

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson Edexcel
International GCSE**

Centre Number

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Candidate Number

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Wednesday 15 January 2020

Morning (Time: 2 hours)

Paper Reference **4MA1/2HR**

**Mathematics A
Paper 2HR
Higher Tier**



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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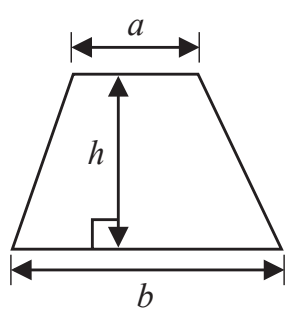
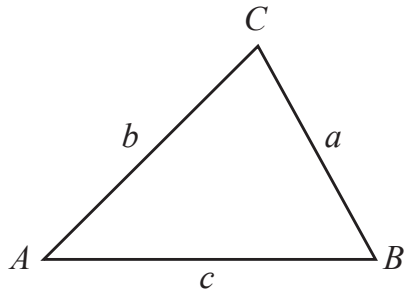
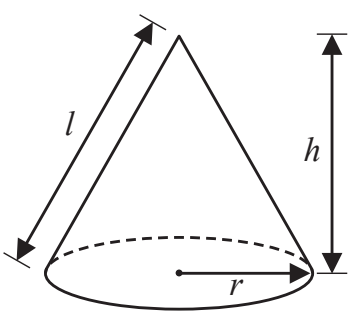
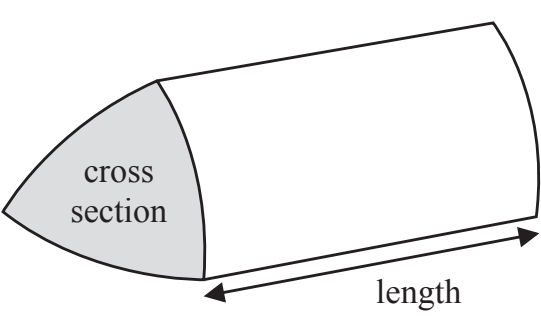
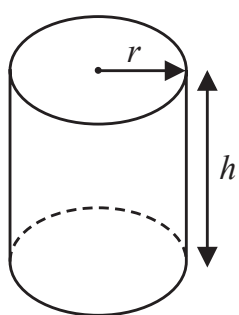
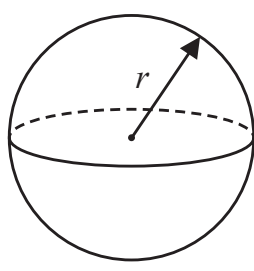
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Pearson

International GCSE Mathematics

Formulae sheet – Higher Tier

<p>Arithmetic series</p> <p>Sum to n terms, $S_n = \frac{n}{2} [2a + (n - 1)d]$</p>	<p>Area of trapezium = $\frac{1}{2}(a + b)h$</p> <div style="text-align: center;">  </div>
<p>The quadratic equation</p> <p>The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:</p> $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	
<p>Trigonometry</p> <div style="text-align: center;">  </div>	<p>In any triangle ABC</p> <p>Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$</p> <p>Cosine Rule $a^2 = b^2 + c^2 - 2bc \cos A$</p> <p>Area of triangle = $\frac{1}{2}ab \sin C$</p>
<p>Volume of cone = $\frac{1}{3} \pi r^2 h$</p> <p>Curved surface area of cone = $\pi r l$</p> <div style="text-align: center;">  </div>	<p>Volume of prism = area of cross section \times length</p> <div style="text-align: center;">  </div>
<p>Volume of cylinder = $\pi r^2 h$</p> <p>Curved surface area of cylinder = $2\pi r h$</p> <div style="text-align: center;">  </div>	<p>Volume of sphere = $\frac{4}{3} \pi r^3$</p> <p>Surface area of sphere = $4\pi r^2$</p> <div style="text-align: center;">  </div>

Answer ALL TWENTY SIX questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

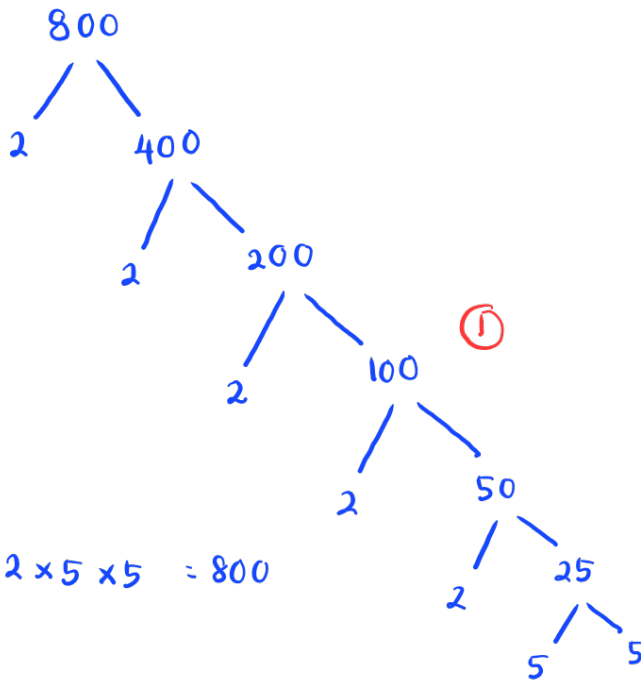
- 1 (a) Write $5^{17} \times 5^2$ as a single power of 5

$$5^{17+2} = 5^{19}$$

$$5^{19} \quad \textcircled{1}$$

(1)

- (b) Write 800 as a product of its prime factors.
Show your working clearly.



$$2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5 = 800$$

$$2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5 \quad \textcircled{1}$$

(2)

(Total for Question 1 is 3 marks)

- 2 The table gives information about the amount of money, in £, that Fiona spent in a grocery store each week during 2019

Amount spent (£x)	Frequency
$0 \leq x < 20$	5
$20 \leq x < 40$	11
$40 \leq x < 60$	8
$60 \leq x < 80$	19
$80 \leq x < 100$	9

Work out an estimate for the total amount of money that Fiona spent in the grocery store during 2019

Total estimation : \sum midpoint \times frequency for all classes

$$\text{Total} = (10 \times 5) + (30 \times 11) + (50 \times 8) + (70 \times 19) + (90 \times 9) \text{ (1)}$$

$$= 50 + 330 + 400 + 1330 + 810 \text{ (1)}$$

$$= 2920 \text{ (1)}$$

£ 2920

(Total for Question 2 is 3 marks)

3 Three tins, A , B and C , each contain buttons.

Tin A contains x buttons.

