

Write your name here

Surname

Model Solutions

Other names

Pearson Edexcel

Level 1/Level 2 GCSE (9 - 1)

Centre Number

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Candidate Number

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# Mathematics

## Paper 1 (Non-Calculator)

Higher Tier

Specimen Papers Set 1

Time: 1 hour 30 minutes

Paper Reference

1MA1/1H

**You must have:** Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser.

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.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- **Calculators may not be used.**
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**



### Information

- The total mark for this paper is 80
- 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.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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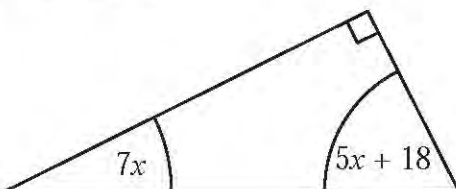
PEARSON

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 The diagram shows a right-angled triangle.



All the angles are in degrees.

Work out the size of the smallest angle of the triangle.

$$5x + 18 + 7x + 90 = 180$$

$$12x = 72$$

$$x = 6$$

angles in tri add to 180

$$90 - 18 = 72$$

$$7 \times 6 = 42^\circ$$

$$5 \times 6 + 18 = 48^\circ$$

42

(Total for Question 1 is 3 marks)

- 2 A box exerts a force of 140 newtons on a table.  
The pressure on the table is 35 newtons/m<sup>2</sup>.

Calculate the area of the box that is in contact with the table.

$$p = \frac{F}{A}$$

$p$  = pressure  
 $F$  = force  
 $A$  = area

$$p = \frac{F}{A}$$

$$A = \frac{F}{p}$$

$$A = \frac{140}{35} = 4$$

remember units  
4m<sup>2</sup>

(Total for Question 2 is 3 marks)

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3 There are only red counters, blue counters, green counters and yellow counters in a bag.

The table shows the probabilities of picking at random a red counter and picking at random a yellow counter.

Colour	red	blue	green	yellow
Probability	0.24	0.22	0.22	0.32

call P(blue) and P(green)  $x$ .

The probability of picking a blue counter is the same as the probability of picking a green counter.

Complete the table.

$$\begin{array}{r} 0.24 \\ + 0.32 \\ \hline 0.56 \end{array}$$

$$1 - 0.24 - 0.32 = 2x$$

$$1 - 0.56 = 2x$$

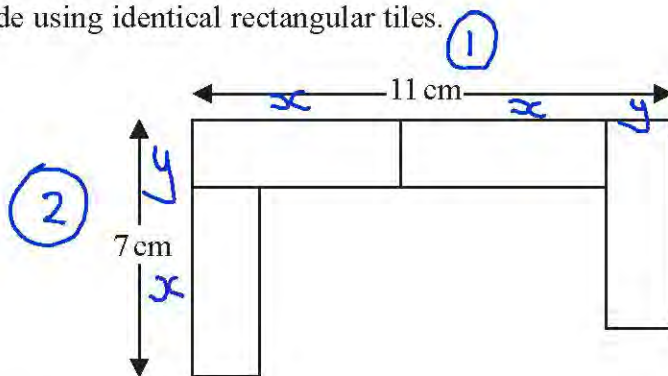
$$0.44 = 2x$$

$$x = \frac{0.44}{2} = 0.22$$

Probabilities add to 1

(Total for Question 3 is 2 marks)

4 A pattern is made using identical rectangular tiles.



Find the total area of the pattern.



$$\begin{array}{l} \textcircled{1} \quad 2x + y = 11 \\ \textcircled{2} \quad x + y = 7 \\ \hline x = 4 \text{ cm} \end{array}$$

$$\begin{array}{l} \leftarrow 4 + y = 7 \\ y = 3 \text{ cm} \end{array}$$

$$\text{Area of rect} = 4 \times 3 = 12$$

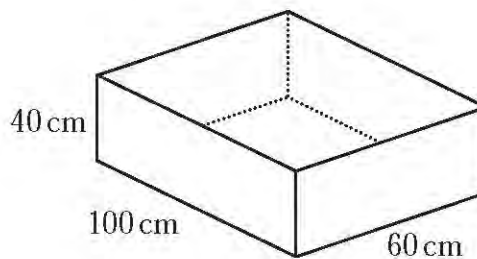
$$\text{A of 4 rect} = 12 \times 4 = 48 \text{ cm}^2$$

48 cm<sup>2</sup>

(Total for Question 4 is 4 marks)

- 5 The diagram shows a sand pit.  
The sand pit is in the shape of a cuboid.

