Write your name here

Surname Model Solutions | 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 ▶

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1/2/1/1/1/

S 5 1 8 3 3 A 0 1 2 4

PEARSON

International GCSE Mathematics

Formulae sheet – Higher Tier

Arithmetic series

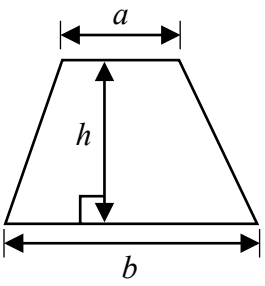
Sum to n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$

The quadratic equation

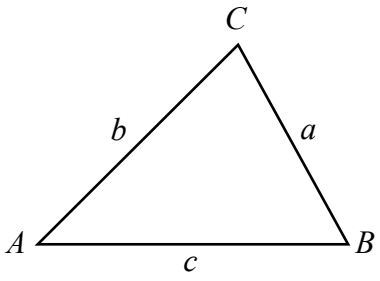
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:

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

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



Trigonometry



In any triangle *ABC*

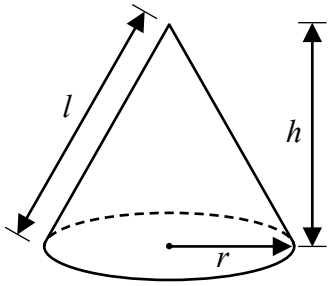
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

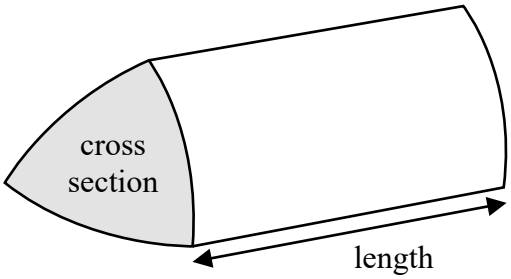
Area of triangle $= \frac{1}{2}ab\sin C$