Tin B contains 4 times the number of buttons that tin A contains.

Tin C contains 7 fewer buttons than tin A .

The total number of buttons in the three tins is 137

Work out the number of buttons in tin C .

$$A = x$$

$$B = 4x \quad (1)$$

$$C = x - 7$$

$$\text{Total} = A + B + C$$

$$= x + 4x + (x - 7) = 137 \quad (1)$$

$$= 6x = 137 + 7$$

$$6x = 144$$

$$x = \frac{144}{6} = 24 \quad (1)$$

$$C = 24 - 7$$

$$= 17 \quad (1)$$

17

(Total for Question 3 is 4 marks)

- 4 The diagram shows a rectangle and a diagonal of the rectangle.

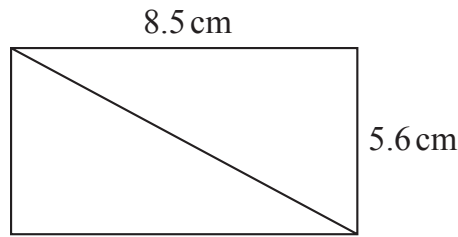


Diagram **NOT** accurately drawn

Work out the length of the diagonal of the rectangle.
Give your answer correct to 1 decimal place.

Using Pythagoras' theorem :

$$\begin{aligned} \text{diagonal} &= \sqrt{8.5^2 + 5.6^2} \quad (1) \\ &= \sqrt{103.61} \quad (1) \\ &= 10.2 \quad (1) \end{aligned}$$

..... 10.2 cm

(Total for Question 4 is 3 marks)

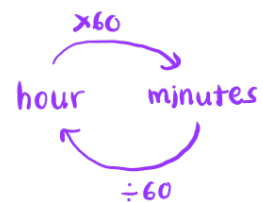
- 5 A plane takes 3 hours 36 minutes to fly from the Cayman Islands to New York.
The plane flies a distance of 2470 km.

Work out the average speed of the plane in km/h.
Give your answer correct to the nearest whole number.

$$36 \text{ minutes} \times \frac{1 \text{ hour}}{60 \text{ minutes}} = 0.6 \text{ hour} \quad (1)$$

$$\begin{aligned} \text{speed} &= \frac{2470 \text{ km}}{3.6 \text{ h}} \quad (1) \\ &= 686 \text{ km/h} \quad (1) \end{aligned}$$

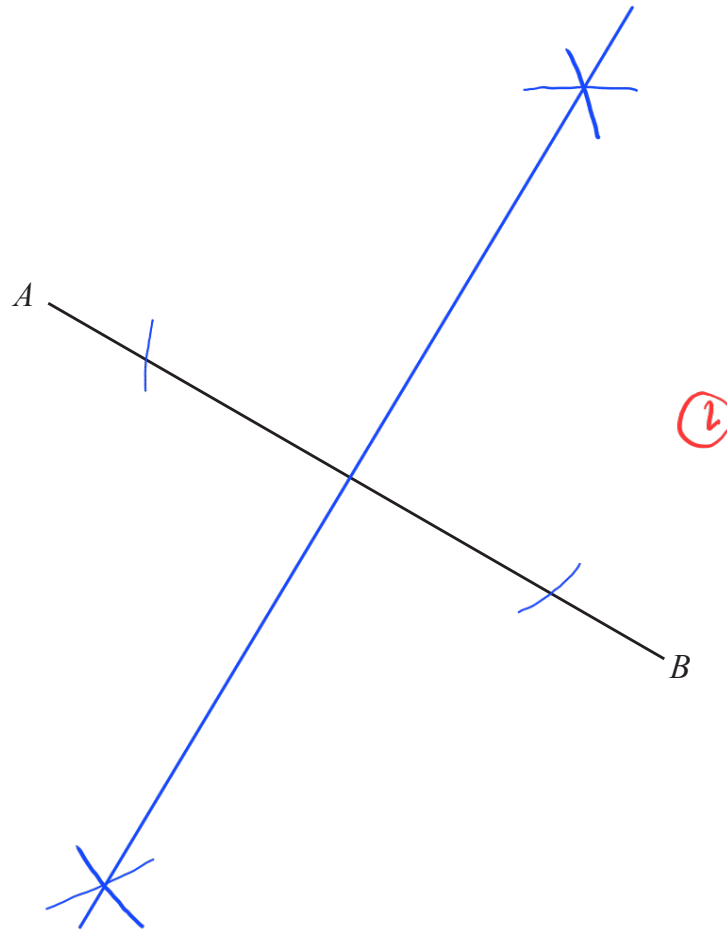
$$\text{speed} = \frac{\text{distance}}{\text{time}}$$



..... 686 km/h

(Total for Question 5 is 3 marks)

- 6 Use ruler and compasses only to construct the perpendicular bisector of the line AB . You must show all your construction lines.



(Total for Question 6 is 2 marks)

7 Solve the simultaneous equations

$$\begin{aligned} 3x + 5y &= 6 \\ 7x - 5y &= -11 \quad \text{--- ①} \end{aligned}$$

$$x = \frac{6-5y}{3} \quad \text{--- ②}$$

Show clear algebraic working.