Sally wants to fill the sand pit with sand.  
A bag of sand costs £2.50  
There are 8 litres of sand in each bag.



Sally says,

“The sand will cost less than £70”

Show that Sally is wrong.

$$\begin{aligned} \text{Volume of sandpit} &= 100 \times 60 \times 40 \\ &= 240,000 \text{ cm}^3 \end{aligned}$$

$$8 \text{ l} = 8000 \text{ ml} = 8000 \text{ cm}^3$$

$$\text{Number of bags needed} = \frac{240,000}{8,000} = 30 \text{ bags}$$

$$\begin{aligned} \text{Cost} &= 30 \times 2.50 \\ &= 60 + 15 = \text{£}75 \end{aligned}$$

$$75 > 70$$

Sally is wrong

(Total for Question 5 is 5 marks)

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- 6 Four friends each throw a biased coin a number of times.  
The table shows the number of heads and the number of tails each friend got.

	Ben	Helen	Paul	Sharif
heads	34	66	80	120
tails	8	12	40	40

The coin is to be thrown one more time.

- (a) Which of the four friends' results will give the best estimate for the probability that the coin will land heads?  
Justify your answer.

Sharif because he carried out the most trials

(1)

Paul says,

"With this coin you are twice as likely to get heads as to get tails."

- (b) Is Paul correct?  
Justify your answer.

$$\text{Sharif: } \frac{120 \leftarrow \text{Heads}}{40 \leftarrow \text{Tails}} = 3$$

This shows that you are 3 times more likely,  
so Paul is wrong

(2)

The coin is to be thrown twice.

- (c) Use all the results in the table to work out an estimate for the probability that the coin will land heads both times.

$$\text{Total Number of Heads} = 34 + 66 + 80 + 120 = 300$$

$$\text{Tails} = 8 + 12 + 40 + 40 = 100$$

$$\text{Total} = 300 + 100 = 400$$

$$P(\text{Heads}) = \frac{300}{400} = \frac{3}{4}$$

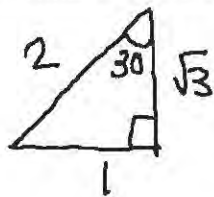
$$\frac{9}{16}$$

(2)

$$P(\text{Heads + Heads}) = \frac{3}{4} \times \frac{3}{4} = \frac{9}{16}$$

(Total for Question 6 is 5 marks)

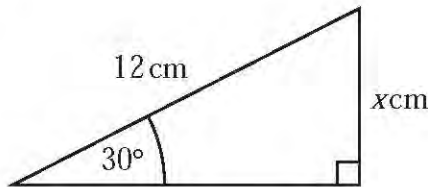
7 (a) Write down the exact value of  $\cos 30^\circ$



$$\frac{\sqrt{3}}{2}$$

(1)

(b)



Given that  $\sin 30^\circ = 0.5$ ,  
work out the value of  $x$ .

$$\sin \theta = \frac{\text{opp}}{\text{hyp}}$$

$$\sin 30 = \frac{x}{12}$$

$$12 \times 0.5 = x$$

$$6 = x$$

$$6 \text{ cm}$$

(2)

(Total for Question 7 is 3 marks)

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- 8 The mass of Jupiter is  $1.899 \times 10^{27}$  kg.  
The mass of Saturn is 0.3 times the mass of Jupiter.