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

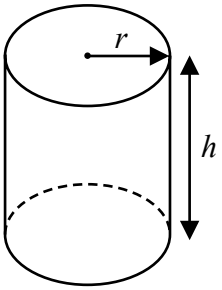
Curved surface area of cone $= \pi rl$



Volume of prism
= area of cross section × length

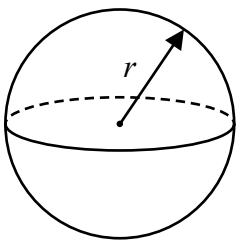


Volume of cylinder $= \pi r^2 h$
Curved surface area of cylinder $= 2\pi rh$



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

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

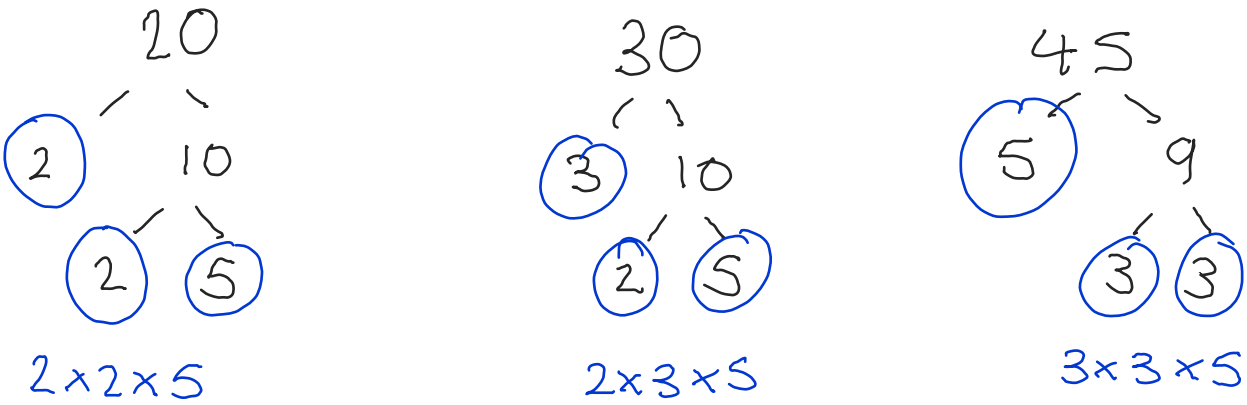


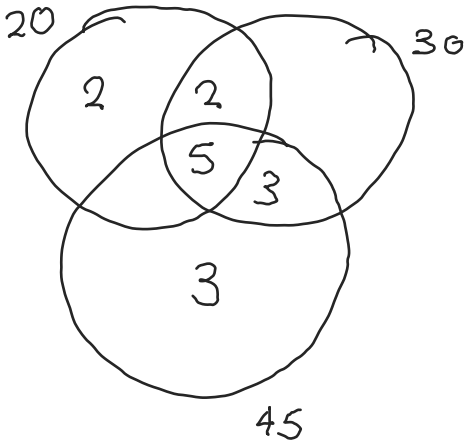
Answer ALL TWENTY FIVE questions.

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



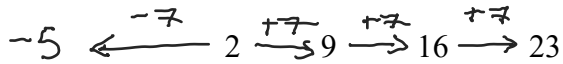


LCM =
2 × 2 × 3 × 3 × 5
= 4 × 9 × 5

= 180

(Total for Question 1 is 3 marks)

2 The first four terms of an arithmetic sequence are



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

D : Difference 7
n : place n n
0 : 0th term −5

7n − 5

(Total for Question 2 is 2 marks)

3

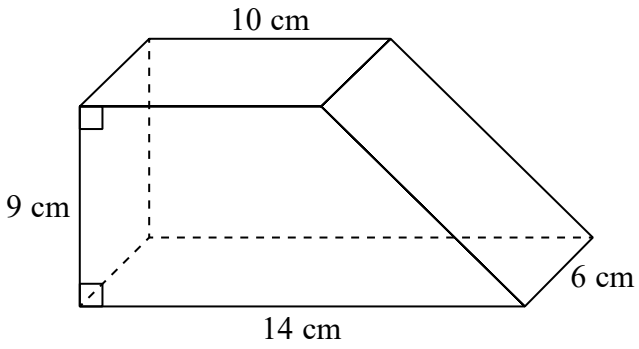


Diagram **NOT** accurately drawn

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

Work out the mass of the prism.

Density = $\frac{\text{mass}}{\text{volume}}$

Volume = Area of cross section × depth

= $\frac{1}{2}(10+4) \times 9 \times 6$

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

Mass = Density × Vol

= 0.7×648

= 453.6 g

(Total for Question 3 is 4 marks)

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

p^{5+4}

p^9

(1)

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

$m^{4 \times -3}$

m^{-12}

(1)

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

1

(1)

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

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

$2^{1/3}$

(1)