Substitute ② into ① :

$$7\left(\frac{6-5y}{3}\right) - 5y = -11$$

$$7(6-5y) - 15y = -33$$

$$\begin{aligned} 42 - 35y - 15y &= -33 \\ -50y &= -33 - 42 \quad \left. \vphantom{-50y} \right\} -42 \end{aligned}$$

$$\begin{aligned} -50y &= -75 \quad \text{①} \\ \div 50 \quad \left. \vphantom{-50y} \right\} & y = \frac{-75}{-50} = 1.5 \quad \text{①} \end{aligned}$$

$$\begin{aligned} x &= \frac{6-5(1.5)}{3} \\ &= -0.5 \quad \text{①} \end{aligned}$$

$$\begin{aligned} x &= \dots\dots\dots -0.5 \\ y &= \dots\dots\dots 1.5 \end{aligned}$$

(Total for Question 7 is 3 marks)

8 Hamish buys a new car for \$20 000
The car depreciates in value by 19% each year.

Work out the value of the car at the end of 3 years.
Give your answer to the nearest \$.

$$\begin{aligned} \text{Value of the car each year} &= 100\% - 19\% \\ &= 81\% \quad \text{(from the value at the start of each year)} \\ &\quad \text{①} \end{aligned}$$

$$\begin{aligned} \text{Value of the car at the} &: 20\,000 \times \left(\frac{81}{100}\right)^3 \quad \text{①} \\ \text{end of year 3} & \\ &= 10\,629 \quad \text{①} \end{aligned}$$

$$\text{\$} \dots\dots\dots 10\,629$$

(Total for Question 8 is 3 marks)

- 9 The diagram shows a box in the shape of a cuboid.

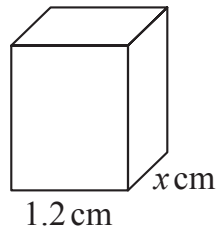


Diagram **NOT**
accurately drawn

The box is put on a table.

The face of the box in contact with the table has length 1.2 metres and width x metres.

The force exerted by the box on the table is 27 newtons.

The pressure on the table due to the box is 30 newtons/m²

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

Work out the value of x .

Area of the base of the box :

$$1.2x \text{ m}^2$$

$$30 \text{ N/m}^2 = \frac{27 \text{ N}}{1.2x \text{ m}^2} \quad (1)$$

$$1.2x = \frac{27}{30}$$

$$1.2x = 0.9$$

$$x = \frac{0.9}{1.2} \quad (1)$$

$$= 0.75 \quad (1)$$

$$x = \underline{\quad 0.75 \quad}$$

(Total for Question 9 is 3 marks)

10 The table shows information about the surface area of each of the world's oceans.

Ocean	Surface area in square kilometres
Pacific	1.56×10^8
Indian	6.86×10^7
Southern	2.03×10^7
Arctic	1.41×10^7
Atlantic	1.06×10^8

- (a) Work out the difference, in square kilometres, between the surface area of the Atlantic Ocean and the surface area of the Indian Ocean.
Give your answer in standard form.

$$\text{Atlantic} : 1.06 \times 10^8 = 10.6 \times 10^7 \quad (1)$$

$$\text{Indian} : 6.86 \times 10^7$$

$$10.6 \times 10^7 - 6.86 \times 10^7$$

$$= (10.6 - 6.86) \times 10^7$$

$$= 3.74 \times 10^7 \quad (1)$$

3.74×10^7 square kilometres
(2)

The surface area of the Pacific Ocean is k times the surface area of the Arctic Ocean.

- (b) Work out the value of k .
Give your answer correct to the nearest whole number.

$$\text{Pacific} : 1.56 \times 10^8 = 15.6 \times 10^7$$

$$\text{Arctic} : 1.41 \times 10^7$$

$$\text{Pacific} = k \times \text{Arctic}$$

$$k = \frac{\text{Pacific}}{\text{Arctic}} = \frac{15.6 \times 10^7}{1.41 \times 10^7}$$

$$= 11 \quad (1)$$

$k = 11$
(1)

(Total for Question 10 is 3 marks)

11 (a) Write down the integer values of x that satisfy the inequality $-2 < x \leq 4$

$-1, 0, 1, 2, 3, 4$ (2)

(2)

The region **R**, shown shaded in the diagram, is bounded by three straight lines.

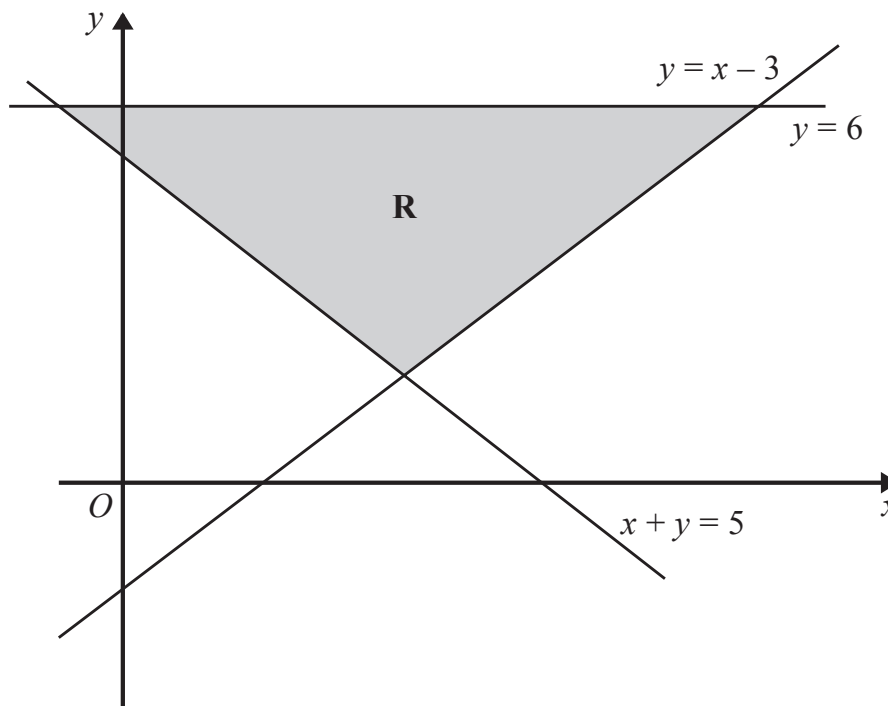


Diagram **NOT** accurately drawn

(b) Write down the three inequalities that define the region **R**.

$y \leq 6$

$x + y \geq 5$ (2)

$y \geq x - 3$

(2)

(Total for Question 11 is 4 marks)

- 12 The diagram shows two congruent isosceles triangles and parts of two congruent regular polygons, X and Y.

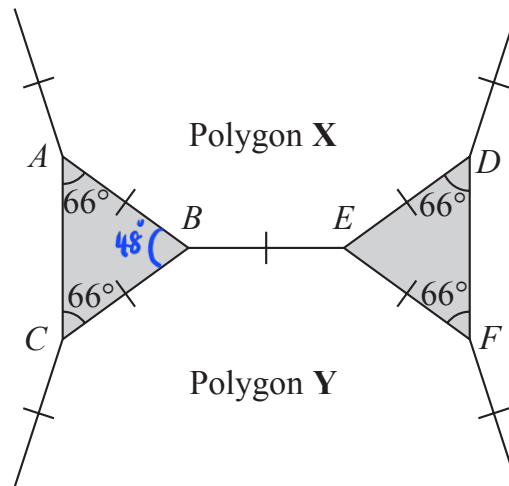


Diagram **NOT** accurately drawn

The two regular polygons each have n sides.

Work out the value of n .

$$\begin{aligned} \text{angle } ABC &= 180^\circ - 66^\circ - 66^\circ \\ &= 48^\circ \quad \textcircled{1} \end{aligned}$$

$$\begin{aligned} \text{Half of angle } ABC &= \text{exterior angle of polygon X and Y} \\ &= \frac{1}{2} \times 48^\circ = 24^\circ \end{aligned}$$

$$\text{Exterior angle of polygon} = \frac{360^\circ}{\text{no. of sides}}$$

$$24^\circ = \frac{360^\circ}{n}$$

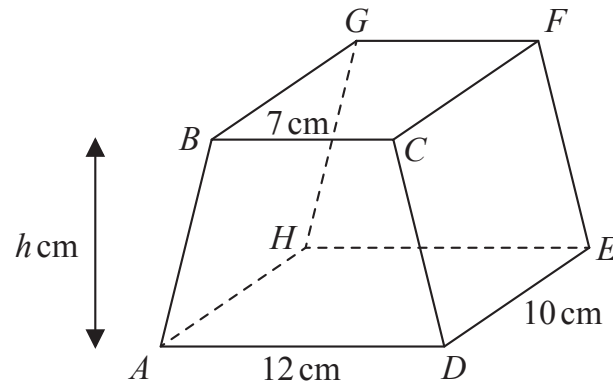
$$n = \frac{360^\circ}{24^\circ} \quad \textcircled{1}$$

$$= 15 \quad \textcircled{1}$$

$$n = \dots\dots\dots 15$$

(Total for Question 12 is 3 marks)

13

Diagram NOT
accurately drawn

The diagram shows a prism $ABCDEFGH$ in which $ABCD$ is a trapezium with BC parallel to AD and $CDEF$ is a rectangle.

$$BC = 7 \text{ cm} \quad AD = 12 \text{ cm} \quad DE = 10 \text{ cm}$$

The height of trapezium $ABCD$ is h cm

The volume of the prism is 608 cm^3

Work out the value of h .

$$\begin{aligned} \text{Volume} &= \text{area of trapezium} \times \text{width} \\ &= \frac{1}{2} \times (BC + AD) \times h \times DE \end{aligned}$$

$$\text{Volume} = \frac{1}{2} \times (7 + 12) \times h \times 10 = 608 \quad (1)$$

$$: 95h = 608$$

$$h = \frac{608}{95} \quad (1)$$

$$= 6.4 \quad (1)$$

$$h = \dots\dots\dots 6.4$$

(Total for Question 13 is 3 marks)

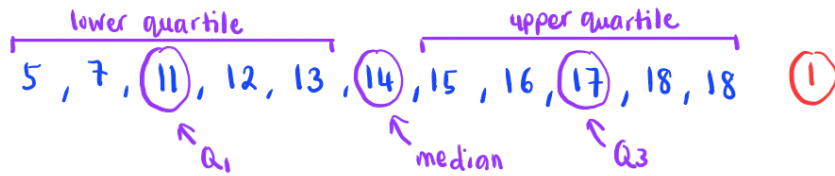
14 Max kept a record of the marks he scored in each of the 11 spelling tests he took one term.

Here are his marks.

18 5 7 12 11 18 15 16 17 13 14

Find the interquartile range of the marks.

Arrange the scores in order :



$$\begin{aligned} \text{Interquartile range} &: Q_3 - Q_1 \\ &: 17 - 11 \quad \text{①} \\ &: 6 \quad \text{①} \end{aligned}$$

6

(Total for Question 14 is 3 marks)