- (a) Work out an estimate for the mass of Saturn.  
Give your answer in standard form.

$$\begin{aligned} \text{Mass of Saturn} &= 1.899 \times 10^{27} \times 0.3 \approx 2 \times 10^{27} \times 0.3 \\ &= 0.6 \times 10^{27} \\ &= 6 \times 10^{26} \end{aligned}$$

$$6 \times 10^{26} \text{ kg} \quad (3)$$

- (b) Give evidence to show whether your answer to (a) is an underestimate or an overestimate.

Overestimate, because 1.899 is rounded up to 2

(1)

(Total for Question 8 is 4 marks)

- 9 Walkden Reds is a basketball team.

At the end of 11 games, their mean score was 33 points per game.  
At the end of 10 games, their mean score was 2 points higher.

Jordan says,

“Walkden Reds must have scored 13 points in their 11th game.”

Is Jordan right?

You must show how you get your answer.

$$\begin{aligned} \text{after 11 games: Total score} &= 33 \times 11 \\ &= 363 \end{aligned}$$

$$\begin{array}{r} 33 \\ \times 11 \\ \hline 33 \\ 330 \\ \hline 363 \end{array}$$

$$\begin{aligned} \text{after 10 games: Total} &= (33 + 2) \times 10 \\ &= 350 \end{aligned}$$

$$363 - 350 = 13 \leftarrow \text{points in 11th game}$$

Jordan is correct

(Total for Question 9 is 3 marks)

- 10 There are some red counters and some yellow counters in a bag.  
 There are 30 yellow counters in the bag.  
 The ratio of the number of red counters to the number of yellow counters is 1:6

(a) Work out the number of red counters in the bag.

$$\begin{array}{c} \text{Red : Yellow} \\ 1 : 6 \\ \times 5 \quad \left( \quad \right) \quad \times 5 \\ \rightarrow 5 : 30 \end{array}$$

5 red  
(2)

Riza puts some more red counters into the bag.  
 The ratio of the number of red counters to the number of yellow counters is now 1:2

(b) How many red counters does Riza put into the bag?

$$\begin{array}{c} \text{Red : Yellow} \\ 1 : 2 \\ \times 15 \quad \left( \quad \right) \quad \times 15 \\ \rightarrow 15 : 30 \end{array}$$

← There are still 30 yellow in the bag

$$15 - 5 = 10$$

10 more red  
(2)

(Total for Question 10 is 4 marks)

- 11 Write down the value of  $125^{\frac{2}{3}}$

$$\begin{aligned} &= \left( \sqrt[3]{125} \right)^2 \\ &= 5^2 = 25 \end{aligned}$$

25

(Total for Question 11 is 1 mark)

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12 Sean drives from Manchester to Gretna Green.

He drives at an average speed of 50 mph for the first 3 hours of his journey.

He then has 150 miles to drive to get to Gretna Green.

Sean drives these 150 miles at an average speed of 30 mph.

Sean says,

“My average speed from Manchester to Gretna Green was 40 mph.”

Is Sean right?

You must show how you get your answer.

*first part*      *second part*       $\text{speed} = \frac{\text{Distance}}{\text{Time}}$

$$\begin{aligned} \text{Total distance :} & \quad 50 \times 3 + 150 \\ & = 150 + 150 = 300 \text{ miles} \end{aligned}$$

$$\begin{aligned} \text{Total time :} & \quad 3 + \frac{150}{30} \\ & = 3 + 5 = 8 \text{ hours} \end{aligned}$$

$$\text{Average speed : } \frac{300}{8} = 37.5 \text{ mph} \neq 40 \text{ Sam is wrong}$$

(Total for Question 12 is 4 marks)

13  $m = \sqrt{\frac{k^3 + 1}{4}}$       *isolate k*

Make  $k$  the subject of the formula.