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

expand bracket

$5x + 35 = 2x - 10$

$-2x$

$3x + 35 = -10$

-35

$3x = -45$

$\div 3$

$x = -15$

$x =$ −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

Decrease 7.5% = 100% − 7.5% = 92.5%
= ×0.925

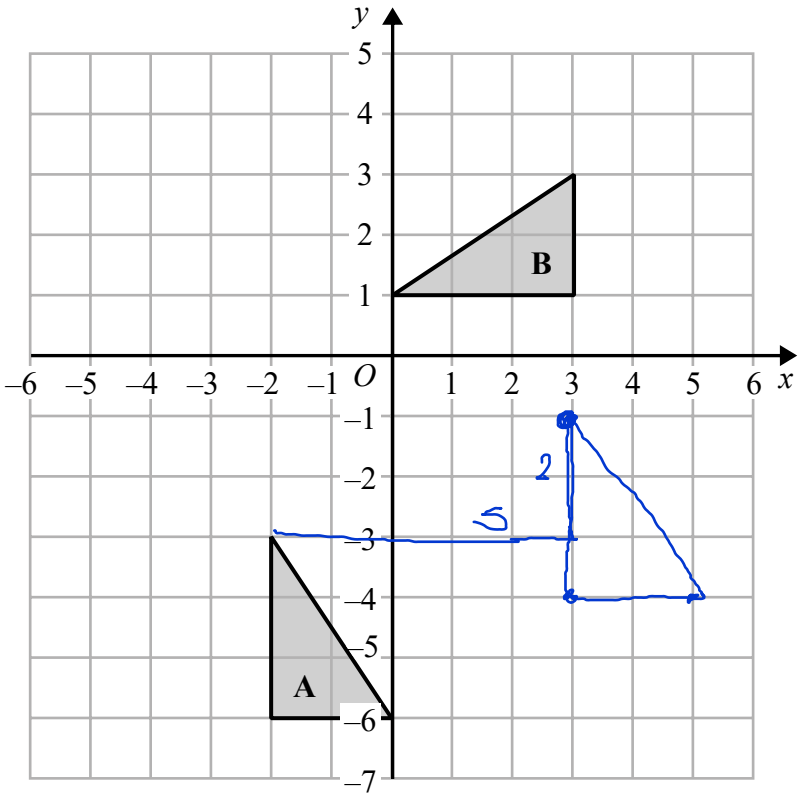
5g = 14,000
20g = 56,000

In 2013, 20g = 56000 × 0.925

= 51800 rupees

(Total for Question 5 is 4 marks)

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

Mean = sum of values / frequency

(a) Find the value of d.

(1) $\frac{a+b+c+d}{4} = 15$ (2) $a+b+c=39$

substitute (2)

$a+b+c+d = 60$

$39 + d = 60$

-39

$d = 21$

$d =$ 21

(2)

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

Range = biggest − smallest

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

(1) $d - a = 10$

$21 - a = 10$

$a = 11$

11, b, c, d

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

Using (2), $a+b+c=39$

$11+b+c=39$

$b+c=28$

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.

Interest 2% : 100 + 2 = 102% = ×1.02

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

initial value

multiplier (interest)

= 42448.32

HK$ 42448.32

(Total for Question 8 is 3 marks)

9 Solve the simultaneous equations

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

Show clear algebraic working.

① × 2 = $6x + 2y = 26$

② = $x - 2y = 9$ +

$7x = 35$

$\div 7$

$x = 5$

Using ①: $3(5) + y = 13$

$15 + y = 13$

-15

$y = -2$

$x =$ 5

$y =$ -2

(Total for Question 9 is 3 marks)

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

$4\frac{2}{3} = \frac{14}{3}$ $\quad 3\frac{5}{9} = \frac{32}{9}$ $\quad 1\frac{5}{16} = \frac{21}{16}$

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

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

(Total for Question 10 is 3 marks)

11

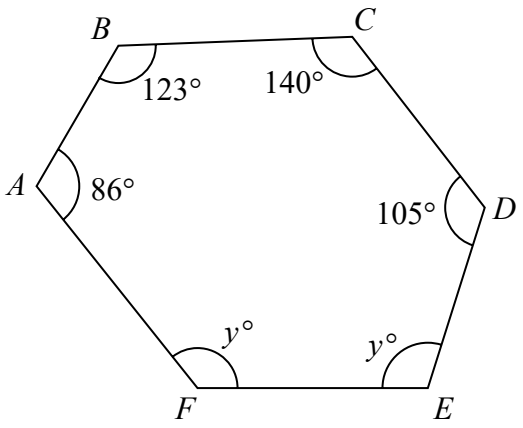


Diagram **NOT** accurately drawn

ABCDEF is a hexagon.

Work out the value of y.

Sum of interior angles = $180(n-2)$
n = number of sides

Hexagon $n = 6$

$\therefore 180(6-2) = 720°$

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

collect like terms

$2y + 454 = 720$

-454

$2y = 266$

$\div 2$

$y = 133$

$y =$ 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.