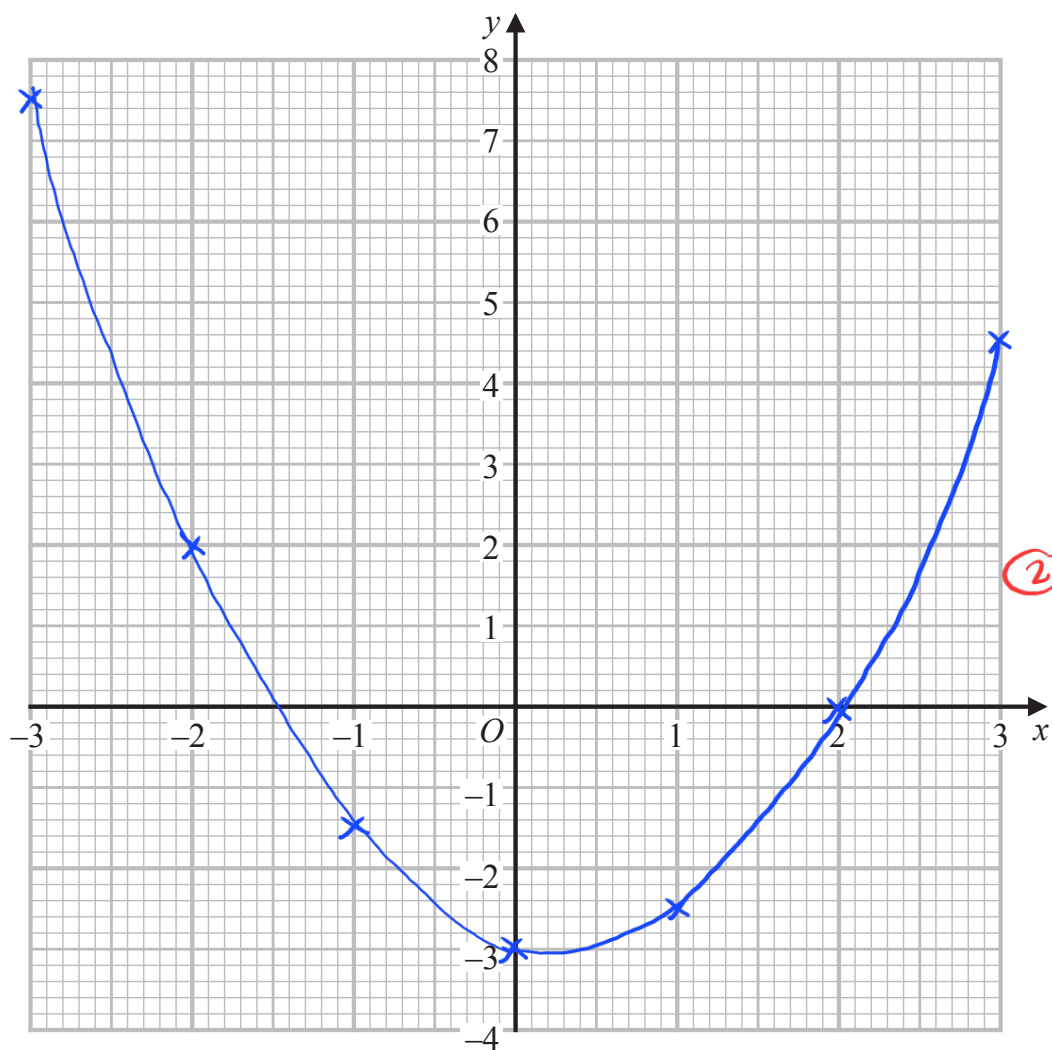
15 (a) Complete the table of values for $y = x^2 - \frac{x}{2} - 3$

x	-3	-2	-1	0	1	2	3
y	7.5	2	-1.5	-3	-2.5	0	4.5

(2)

(2)

(b) On the grid, draw the graph of $y = x^2 - \frac{x}{2} - 3$ for values of x from -3 to 3



(2)

(2)

(Total for Question 15 is 4 marks)

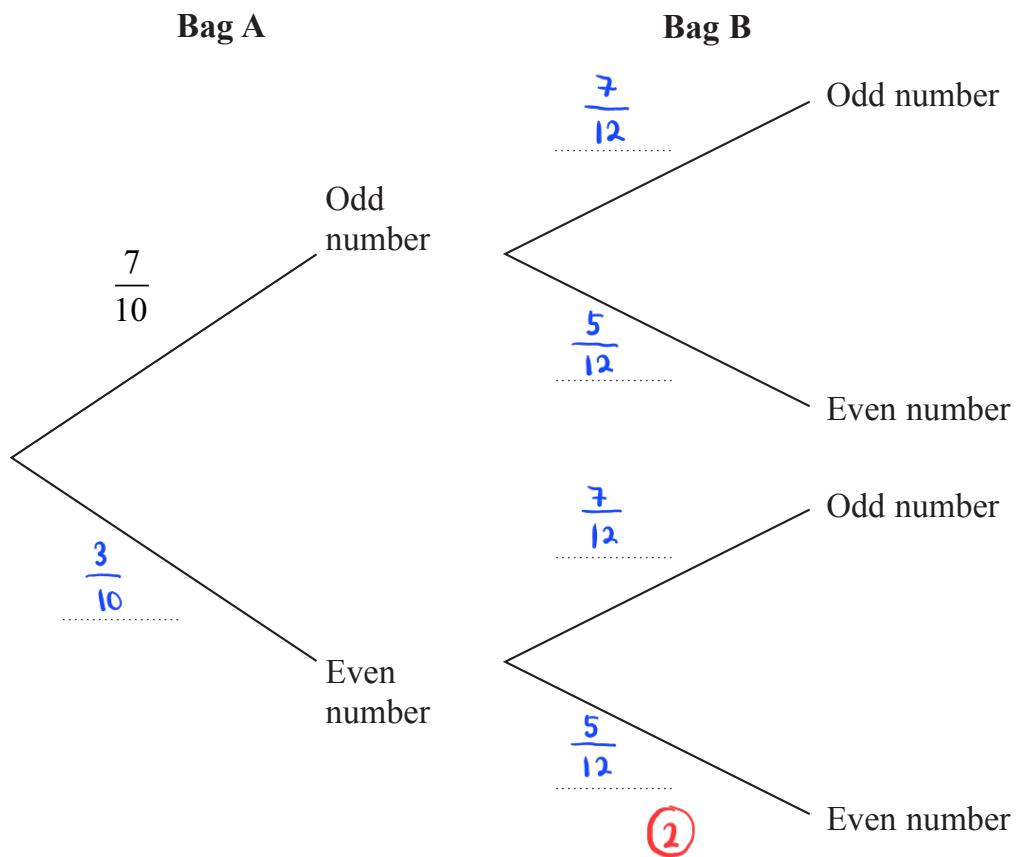
16 Cody has two bags of counters, bag A and bag B.

Each of the counters has either an odd number or an even number written on it.

There are 10 counters in bag A and 7 of these counters have an **odd** number written on them. There are 12 counters in bag B and 7 of these counters have an **odd** number written on them.

Cody is going to take at random a counter from bag A and a counter from bag B.

(a) Complete the probability tree diagram.



(2)

- (b) Calculate the probability that the total of the numbers on the two counters will be an odd number.

To get a total of odd numbers,

① odd + even

② even + odd

$$\textcircled{1} \frac{7}{10} \times \frac{5}{12} = \frac{7}{24} \textcircled{1}$$

$$\textcircled{2} \frac{3}{10} \times \frac{7}{12} = \frac{7}{40}$$

$$\text{Total} = \frac{7}{24} + \frac{7}{40} \textcircled{1}$$

$$= \frac{56}{120} \textcircled{1}$$

$$\frac{56}{120}$$

(3)

Harriet also has a bag of counters.

Each of her counters also has either an odd number or an even number written on it.

Harriet is going to take at random a counter from her bag of counters.

The probability that the number on each of Cody's two counters **and** the number on

Harriet's counter will all be even is $\frac{3}{100}$

- (c) Find the least number of counters that Harriet has in her bag.
Show your working clearly.

Let Harriet's even counter = E

Let Harriet's odd counter = D

$$P(\text{all even}) = \frac{3}{10} \times \frac{5}{12} \times \frac{E}{E+D} = \frac{3}{100} \textcircled{1}$$

$$\frac{E}{E+D} = \frac{0.03}{0.125}$$

$$\frac{E}{E+D} = 0.24 \textcircled{1}$$

$$E = 0.24E + 0.24D$$

$$0.76E = 0.24D$$

$$E = \frac{6}{19}D$$

→ 6 E and 19 D

25

∴ Least number of counter is $6 + 19 = 25$ ①

(3)

(Total for Question 16 is 8 marks)

17 Some students in a school were asked the following question.

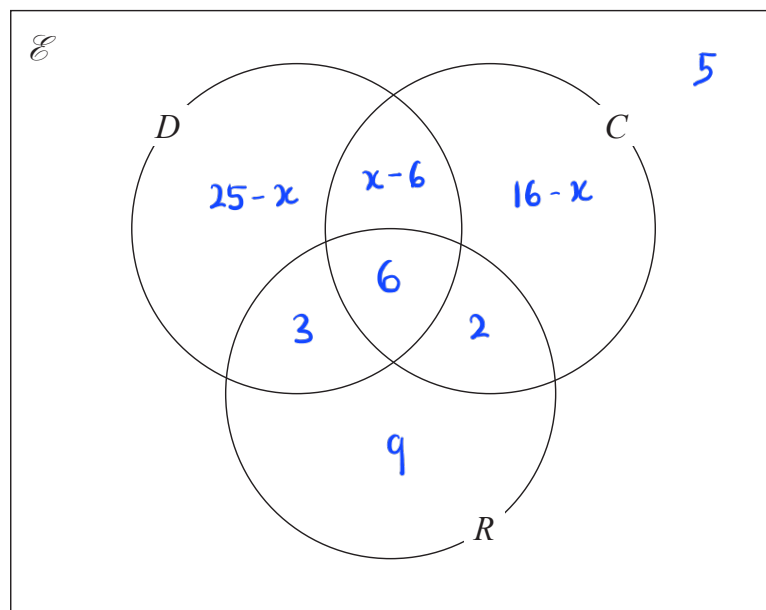
“Do you have a dog (D), a cat (C) or a rabbit (R)?”

Of these students

- 28 have a dog
- 18 have a cat
- 20 have a rabbit
- 8 have both a cat and a rabbit
- 9 have both a dog and a rabbit
- x have both a dog and a cat
- 6 have a dog, a cat and a rabbit
- 5 have not got a dog or a cat or a rabbit

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

Give the numbers in terms of x where necessary.



③

(3)

Given that a total of 50 students answered the question,

(b) work out the value of x .

$$(25 - x) + (x - 6) + (16 - x) + 3 + 6 + 9 + 2 + 5 = 50 \quad \text{①}$$

$$60 - x = 50$$

$$x = 60 - 50$$

$$= 10 \quad \text{①}$$

$$x = \dots\dots\dots 10$$

(2)

↗ not C ↘ not D

(c) Find $n(C' \cap D')$

$$9 + 5 = 14 \quad \textcircled{1}$$

14

(1)

(Total for Question 17 is 6 marks)

18

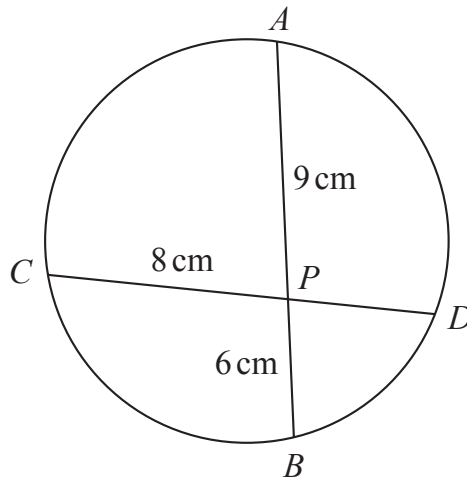


Diagram **NOT** accurately drawn

APB and CPD are chords of a circle.

$$AP = 9 \text{ cm} \quad PB = 6 \text{ cm} \quad CP = 8 \text{ cm}$$

Calculate the length of PD .

$$AP \times PB = CP \times PD$$

$$9 \times 6 = 8 \times PD \quad \textcircled{1}$$

$$PD = \frac{9 \times 6}{8}$$

$$= 6.75 \quad \textcircled{1}$$

6.75

cm

(Total for Question 18 is 2 marks)

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

Show clear algebraic working.

$$2(4-3x) - 5(3x-5) = -3(5)(2) \quad (1)$$

$$8 - 6x - 15x + 25 = -30 \quad (1)$$

$$33 - 21x = -30$$

$$21x = 63$$

$$x = \frac{63}{21}$$

$$= 3 \quad (1)$$

$$x = \dots\dots\dots 3 \quad (3)$$

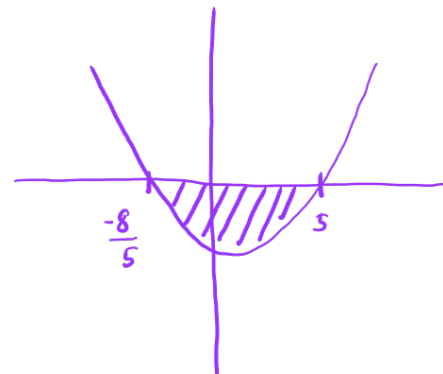
(b) Solve the inequality $5y^2 - 17y \leq 40$

$$5y^2 - 17y - 40 \leq 0$$

$$(5y+8)(y-5) \leq 0 \quad (1)$$

$$y = -\frac{8}{5} \text{ or } y = 5 \quad (1)$$

$$-\frac{8}{5} \leq y \leq 5 \quad (1)$$



$$-\frac{8}{5} \leq y \leq 5$$

(3)