$$m = \sqrt{\frac{k^3 + 1}{4}}$$

*square*

$$m^2 = \frac{k^3 + 1}{4}$$

*x4*      *x4*

$$4m^2 = k^3 + 1$$

*-1*

*-1*

$$4m^2 - 1 = k^3$$

*cube root*

$$\sqrt[3]{4m^2 - 1} = k$$

$$\sqrt[3]{4m^2 - 1}$$

(Total for Question 13 is 3 marks)

14 Solve  $\frac{x^2}{3x} + \frac{x-2}{2x} = 3$

$$\frac{2(x+2) + 3(x-2)}{6x} = 3$$

$$2x + 4 + 3x - 6 = 18x$$

$$5x - 2 = 18x$$

$$-2 = 13x$$

$$\frac{-2}{13} = x$$

$$x = \frac{-2}{13}$$

(Total for Question 14 is 3 marks)

15 Show that  $\frac{2x^2 - 3x - 5}{x^2 + 6x + 5}$  can be written in the form  $\frac{ax + b}{cx + d}$  where  $a, b, c$  and  $d$  are integers.

Factorise top and bottom

Top:  $2x^2 - 3x - 5$

$$-5 \times 2 = -10$$

2 numbers  
-5, +2

(x to)  
(+ to)

$$2x^2 + 2x \mid -5x - 5$$

$$2x(x+1) \mid -5(x+1)$$

$$= (2x-5)(x+1)$$

Bottom:  $x^2 + 6x + 5$

$$5(x \text{ to})$$

-5, 1

$$= (x+1)(x+5)$$

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

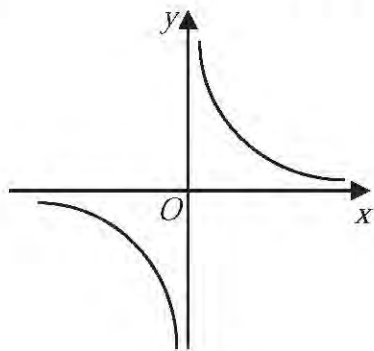
(Total for Question 15 is 3 marks)

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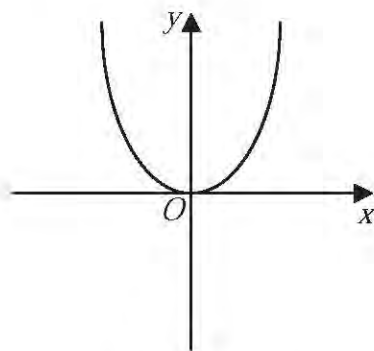
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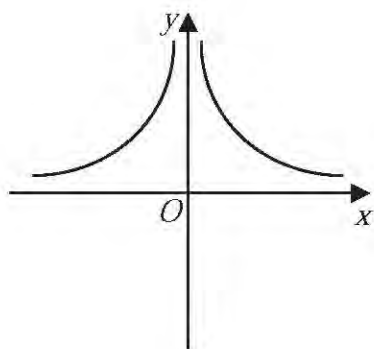
16 These graphs show four different proportionality relationships between  $y$  and  $x$ .



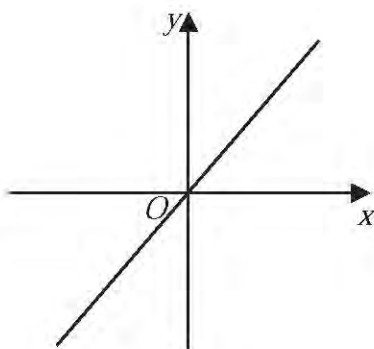
Graph A



Graph B



Graph C



Graph D

Match each graph with a statement in the table below.