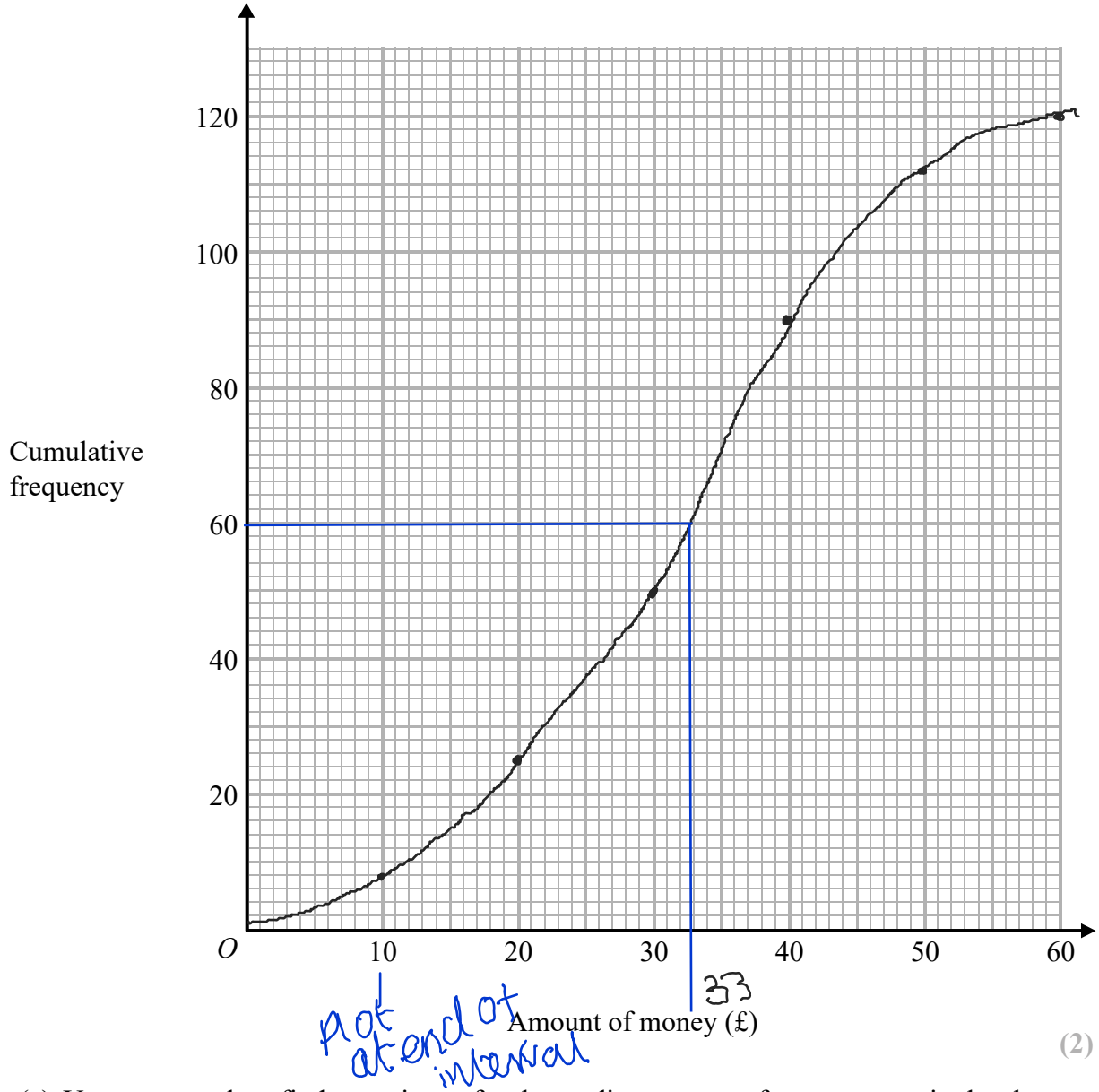
Amount of money (£m)	**Frequency**
$0 < m \leqslant 10$	8
$10 < m \leqslant 20$	17
$20 < m \leqslant 30$	25
$30 < m \leqslant 40$	40
$40 < m \leqslant 50$	22
$50 < m \leqslant 60$	8

(a) Complete the cumulative frequency table.