(Total for Question 19 is 6 marks)

20 The diagram shows two similar vases, **A** and **B**.

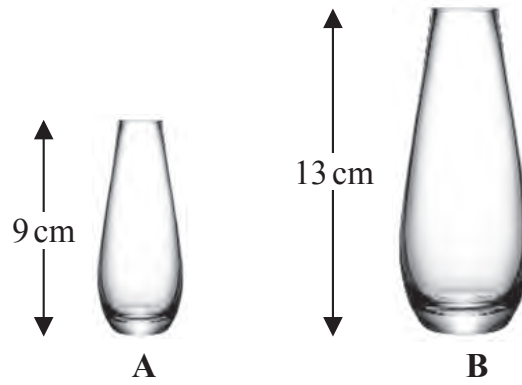


Diagram **NOT** accurately drawn

The height of vase **A** is 9 cm and the height of vase **B** is 13 cm.

Given that

$$\text{surface area of vase A} + \text{surface area of vase B} = 1800 \text{ cm}^2$$

calculate the surface area of vase **A**.

Comparing scale factor of **A** and **B** :

$$\begin{array}{l} \text{A} \quad : \quad \text{B} \\ \text{Height} \quad 9 \quad : \quad 13 \\ \text{Area} \quad 9^2 \quad : \quad 13^2 \\ \quad = 81 \quad : \quad 169 \end{array}$$

$$\therefore \frac{A}{B} = \frac{81}{169} \quad \textcircled{1}$$

$$A + B = 1800$$

$$A + \frac{169}{81}A = 1800 \quad \textcircled{1}$$

$$\frac{250}{81}A = 1800 \quad \textcircled{1}$$

$$A = 583.2 \quad \textcircled{1}$$

$$\dots\dots\dots 583.2 \text{ cm}^2$$

(Total for Question 20 is 4 marks)

21 (a) Simplify fully $\frac{10x^2 + 23x + 12}{4x^2 - 9}$

Factorising numerator :

$$10x^2 + 23x + 12 \equiv (5x+4)(2x+3) \quad (1)$$

Factorising denominator :

$$4x^2 - 9 \equiv (2x+3)(2x-3) \quad (1)$$

$$\frac{10x^2 + 23x + 12}{4x^2 - 9} \equiv \frac{(5x+4)(2x+3)}{(2x+3)(2x-3)}$$

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

$$\frac{5x+4}{2x-3}$$

(3)

$$2^{2y} \times 2^{3y+2} = \frac{8^{5y}}{4^n}$$

(b) Find an expression for n in terms of y .
Show clear algebraic working and simplify your expression.

$$8^{5y} = (2^3)^{5y}$$

$$= 2^{15y} \quad (1)$$

$$4^n = (2^2)^n$$

$$= 2^{2n}$$

$$2^{2y} \times 2^{3y+2} = \frac{2^{15y}}{2^{2n}}$$

$$2^{2y+3y+2} = 2^{15y-2n} \quad (1)$$

$$2n = 10y - 2$$

$$n = 5y - 1 \quad (1)$$

$$2y + 3y + 2 = 15y - 2n$$

$$5y + 2 = 15y - 2n \quad (1)$$

$$2n = 15y - 5y - 2$$

$$n = 5y - 1$$

(4)

(Total for Question 21 is 7 marks)

- 22 The first term of an arithmetic series S is -6
The sum of the first 30 terms of S is 2865

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

Find the 9th term of S .

$$T_n = a + (n-1)d$$

$$a = -6$$

$$S_{30} = 2865 = \frac{30}{2} [2(-6) + (30-1)d] \quad \textcircled{1}$$

$$2865 = 15 (-12 + 29d)$$

$$191 = -12 + 29d$$

$$29d = 203$$

$$d = 7 \quad \textcircled{1}$$

$$T_9 = -6 + (9-1)7$$

$$= -6 + 8(7) \quad \textcircled{1}$$

$$= -6 + 56$$

$$= 50 \quad \textcircled{1}$$

50

(Total for Question 22 is 4 marks)

- 23 Express $7 - 12x - 2x^2$ in the form $a + b(x + c)^2$ where a , b and c are integers.

$$-2x^2 - 12x + 7$$

$$-2\left(x^2 + 6x - \frac{7}{2}\right) \quad \textcircled{1}$$

$$-2\left[(x+3)^2 - 9 - \frac{7}{2}\right] \quad \textcircled{1}$$

$$-2\left[(x+3)^2 - \frac{25}{2}\right]$$

$$-2(x+3)^2 + 25$$

$$\therefore 25 - 2(x+3)^2 \quad \textcircled{1} \quad \text{where } a = 25$$

$$b = -2$$

$$c = 3$$

$$25 - 2(x+3)^2$$

(Total for Question 23 is 3 marks)

24 L_1 and L_2 are two straight lines.
The origin of the coordinate axes is O .

L_1 has equation $5x + 10y = 8$

L_2 is perpendicular to L_1 and passes through the point with coordinates $(8, 6)$

L_2 crosses the x -axis at the point A .

L_2 intersects the straight line with equation $x = -3$ at the point B .

Find the area of triangle AOB .

Show your working clearly.

$$\text{Equation of } L_1 : 5x + 10y = 8$$

$$10y = -5x + 8$$

$$y = -\frac{1}{2}x + \frac{4}{5}$$

in terms of $y = mx + c$

$$\text{Gradient of } L_1 = -\frac{1}{2}$$

$$\text{Gradient of } L_2 = 2$$

$$m_{L_1} = -\frac{1}{m_{L_2}}$$

$$\text{Equation of } L_2 : 6 = 2(8) + c$$

$$c = -10$$

$$\therefore y = 2x - 10 \quad \textcircled{1}$$

when L_2 crosses point A :

$$y = 0 : 0 = 2x - 10$$

$$x = 5 \quad \textcircled{1}$$

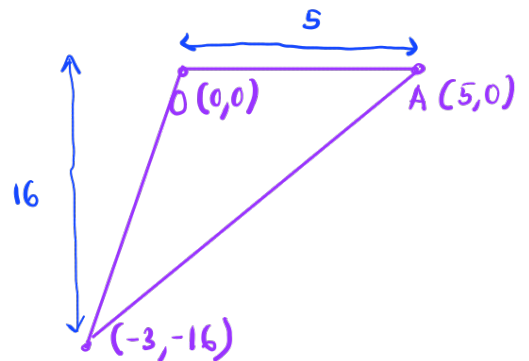
$\therefore L_2$ crosses point A at $(5, 0)$

when L_2 intersects at point B :

$$x = -3 : y = 2(-3) - 10$$

$$y = -16$$

$\therefore L_2$ intersects at $(-3, -16)$



$$\text{Area} = \frac{1}{2} \times 5 \times 16 \quad \textcircled{1}$$

$$= 40 \quad \textcircled{1}$$

40

(Total for Question 24 is 5 marks)

25 N is a multiple of 5

$$A = N + 1$$

$$B = N - 1$$

Prove, using algebra, that $A^2 - B^2$ is always a multiple of 20

$$\begin{aligned} A^2 &= (N+1)(N+1) \\ &= N^2 + 2N + 1 \quad \textcircled{1} \end{aligned}$$

$$\begin{aligned} B^2 &= (N-1)(N-1) \\ &= N^2 - 2N + 1 \end{aligned}$$

$$\begin{aligned} A^2 - B^2 &= (N^2 + 2N + 1) - (N^2 - 2N + 1) \\ &= N^2 - N^2 + 2N + 2N + 1 - 1 \\ &= 4N \quad \textcircled{1} \end{aligned}$$

since N is a multiple of 5,

$4N$ is a multiple of 20. $\textcircled{1}$

$\therefore A^2 - B^2$ is always a multiple of 20.

(Total for Question 25 is 3 marks)

26 The diagram shows trapezium $OACB$.

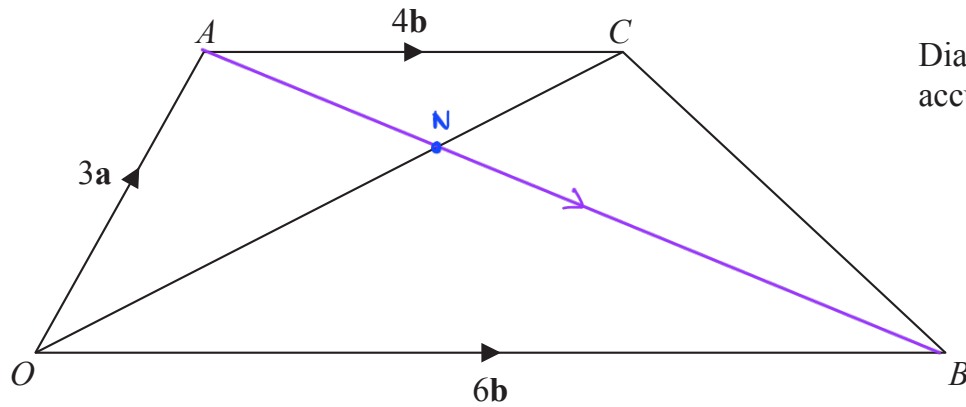


Diagram **NOT** accurately drawn

$$\vec{OA} = 3\mathbf{a} \quad \vec{OB} = 6\mathbf{b} \quad \vec{AC} = 4\mathbf{b}$$

N is the point on OC such that ANB is a straight line.

Find \vec{ON} as a simplified expression in terms of \mathbf{a} and \mathbf{b} .

$$\begin{aligned} \vec{OC} &= \vec{OA} + \vec{AC} \\ &= 3\mathbf{a} + 4\mathbf{b} \quad \text{①} \end{aligned}$$

$$\begin{aligned} \vec{AB} &= \vec{AO} + \vec{OB} \\ &= -3\mathbf{a} + 6\mathbf{b} \end{aligned}$$

$$\begin{aligned} \vec{ON} &= x(\vec{OC}) \\ &= x(3\mathbf{a} + 4\mathbf{b}) \quad \text{①} \end{aligned}$$

$$\begin{aligned} \vec{AN} &= y(\vec{AB}) \\ &= y(-3\mathbf{a} + 6\mathbf{b}) \end{aligned}$$

$$\begin{aligned} \vec{ON} &= \vec{OA} + \vec{AN} \\ &= 3\mathbf{a} + y(-3\mathbf{a} + 6\mathbf{b}) \end{aligned}$$

$$\therefore x(3\mathbf{a} + 4\mathbf{b}) = 3\mathbf{a} + y(-3\mathbf{a} + 6\mathbf{b}) \quad \text{①}$$

$$\begin{aligned} \mathbf{a} \text{ term} : 3x &= 3 - 3y \\ x &= 1 - y \end{aligned}$$

$$\begin{aligned} \vec{ON} &= 0.6(3\mathbf{a} + 4\mathbf{b}) \\ &= 1.8\mathbf{a} + 2.4\mathbf{b} \quad \text{①} \end{aligned}$$

$$\begin{aligned} \mathbf{b} \text{ term} : 4x &= 6y \\ 4(1-y) &= 6y \\ 4 - 4y &= 6y \\ 4 &= 10y \\ y &= \frac{4}{10} = 0.4, \quad x = 0.6 \quad \text{①} \end{aligned}$$

$$\vec{ON} = 1.8\mathbf{a} + 2.4\mathbf{b}$$

(Total for Question 26 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS

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