Proportionality relationship	Graph letter
$y$ is directly proportional to $x$	D
$y$ is inversely proportional to $x$	A
$y$ is proportional to the square of $x$	B
$y$ is inversely proportional to the square of $x$	C

$y = x$   
 reciprocal  
 quadratic  
 $y = \frac{1}{x^2}$

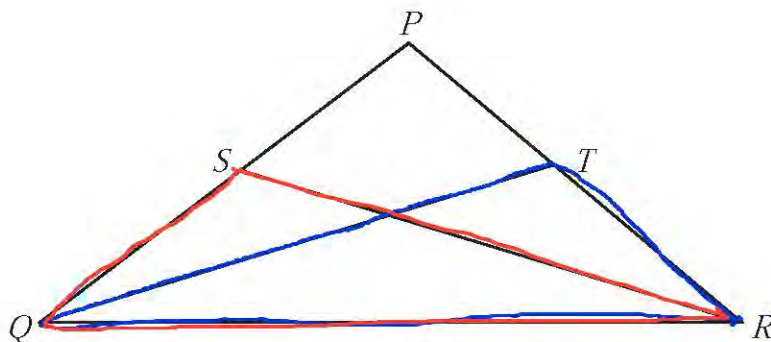
(Total for Question 16 is 2 marks)

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17



$$PQ = PR.$$

$S$  is the midpoint of  $PQ$ .

$T$  is the midpoint of  $PR$ .

Prove triangle  $QTR$  is congruent to triangle  $RSQ$ .

Side :  $QR$  in both triangles

Side :  $QS = TR$   $PQ = PR$   $S$  and  $T$  are midpoints

Angle:  $\angle PQR = \angle PRQ$  base angle in isosceles tri  $PQR$  are equal

Triangles are congruent by SAS.

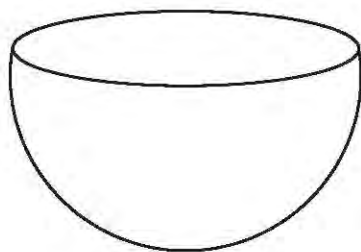
(Total for Question 17 is 3 marks)

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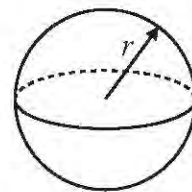
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18 The diagram shows a solid hemisphere.



Volume of sphere =  $\frac{4}{3}\pi r^3$   
 Surface area of sphere =  $4\pi r^2$



The volume of the hemisphere is  $\frac{250}{3}\pi$

Work out the exact total surface area of the solid hemisphere.  
 Give your answer as a multiple of  $\pi$ .

Volume of hemisphere =  $\frac{1}{2}$  V of sphere

$$\frac{250}{3}\pi = \frac{1}{2} \times \frac{4}{3}r^3\pi$$

$$\begin{aligned} 250 &= 2r^3 \\ 125 &= r^3 \\ r &= 5\text{cm} \end{aligned}$$

SA of hemisphere : area of curved surface + area of flat circle  
 $\frac{1}{2}$  SA of sphere  $\rightarrow$

$$\begin{aligned} &= 2\pi \times 5^2 + \pi \times 5^2 \\ &= 50\pi + 25\pi \\ &= 75\pi \end{aligned}$$

75 cm<sup>2</sup>

(Total for Question 18 is 4 marks)

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19 Simplify fully  $\frac{(6 - \sqrt{5})(6 + \sqrt{5})}{\sqrt{31}}$

You must show your working.

$$\frac{36 + \cancel{6\sqrt{5}} - \cancel{6\sqrt{5}} - 5}{\sqrt{31}} = \frac{31}{\sqrt{31}} \frac{\times \sqrt{31}}{\times \sqrt{31}} = \frac{\cancel{31}\sqrt{31}}{31}$$

$$\sqrt{31}$$

(Total for Question 19 is 3 marks)

20 Prove algebraically that the difference between the squares of any two consecutive integers is equal to the sum of these two integers.

