3, 0)

same distance
from (-3, 0) (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.

1 The mean of a, b, c and d is 15

2 The sum of a, b and c is 39

$$\text{Mean} = \frac{\text{sum of values}}{\text{frequency}}$$

(a) Find the value of d .

$$\textcircled{1} \quad \frac{a+b+c+d}{4} = 15$$

$$\textcircled{2} \quad a+b+c = 39$$

substitute $\textcircled{2}$

$$\frac{a+b+c+d}{4} = 15$$

$$\frac{39+d}{4} = 15$$

$$39 + d = 60$$

$$d = 21$$

$$d = 21$$

(2)

$\textcircled{1}$ Given also that the range of a, b, c and d is 10

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

$$\textcircled{1} \quad d - a = 10$$

$$21 - a = 10$$

$$a = 11$$

Range = biggest - smallest

$$11, b, c, d$$

↑
median

is between b and c
so $\frac{b+c}{2}$

Using $\textcircled{2}$, $a+b+c = 39$

$$11 + b + c = 39$$

$$b + c = 28$$

$$\text{so median} = \frac{28}{2}$$

$$= 14$$

(2)

(Total for Question 7 is 4 marks)

- 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.

$$\text{Interest } 2\% : 100 + 2 = 102\% = \times 1.02$$

$$\text{Final Value} = 40,000 \times 1.02^3$$

initial value *multiplier (interest)* *3 ← 3 years*

$$= 42448.32$$

HK\$ 42448.32

(Total for Question 8 is 3 marks)

9 Solve the simultaneous equations

$$\begin{array}{l} 1 \quad 3x + y = 13 \quad \times 2 \\ 2 \quad x - 2y = 9 \end{array}$$

Show clear algebraic working.

$$\begin{array}{r} \textcircled{1} \times 2 \quad = \quad 6x + 2y = 26 \\ \textcircled{2} \quad = \quad x - 2y = 9 \quad + \\ \hline 7x \quad = \quad 35 \\ \div 7 \\ x = 5 \end{array}$$

Using $\textcircled{1}$: $3(5) + y = 13$

$$15 + y = 13$$

$$y = -2$$

$$\begin{array}{l} x = 5 \\ y = -2 \end{array}$$

(Total for Question 9 is 3 marks)

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

$$4\frac{2}{3} = \frac{14}{3}$$

$$3\frac{5}{9} = \frac{32}{9}$$

$$1\frac{5}{16} = \frac{21}{16}$$

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

$$= \frac{14}{3} \times \frac{9}{32} = \frac{126}{96} \div 6 = \frac{21}{16} = 1\frac{5}{16}$$

(Total for Question 10 is 3 marks)

11

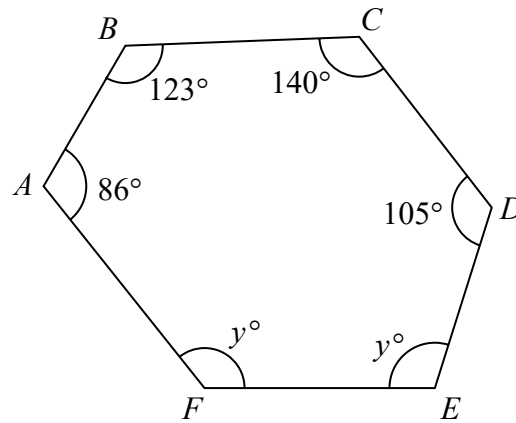


Diagram **NOT**
accurately drawn

$ABCDEF$ is a hexagon.

Work out the value of y .

$$\text{Sum of interior angles} = 180(n-2)$$

$n = \text{number of sides}$

$$\text{Hexagon } n = 6$$

$$: 180(6-2) = 720^\circ$$

$$86 + 123 + 140 + 105 + y + y = 720$$

collect like terms

$$2y + 454 = 720$$

$$-454$$

$$2y = 266$$

$$\div 2$$

$$y = 133$$

$$y = \dots 133$$

(Total for Question 11 is 4 marks)