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

$-c \quad -c$

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

$\times 2$

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

$\div a$

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

$\sqrt{}$

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

always +ve

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

(Total for Question 13 is 3 marks)

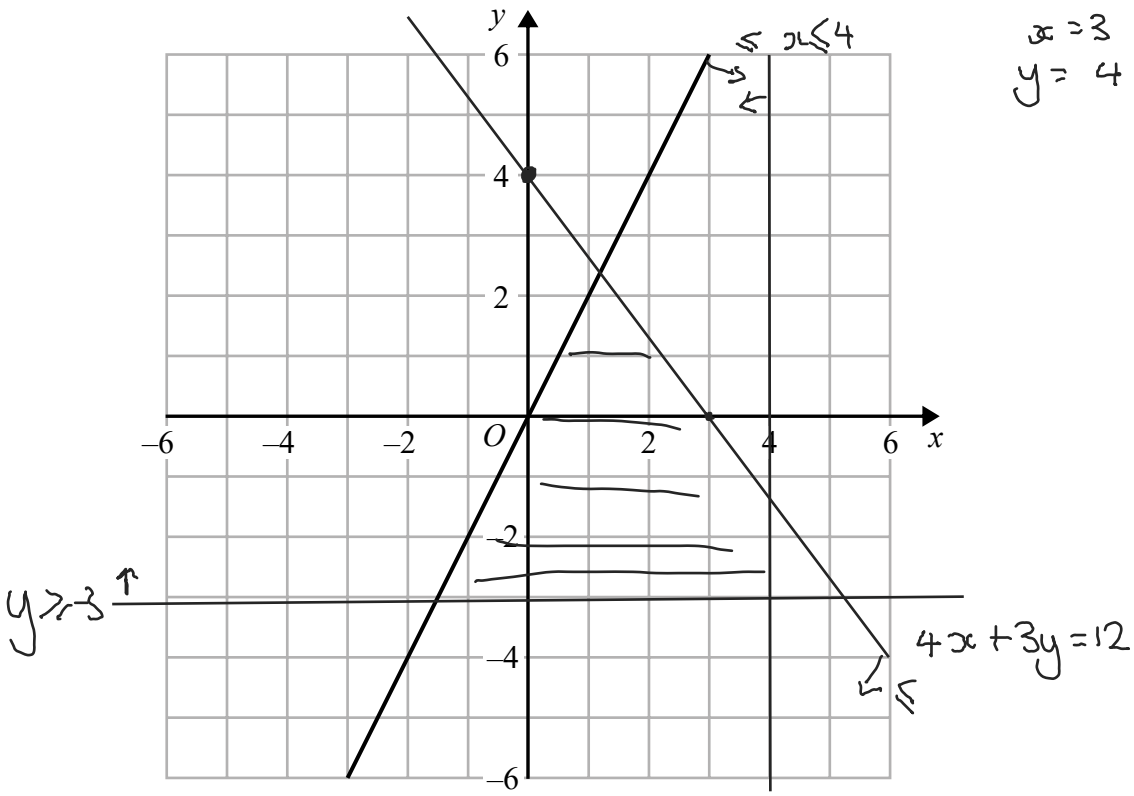
14 The line with equation $y = 2x$ is drawn on the grid.

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

$3y = 12 - 4x$

$y = 4 - \frac{4}{3}x$

(2)



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

$y \leqslant 2x$

$4x + 3y \leqslant 12$

$y \geqslant -3$

$x \leqslant 4$

All $\leqslant$ or $\geqslant$ so soild line

(3)

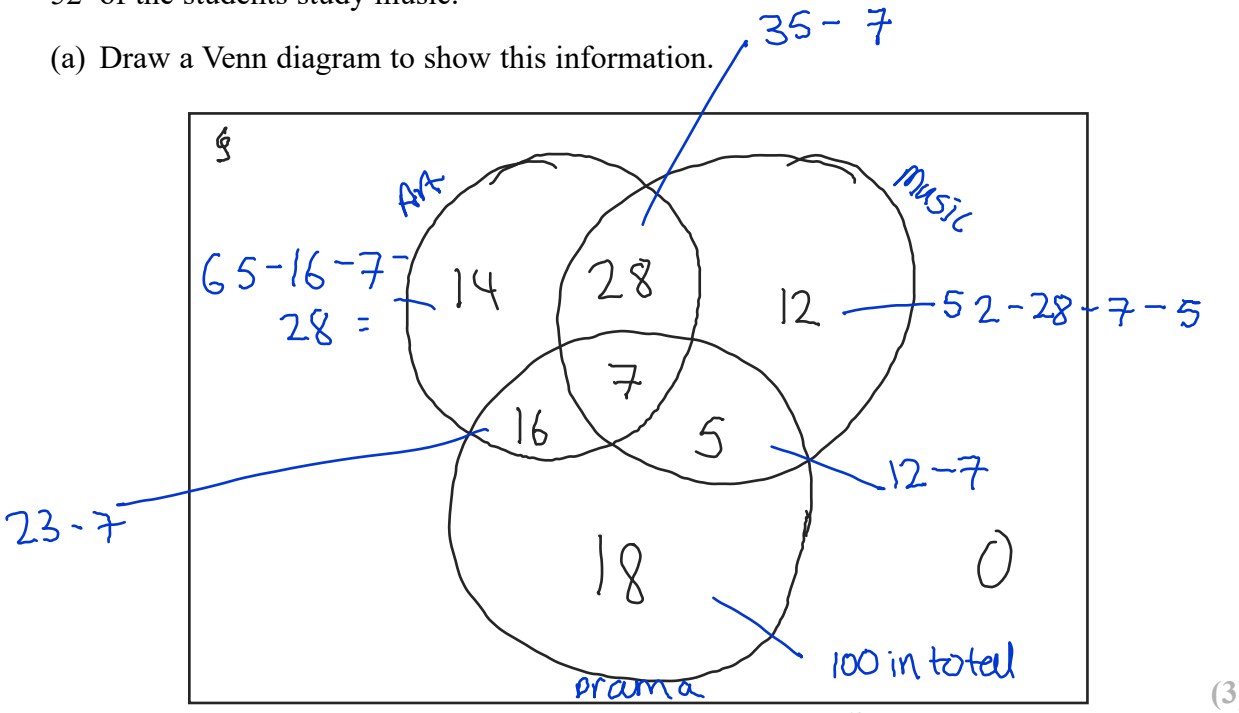
(Total for Question 14 is 5 marks)

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.



(3)

100 - 16 - 7 - 5 - 14 - 28 - 12 = 18

One of the 100 students is selected at random.

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

$= \frac{16+18}{100} = \frac{34}{100} = \frac{17}{50}$

(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 $\frac{23}{46} = \frac{1}{2}$

(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

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

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

$24 \times 2.5^3 = k$

$k = 375$

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

(3)

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

cross multiply

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

$g^3 = 375 \times 9$

$= 3375$

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

$g = 15$

$g =$ 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 facter

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**.

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

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

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

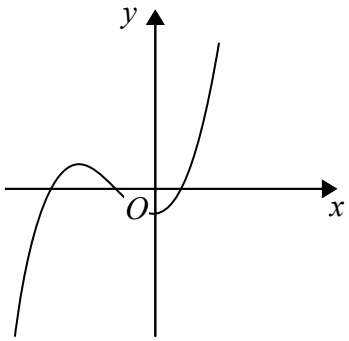
B → A = ÷ by sf

728 cm^3

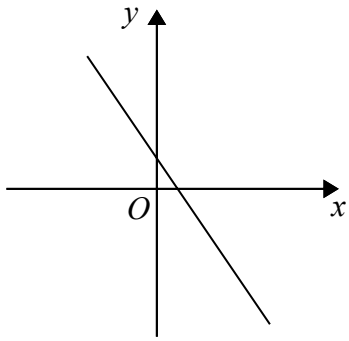
(Total for Question 18 is 3 marks)

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

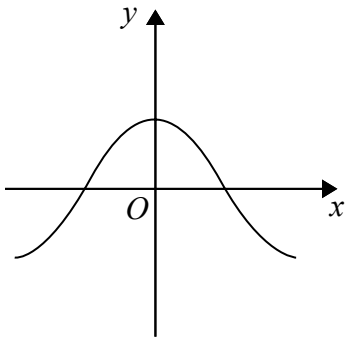
19 Here are nine graphs.



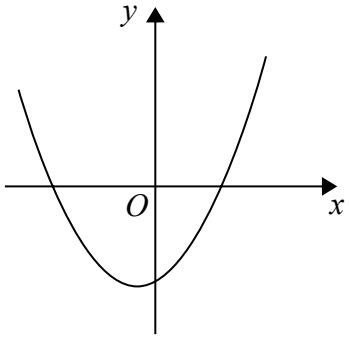
Graph A



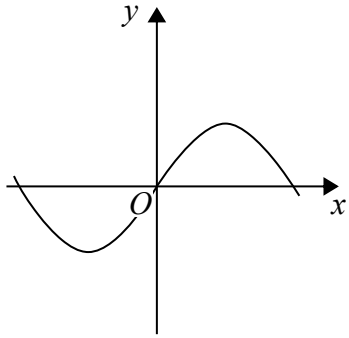
Graph B



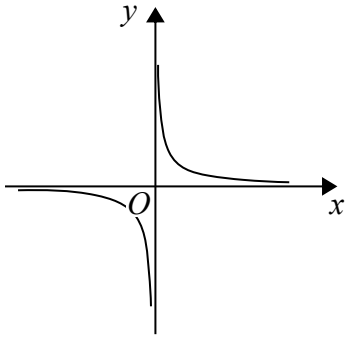
Graph C



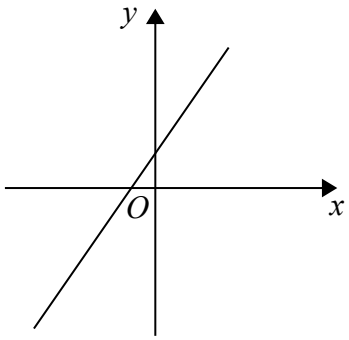
Graph D



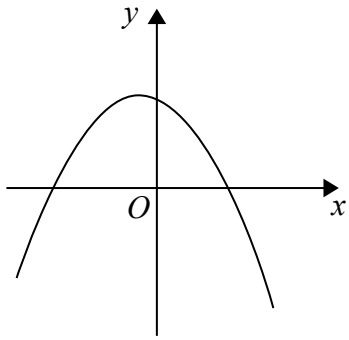
Graph E



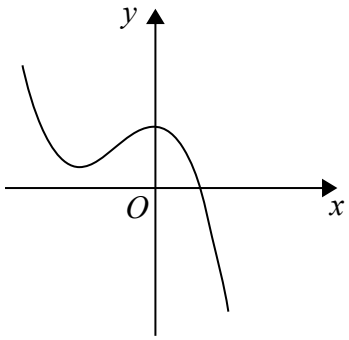
Graph F



Graph G



Graph H



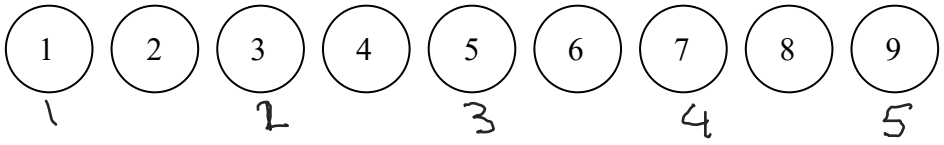
Graph I

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.

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

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

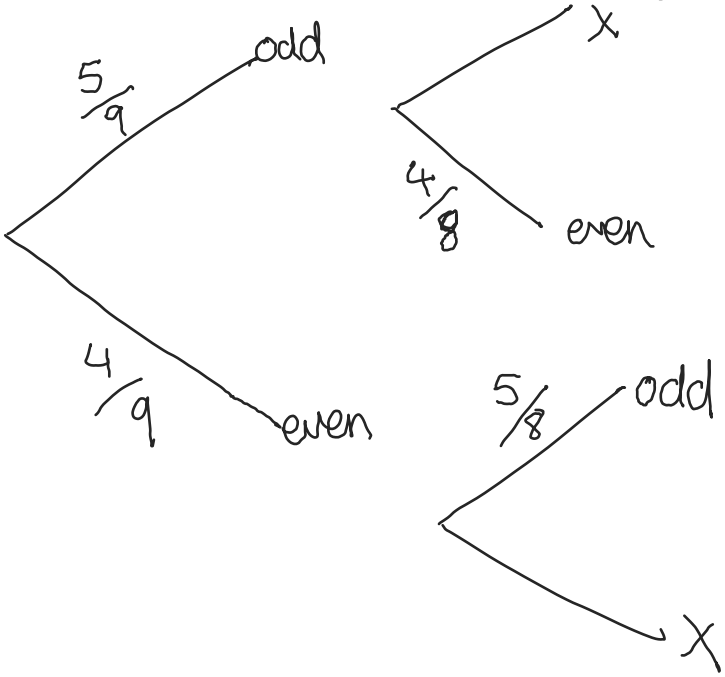
doesn't replace so 1 less counter

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

(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 total = odd + even
or even + odd



$= \frac{5 \times 4}{9 \times 8} + \frac{4 \times 5}{9 \times 8}$

$= \frac{40}{72}$

$= \frac{5}{9}$

(3)

(Total for Question 20 is 5 marks)

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

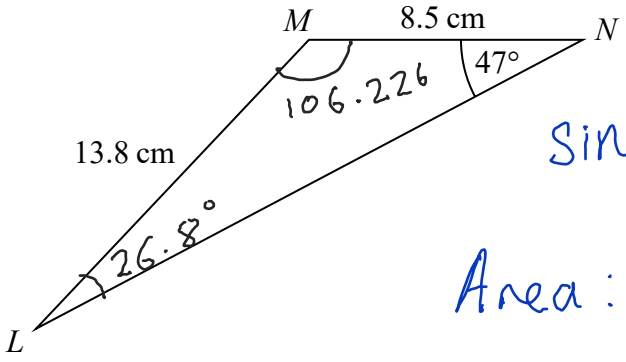


Diagram **NOT** accurately drawn

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 $\angle MLN$: $\frac{\sin A}{8.5} = \frac{\sin 47}{13.8}$

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

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

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

180° in a triangle

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

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

3sf round down

56.3 cm^2

(Total for Question 21 is 6 marks)

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

Take 2 factor out

$= 2(x^2 - 4x) + 9$

complete the square

$= 2((x - 2)^2 - 4) + 9$

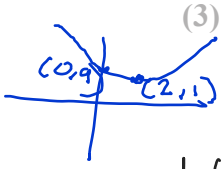
expand first bracket

$= 2(x-2)^2 - 8 + 9$

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

(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.



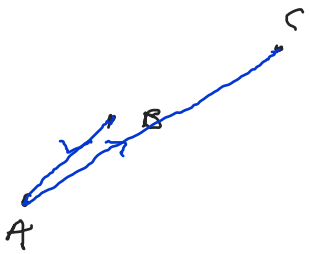
Turning point (2, 1) is above the x axis and the curve is a positive quadratic so it doesn't interesect the x axis

(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 $\overrightarrow{BC}$

$BC = BA + BC$

$= -AB + BC$

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

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

(Total for Question 23 is 3 marks)

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

Show your working clearly.

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

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

$= 4+3\sqrt{3}$

(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.

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

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

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

$\dfrac{d}{dx}(x^n) = nx^{n-1}$

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

x to $3x-8$: -24
$+$ to -10
$-12, +2$

$3t^2 + 2 \mid -12 - 8$
$t(3t+2) \mid -4(3t+2)$

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

$t = -\dfrac{2}{3}$ can't be negative

$t = 4$

$t =$ 4

(Total for Question 25 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS

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