$n, n+1$

$$\begin{aligned} \text{Difference between square: } & (n+1)^2 - n^2 \\ & = n^2 + 2n + 1 - n^2 \\ & = 2n + 1 \end{aligned}$$

$$\begin{aligned} \text{Sum of integers: } & n + n + 1 \\ & = 2n + 1 \end{aligned}$$

$$2n + 1 = 2n + 1$$

therefore this statement is true

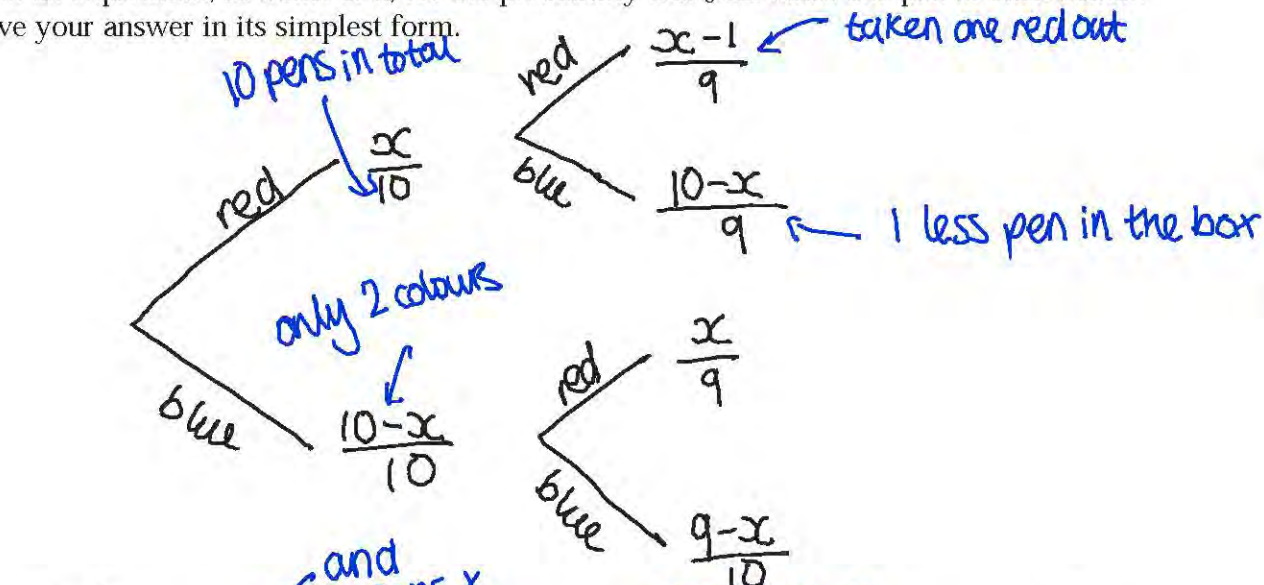
(Total for Question 20 is 4 marks)

21 There are 10 pens in a box.

There are  $x$  red pens in the box.  
All the other pens are blue.

Jack takes at random two pens from the box.

Find an expression, in terms of  $x$ , for the probability that Jack takes one pen of each colour.  
Give your answer in its simplest form.



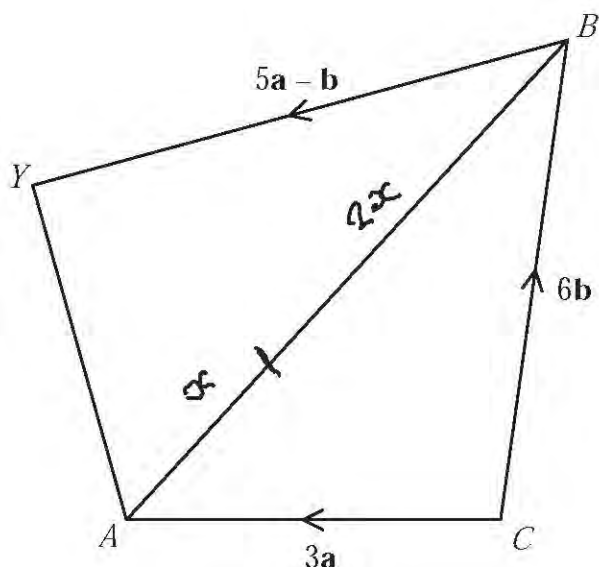
$P(\text{red and blue OR blue and red})$   
 (Note: 'and' means  $\times$ , 'or' means  $+$ )

$$\begin{aligned} & \frac{x}{10} \times \frac{10-x}{9} + \frac{10-x}{10} \times \frac{x}{9} \\ &= \frac{x(10-x)}{90} + \frac{x(10-x)}{90} = \frac{2x(10-x)}{90} \\ &= \frac{x(10-x)}{45} \end{aligned}$$