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

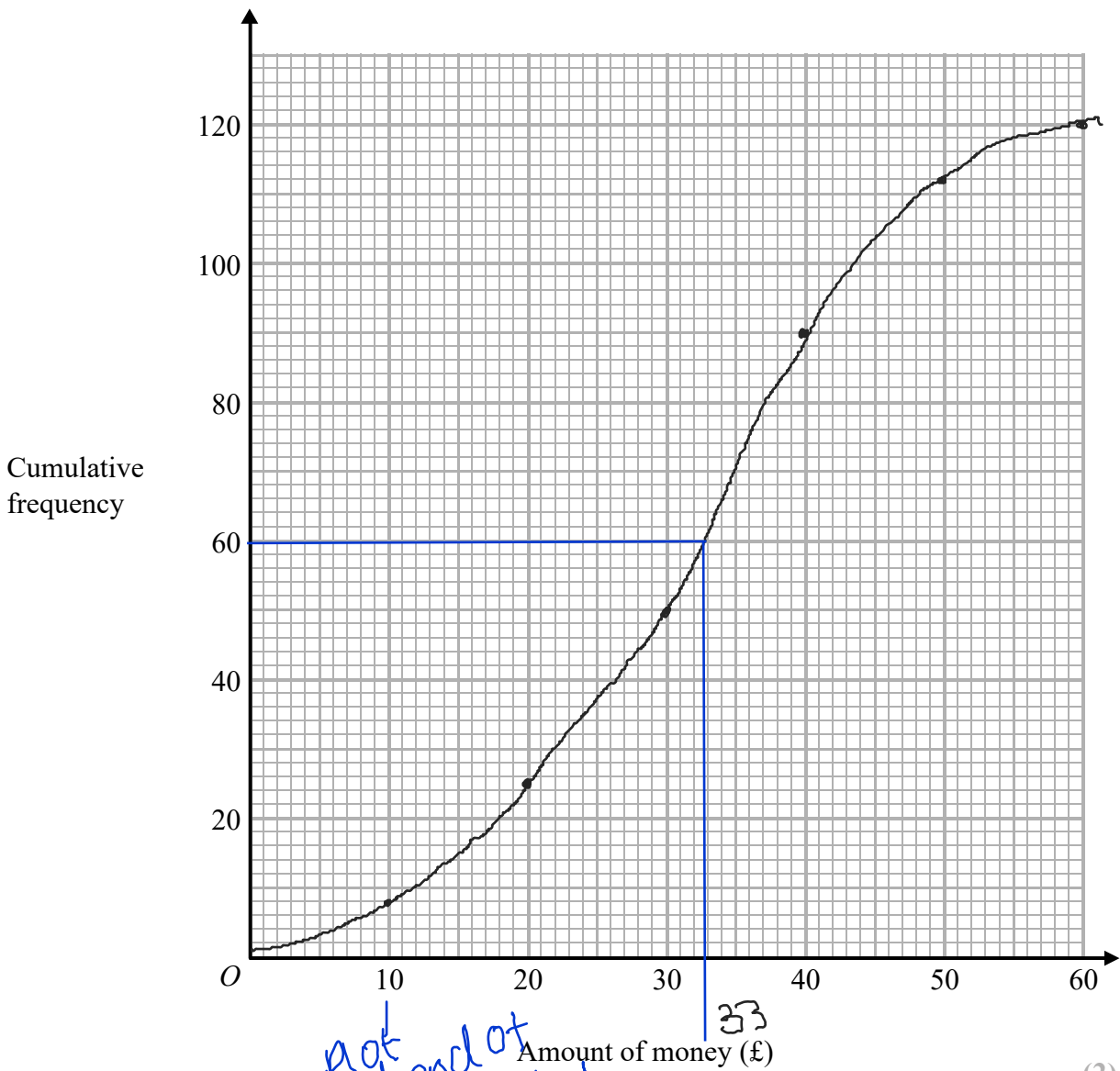
Amount of money (£ m)	Frequency
$0 < m \leq 10$	8
$10 < m \leq 20$	17
$20 < m \leq 30$	25
$30 < m \leq 40$	40
$40 < m \leq 50$	22
$50 < m \leq 60$	8

(a) Complete the cumulative frequency table.

Amount of money (£ m)	Cumulative frequency
$0 < m \leq 10$	8
$0 < m \leq 20$	$8 + 17$ 25
$0 < m \leq 30$	$25 + 25$ 50
$0 < m \leq 40$	$50 + 40$ 90
$0 < m \leq 50$	$90 + 22$ 112
$0 < m \leq 60$	$112 + 8$ 120

(1)

(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.

$$120 \div 2 = 60$$

£ 33

(2)

(Total for Question 12 is 5 marks)

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

isolate b

$$P - c = \frac{1}{2}ab^2$$

$$2(P - c) = ab^2$$

$$\frac{2(P - c)}{a} = b^2$$

$$\sqrt{\frac{2(P - c)}{a}} = b$$

always \oplus

$$b = \sqrt{\frac{2(P - c)}{a}}$$

(Total for Question 13 is 3 marks)

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

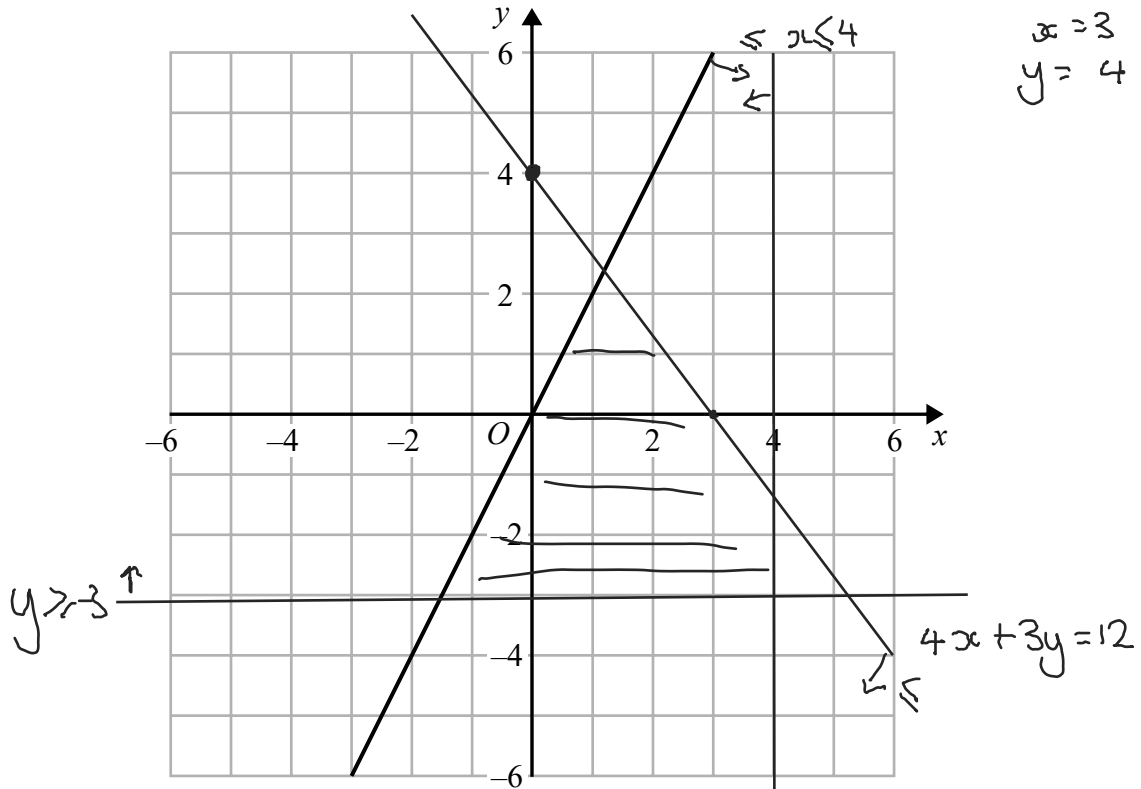
(a) On the same grid, draw the line with equation $4x + 3y = 12$

$$3y = 12 - 4x$$

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

$$x = 3$$

$$y = 4 - 4 = 0$$



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

- $y \leq 2x$
- $4x + 3y \leq 12$
- $y \geq -3$
- $x \leq 4$

All \leq or \geq
so solid line

(3)

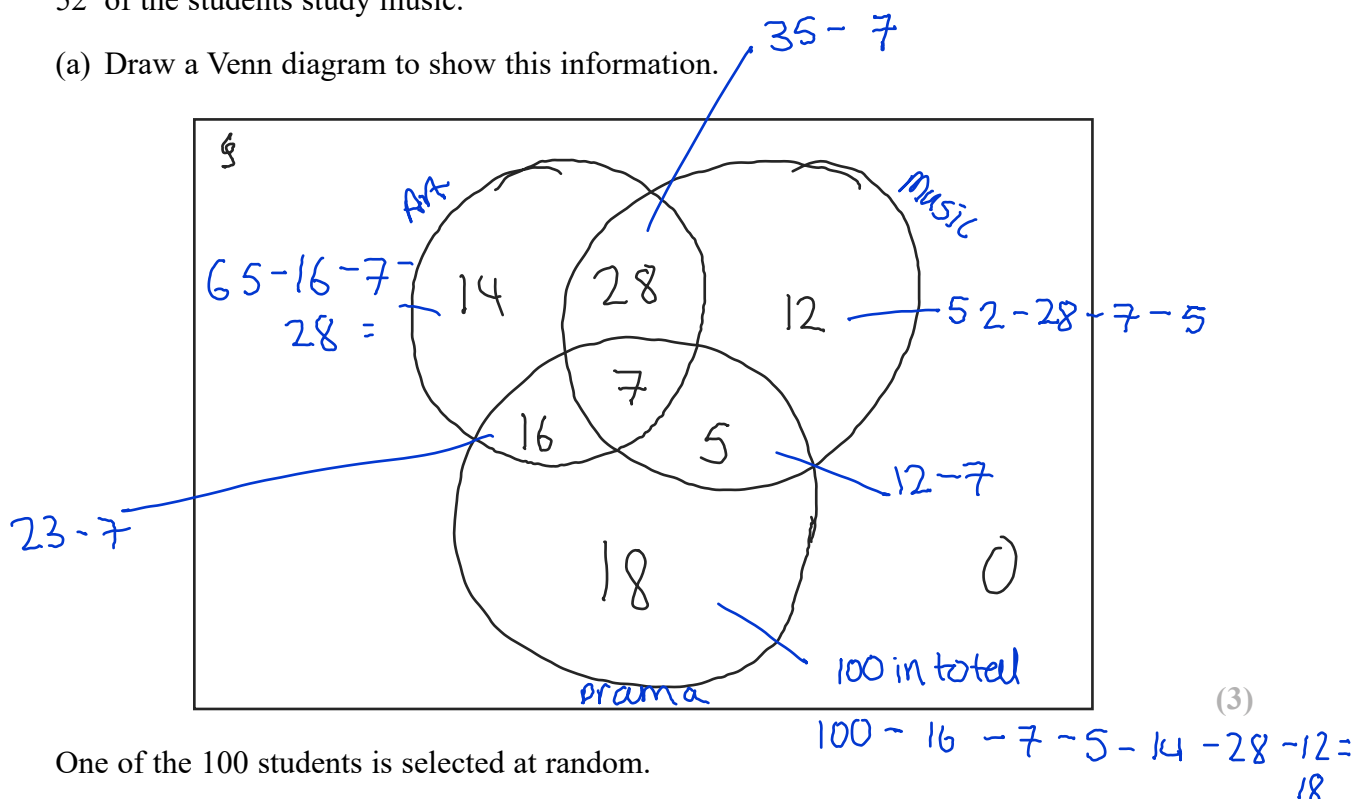
(Total for Question 14 is 5 marks)

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.



One of the 100 students is selected at random.

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

$$= \frac{16+18}{100} = \frac{34}{100} = \frac{17}{50} \quad (1)$$

Given that the student studies Drama, $18+7+16+5 = 46$

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

out of 46 16 study both, 7 all

$$16+7 = 23 \quad \frac{23}{46} = \frac{1}{2} \quad (1)$$

(Total for Question 15 is 5 marks)

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

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

$$M \propto \frac{1}{g^3}$$

$$M = \frac{k}{g^3}$$

$$24 = \frac{k}{2.5^3}$$

$$24 \times 2.5^3 = k$$

$$k = 375$$

$$M = \frac{375}{g^3}$$

(3)

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

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

cross multiply

$$g^3 = 375 \times 9$$

$$= 3375$$

$$g = \sqrt[3]{3375} = 15$$

$$g = 15$$

(2)

(Total for Question 16 is 5 marks)

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

(a) Find $f(1)$ *sub in 1*

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

-3

(1)

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

can't divide by 0
so $x-2 \neq 0$
 $x \neq 2$

2

(1)

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

(c) Calculate $fg(2)$

$$g(2) = 2 + 4 = 6$$

$$f(6) = \frac{3}{6-2} = \frac{3}{4}$$

$\frac{3}{4}$

(2)

(Total for Question 17 is 4 marks)

18 Solid A and solid B are mathematically similar, *scale factor*

Solid A has surface area 384 cm^2

Solid B has surface area 864 cm^2

Solid B has a volume of 2457 cm^3

Calculate the volume of solid A.

$$\text{Area scale factor (A to B)} = \frac{864}{384} = \frac{9}{4}$$

$$\text{linear scale factor} = \sqrt{\frac{9}{4}} = \frac{3}{2}$$

$$\text{Volume sf} = \left(\frac{3}{2}\right)^3 = \frac{27}{8}$$

$$B \rightarrow A = \div \text{ by sf}$$

728

cm^3

(Total for Question 18 is 3 marks)

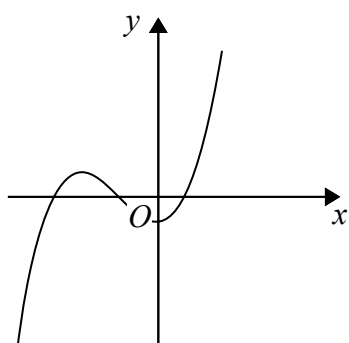
$$2457 \div \frac{27}{8} = 728$$

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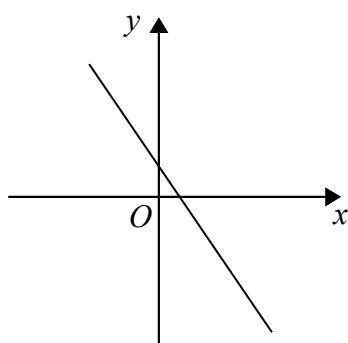
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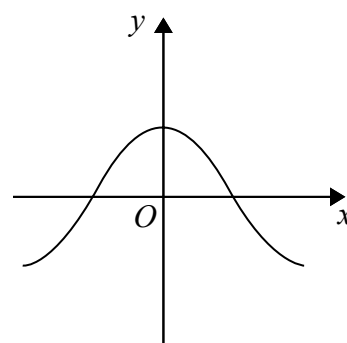
19 Here are nine graphs.



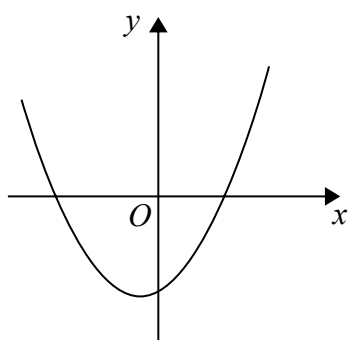
Graph A



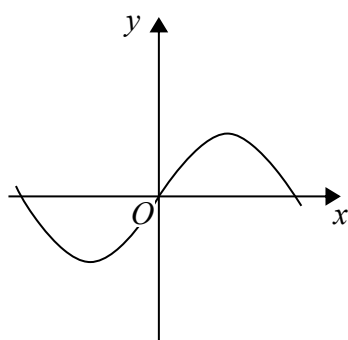
Graph B



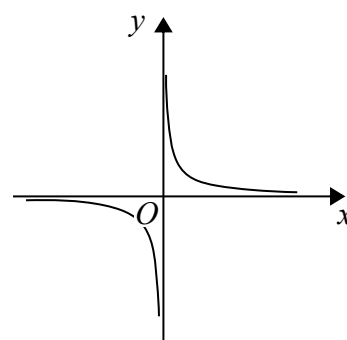
Graph C



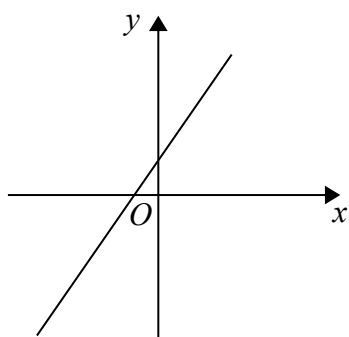
Graph D



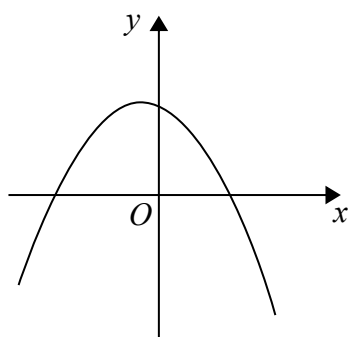
Graph E



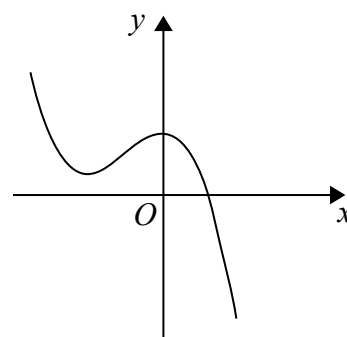
Graph F



Graph G



Graph H



Graph I

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

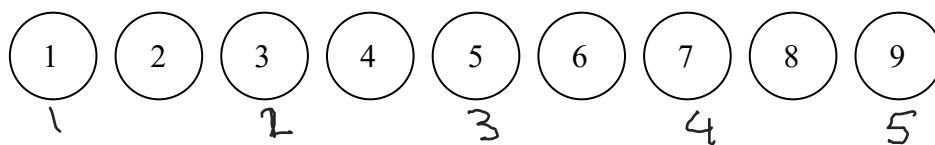


Equation	Graph
$y = \sin x$	E
$y = 2 - 3x$	B
$y = x^2 + x - 6$	D
$y = x^3 + 3x^2 - 2$	A



(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.

$$P(\text{odd}) = \frac{5}{9}$$

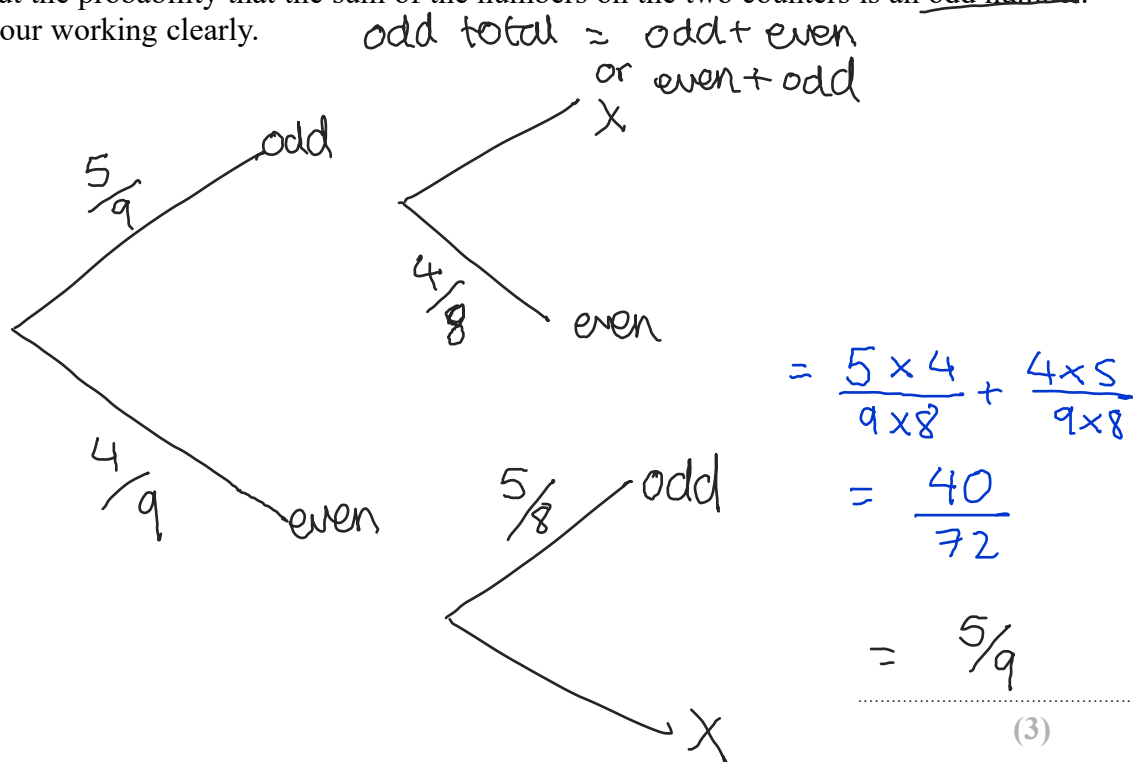
$$P(\text{even}) = \frac{4}{9}$$

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

(2)

doesn't replace so 1 less counter

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



(Total for Question 20 is 5 marks)

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

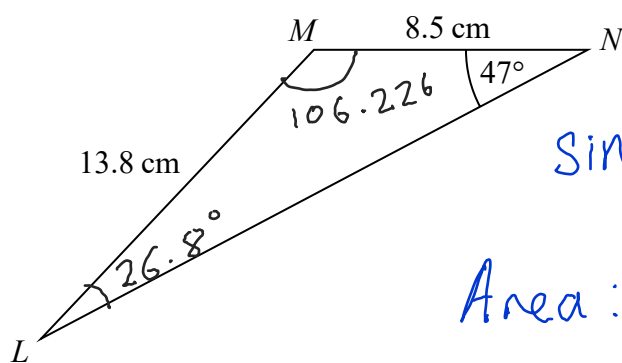


Diagram **NOT** accurately drawn

Sine rule: $\frac{\sin A}{a} = \frac{\sin B}{b}$

Area: $\frac{1}{2} ab \sin C$

Work out the area of triangle LMN .

Give your answer correct to 3 significant figures.

Sine rule to find $\angle MLN$: $\frac{\sin A}{8.5} = \frac{\sin 47}{13.8}$

$$\sin A = \frac{8.5 \sin 47}{13.8}$$

$$A = \sin^{-1}(\quad) = 26.7739\dots$$

$$\angle LMN = 180 - A - 47 = 106.226\dots^\circ$$

\uparrow
 180° in a triangle

$$\text{Area} = \frac{1}{2} \times 13.8 \times 8.5 \times \sin 106.226$$

$$= 56.313\dots \text{ cm}^2$$

3sf round down

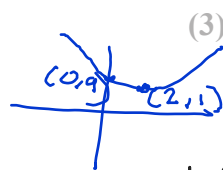
$$\dots\dots\dots 56.3 \text{ cm}^2$$

(Total for Question 21 is 6 marks)

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

$$\begin{aligned}
 &= 2 \left(x^2 - 4x \right) + 9 && \text{Take 2 factor out} \\
 &= 2 \left((x - 2)^2 - 4 \right) + 9 && \text{complete the square} \\
 &= 2(x - 2)^2 - 8 + 9 && \text{expand first bracket} \\
 &= 2(x - 2)^2 + 1
 \end{aligned}$$

(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.



Turning point $(2, 1)$ is above the x axis and the curve is a positive quadratic so it doesn't intersect the x axis (1)

(Total for Question 22 is 4 marks)

23 $ABCD$ is a parallelogram.

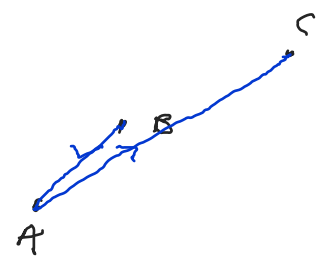
$$\vec{AB} = \begin{pmatrix} 2 \\ 3 \end{pmatrix} \quad \vec{AC} = \begin{pmatrix} 9 \\ 4 \end{pmatrix}$$

Find the magnitude of \vec{BC}

$$\begin{aligned}
 \vec{BC} &= \vec{BA} + \vec{BC} \\
 &= -\vec{AB} + \vec{BC}
 \end{aligned}$$

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

$$\text{magnitude} = \sqrt{7^2 + 1^2} = 5\sqrt{2}$$



(Total for Question 23 is 3 marks)

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

Show your working clearly.

$$\frac{\sqrt{12}-1}{2-\sqrt{3}} \times \frac{(2+\sqrt{3})}{(2+\sqrt{3})}$$

$$\frac{2\sqrt{12} + \sqrt{36} - 2 - \sqrt{3}}{4-3} = \frac{4+3\sqrt{3}}{1}$$

$$= 4+3\sqrt{3}$$

Rationalise

(Total for Question 24 is 4 marks)

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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, $t \geq 0$, is s metres, where

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

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

At rest when speed = 0 $\rightarrow v$ is the rate of change of displacement
so $v = \frac{ds}{dt}$

$$\frac{ds}{dt} \quad s = t^3 - 5t^2 - 8t + 3$$

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

$$\frac{d}{dx} x^n = nx^{n-1}$$

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

$$\begin{array}{r} x \text{ to } 3x - 8 = -24 \\ + 10x - 10 \\ \hline -12, +2 \end{array}$$

$$\begin{array}{r} 3t^2 + 2 \quad | \quad -12 - 8 \\ t(3t+2) \quad | \quad -4(3t+2) \\ \hline \end{array}$$

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

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

can't be negative

(Total for Question 25 is 4 marks)

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TOTAL FOR PAPER IS 100 MARKS

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