(Total for Question 21 is 5 marks)

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22



$CAYB$  is a quadrilateral.

$$\vec{CA} = 3\mathbf{a}$$

$$\vec{CB} = 6\mathbf{b}$$

$$\vec{BY} = 5\mathbf{a} - \mathbf{b}$$

$X$  is the point on  $AB$  such that  $AX:XB = 1:2$

Prove that  $\vec{CX} = \frac{2}{5}\vec{CY}$

$$\vec{CY} = 6\mathbf{b} + 5\mathbf{a} - \mathbf{b} = 5\mathbf{a} + 5\mathbf{b} \quad \frac{2}{5} \times 5 = 2$$

$$\frac{2}{5}\vec{CY} = 2\mathbf{a} + 2\mathbf{b}$$

$$\begin{aligned} \vec{CX} &= \vec{CA} + \vec{AX} & \vec{AX} &= \frac{1}{3}\vec{AB} \\ \vec{CX} &= 3\mathbf{a} - \mathbf{a} + 2\mathbf{b} & &= \frac{1}{3}(\vec{AC} + \vec{CB}) \\ &= 2\mathbf{a} + 2\mathbf{b} & &= -\mathbf{a} + 2\mathbf{b} \end{aligned}$$

3 'parts' AB  
AC + CB

$$2\mathbf{a} + 2\mathbf{b} = 2\mathbf{a} + 2\mathbf{b}$$

therefore  $\vec{CX} = \frac{2}{5}\vec{CY}$

(Total for Question 22 is 5 marks)

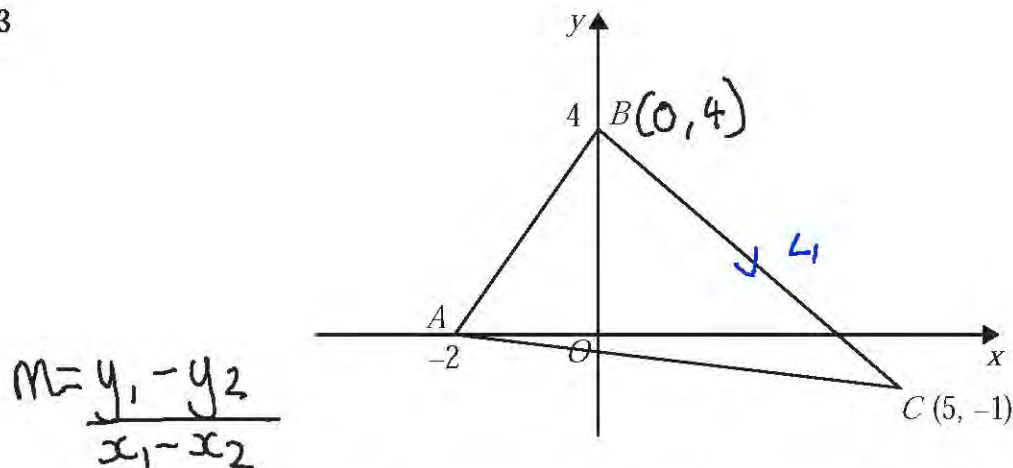
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23



Find an equation of the line that passes through  $C$  and is perpendicular to  $AB$ .

$$\text{Gradient of } AB = \frac{4-0}{0-(-2)} = \frac{4}{2} = 2$$

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

Only  $C$  is a point on this line  
(5, -1)

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

$$-1 = -\frac{1}{2} \times 5 + c$$

$$-1 + \frac{5}{2} = c$$

$$c = \frac{3}{2}$$

$$y = -\frac{1}{2}x + \frac{3}{2}$$

(Total for Question 23 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS