

Write your name here

Surname

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

Thursday 25 May 2017 – Morning
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.
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.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may not be used.**



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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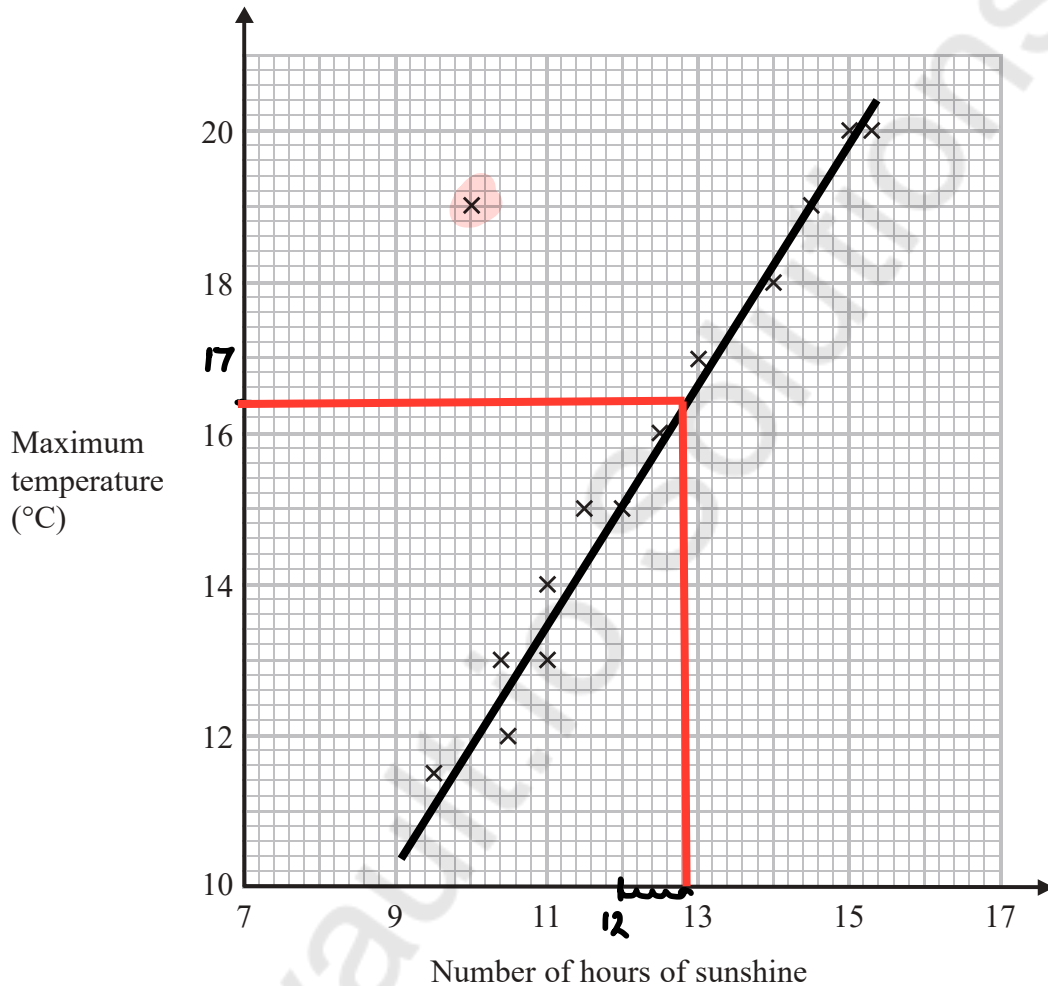
Pearson

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 The scatter graph shows the maximum temperature and the number of hours of sunshine in fourteen British towns on one day.



One of the points is an outlier.

- (a) Write down the coordinates of this point.

(10 , 19)
(1)

- (b) For all the other points write down the type of correlation.

Positive
(1)



On the same day, in another British town, the maximum temperature was 16.4°C .

(c) Estimate the number of hours of sunshine in this town on this day.

..... 12.8 hours
(2)

A weatherman says,

“Temperatures are higher on days when there is more sunshine.”

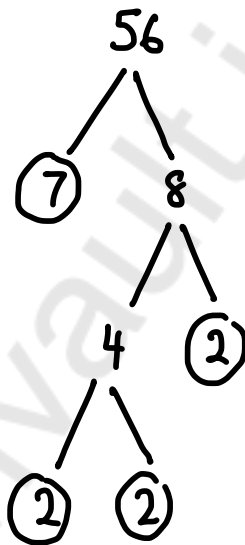
(d) Does the scatter graph support what the weatherman says?
Give a reason for your answer.

Yes, there is a positive correlation

(1)

(Total for Question 1 is 5 marks)

2 Express 56 as the product of its prime factors.



$$2 \times 2 \times 2 \times 7$$

$$2 \times 2 \times 2 \times 7$$

(Total for Question 2 is 2 marks)



3 Work out 54.6×4.3

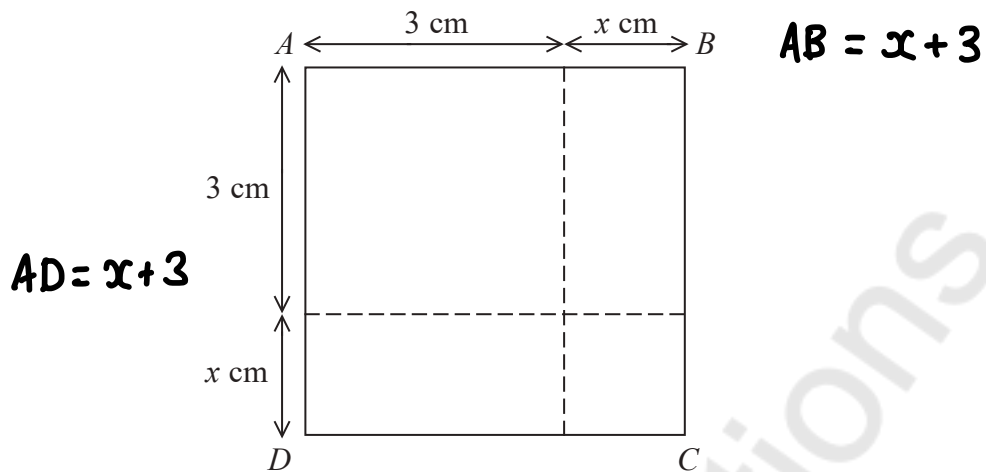
$\downarrow \times 10$ $\downarrow \times 10$
 546×43

$$\begin{array}{r}
 \begin{array}{r}
 \overset{1}{5} \overset{2}{4} \overset{3}{6} \\
 \times \quad \quad \quad \overset{1}{4} \overset{2}{3} \\
 \hline
 \overset{1}{1} \overset{2}{6} \overset{3}{3} \overset{4}{8} \\
 + \quad \overset{1}{2} \overset{2}{1} \overset{3}{8} \overset{4}{4} \overset{5}{0} \\
 \hline
 \overset{1}{2} \overset{2}{3} \overset{3}{4} \overset{4}{7} \overset{5}{8}
 \end{array} \\
 \xrightarrow{\div 100} 234.78
 \end{array}$$

234.78

(Total for Question 3 is 3 marks)





The area of square $ABCD$ is 10 cm^2 .

Show that $x^2 + 6x = 1$

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$$\begin{aligned}
 A &= l \times w \\
 &= AB \times AD \\
 &= (x + 3)(x + 3)
 \end{aligned}$$

x	x	$+3$
x	x^2	$+3x$
$+3$	$+3x$	$+9$

$$3x + 3x = 6x$$

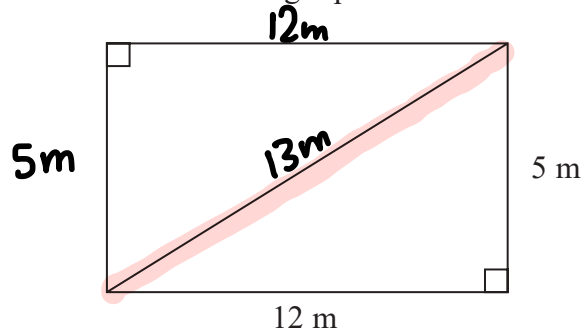
$$\begin{aligned}
 x^2 + 6x + 9 &= 10 \\
 &\quad -9 \quad -9
 \end{aligned}$$

$$x^2 + 6x = 1$$

(Total for Question 4 is 3 marks)

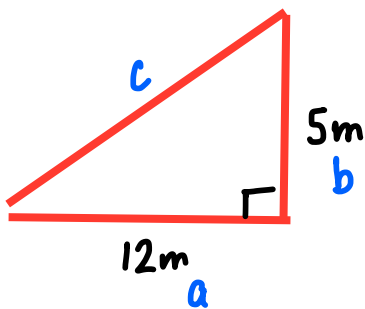


5 This rectangular frame is made from 5 straight pieces of metal.



The weight of the metal is 1.5 kg per metre.

Work out the total weight of the metal in the frame.



$$a^2 + b^2 = c^2$$

$$12^2 + 5^2 = c^2$$

$$\sqrt{\quad} \quad \sqrt{\quad}$$

$$\sqrt{12^2 + 5^2} = c$$

$$\sqrt{144 + 25} = c$$

$$\sqrt{169} = c$$

$$13 = c$$

$$\text{Total length} = 12 + 12 + 5 + 5 + 13 = 47\text{m}$$

$$\text{Total weight} = 47 \times 1.5 = 70.5 \text{ kg}$$

$$\begin{array}{r} \downarrow \times 10 \\ 47 \times 15 \end{array}$$

$$\begin{array}{r} 3 \\ 47 \\ \times 15 \\ \hline \end{array}$$

$$\begin{array}{r} 1235 \\ 470 \\ \hline 705 \end{array}$$

$$\begin{array}{r} 705 \div 10 \rightarrow 70.5 \end{array}$$

..... 70.5 kg

(Total for Question 5 is 5 marks)



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- 6 The equation of the line L_1 is $y = 3x - 2$
 The equation of the line L_2 is $3y - 9x + 5 = 0$

Show that these two lines are parallel.

↳ Same gradients

L_1 $y = mx + c$
 \uparrow
 gradient
 \downarrow
 $y = 3x - 2$
 $m = 3$

L_2 $3y - 9x + 5 = 0$
 $+ 9x \quad + 9x$
 $3y + 5 = 9x$
 $- 5 \quad - 5$
 $3y = 9x - 5$
 $\div 3 \quad \div 3$
 $y = \frac{9x}{3} - \frac{5}{3}$
 $y = 3x - \frac{5}{3}$
 \uparrow
 $y = mx + c$ $m = 3$

(Total for Question 6 is 2 marks)

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- 7 There are 10 boys and 20 girls in a class.
The class has a test.

The mean mark for all the class is 60
The mean mark for the girls is 54

Work out the mean mark for the boys.

$$\text{Mean} = \frac{\text{total marks}}{\text{no. of students}}$$

All class

$$60 = \frac{\text{total marks}}{30}$$

$$\times 30 \quad \times 30$$

$$1800 = \text{total marks}$$

Girls

$$54 = \frac{\text{total marks}}{20}$$

$$\times 20 \quad \times 20$$

$$1080 = \text{total marks}$$

Boys

$$\text{Total marks} = 1800 - 1080$$

$$= 720$$

$$\text{Mean} = \frac{720}{10}$$

$$= 72$$

72

(Total for Question 7 is 3 marks)

- 8 (a) Write 7.97×10^{-6} as an ordinary number.

0.00000797

0.00000797

(1)

- (b) Work out the value of $(2.52 \times 10^5) \div (4 \times 10^{-3})$
Give your answer in standard form.

$$2.52 \div 4 = 0.63$$

$$4 \overline{) 2.52}$$

$$0.63$$

$$10^5 \div 10^{-3}$$

$$10^{5-(-3)} = 10^8$$

$$0.63 \times 10^8$$

$$\downarrow \times 10 \quad \downarrow -1$$

$$6.3 \times 10^7$$

6.3 × 10⁷

(2)

(Total for Question 8 is 3 marks)



9 Jules buys a washing machine.

20% VAT is added to the price of the washing machine.
Jules then has to pay a total of £600

What is the price of the washing machine with **no** VAT added?

$$100\% + 20\% = 120\% \quad (\text{with VAT})$$

$$\begin{array}{l} \div 12 \left(\begin{array}{l} 120\% = \pounds 600 \\ 10\% = \pounds 50 \end{array} \right) \div 12 \\ \times 10 \left(\begin{array}{l} 100\% = \pounds 500 \end{array} \right) \times 10 \\ \text{(no VAT)} \end{array}$$

£ 500

(Total for Question 9 is 2 marks)

10 Show that $(x+1)(x+2)(x+3)$ can be written in the form $ax^3 + bx^2 + cx + d$ where a , b , c and d are positive integers.

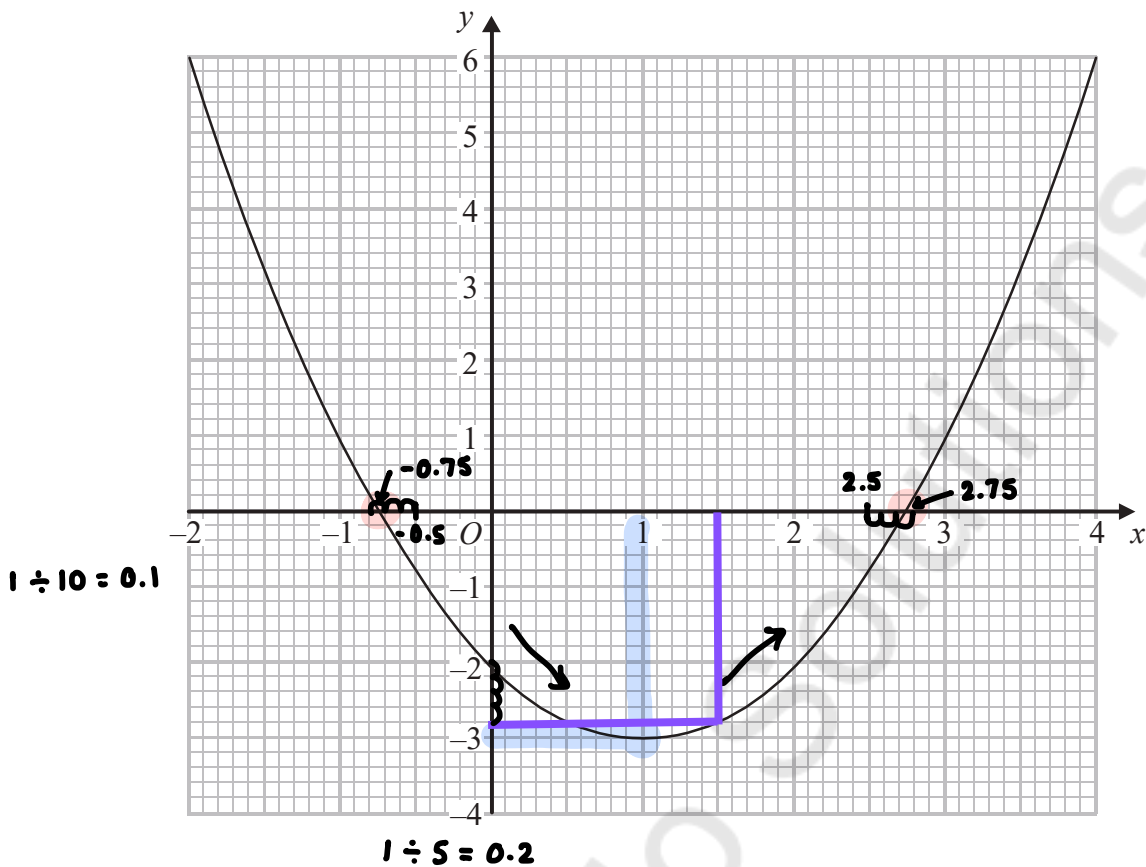
x	x	$+1$	
x	x^2	$+x$	$x^2 + 3x + 2$
$+2$	$+2x$	$+2$	

x	x^2	$+3x$	$+2$	
x	x^3	$+3x^2$	$+2x$	$= x^3 + 6x^2 + 11x + 6$
$+3$	$+3x^2$	$+9x$	$+6$	

(Total for Question 10 is 3 marks)



11 The graph of $y = f(x)$ is drawn on the grid.



(a) Write down the coordinates of the turning point of the graph.

(..... 1 , -3)
(1)

(b) Write down estimates for the roots of $f(x) = 0$

↳ crosses x -axis

..... 2.75 and -0.75

(1)

(c) Use the graph to find an estimate for $f(1.5)$

..... -2.8

(1)

(Total for Question 11 is 3 marks)



12 (a) Find the value of $81^{-\frac{1}{2}}$

$$x^{-a} = \frac{1}{x^a}$$

$$x^{\frac{1}{2}} = \sqrt{x}$$

$$81^{-\frac{1}{2}} = \frac{1}{81^{\frac{1}{2}}}$$

$$\frac{1}{81^{\frac{1}{2}}} = \frac{1}{\sqrt{81}} = \frac{1}{9}$$

$$\frac{1}{9} \quad (2)$$

(b) Find the value of $\left(\frac{64}{125}\right)^{\frac{2}{3}}$

$$x^{\frac{a}{b}} = \left(b\sqrt{x}\right)^a$$

$$\left(\frac{64}{125}\right)^{\frac{2}{3}} = \left(\sqrt[3]{\frac{64}{125}}\right)^2 = \left(\frac{4}{5}\right)^2 = \frac{16}{25}$$

$$\frac{16}{25} \quad (2)$$

(Total for Question 12 is 4 marks)

13 The table shows a set of values for x and y .

x	1	2	3	4
y	9	$2\frac{1}{4}$	1	$\frac{9}{16}$

y is inversely proportional to the square of x .

(a) Find an equation for y in terms of x .

$$y \propto \frac{1}{x^2}$$

$$y = \frac{k}{x^2}$$

$$y = \frac{9}{x^2}$$

$$9 = \frac{k}{(1)^2}$$

$$9 = \frac{k}{1} \quad k=9$$

$$y = \frac{9}{x^2} \quad (2)$$

(b) Find the positive value of x when $y = 16$

$$y = \frac{9}{x^2}$$

$$x^2 = \frac{9}{16}$$

$$16 = \frac{9}{x^2}$$

$$16x^2 = 9$$

$$x = \sqrt{\frac{9}{16}}$$

$$\frac{16x^2}{16} = \frac{9}{16}$$

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

$$\frac{3}{4} \quad (2)$$

(Total for Question 13 is 4 marks)



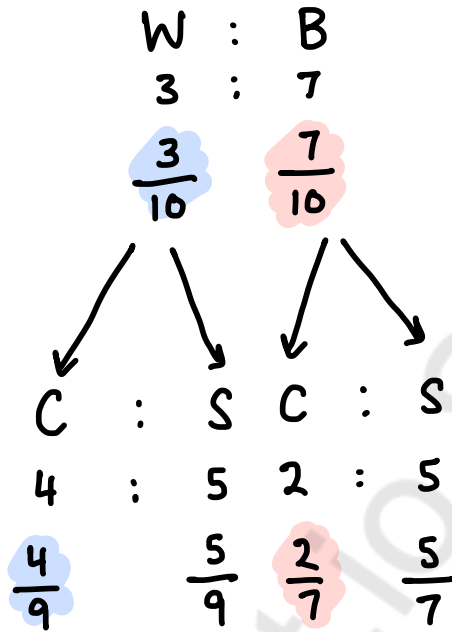
- 14 White shapes and black shapes are used in a game.
Some of the shapes are circles.
All the other shapes are squares.

The ratio of the number of white shapes to the number of black shapes is 3:7

The ratio of the number of white circles to the number of white squares is 4:5

The ratio of the number of black circles to the number of black squares is 2:5

Work out what fraction of all the shapes are circles.



$$\begin{aligned}
 & \frac{12}{90} + \frac{14}{70} \\
 & \quad \div 6 \quad \div 14 \\
 & = \frac{2}{15} + \frac{1}{5} \times 3 \\
 & \quad \times 3 \\
 & = \frac{2}{15} + \frac{3}{15} \\
 & = \frac{5}{15} \div 5 \\
 & \quad \div 5 \\
 & = \frac{1}{3}
 \end{aligned}$$

White circles

$$\frac{3}{10} \times \frac{4}{9} = \frac{12}{90}$$

Black circles

$$\frac{7}{10} \times \frac{2}{7} = \frac{14}{70}$$

$$\frac{1}{3}$$

(Total for Question 14 is 4 marks)



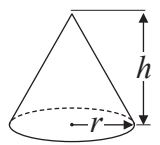
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15 A cone has a volume of 98 cm^3 .
The radius of the cone is 5.13 cm .

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



(a) Work out an estimate for the height of the cone.

$98 \text{ cm}^3 \approx 100 \text{ cm}^3$

$5.13 \text{ cm} \approx 5 \text{ cm}$

$\pi = 3.14 \dots \approx 3$

$100 = \frac{1}{3} \times (3) \times (5)^2 h$

$100 = 25h$

$\div 25 \quad \div 25$

$4 = h$

..... **4** cm
(3)

John uses a calculator to work out the height of the cone to 2 decimal places.

(b) Will your estimate be more than John's answer or less than John's answer?
Give reasons for your answer.

The estimate will be more, as π and r rounded down
so we have divided by a smaller number.

(1)

(Total for Question 15 is 4 marks)

16 n is an integer greater than 1

Prove algebraically that $n^2 - 2 - (n - 2)^2$ is always an even number.

$n^2 - 2 - (n - 2)(n - 2)$

~~n^2~~ - 2 - (~~n^2~~ - 4n + 4)

- 6 + 4n

2(-3 + 2n)

	n	-2
n	n^2	-2n
-2	-2n	+4

(Total for Question 16 is 4 marks)

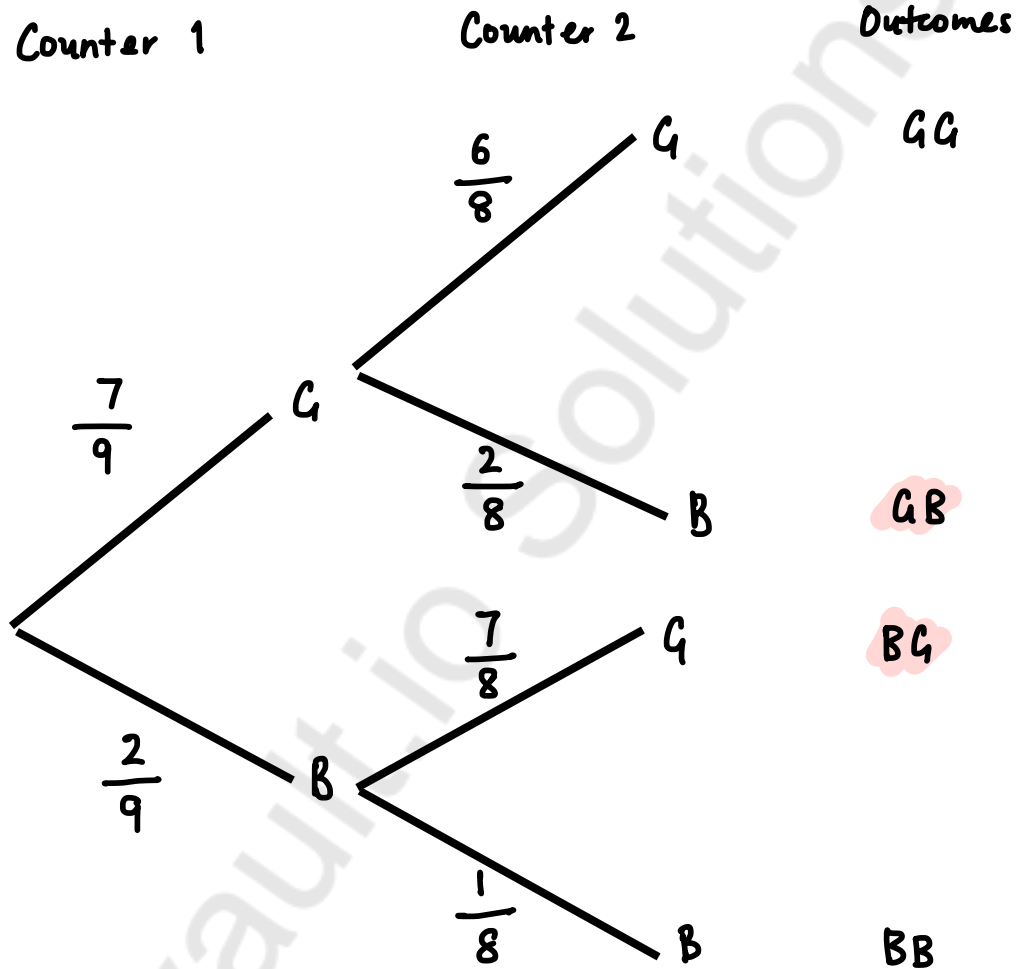


17 There are 9 counters in a bag.

7 of the counters are green.
2 of the counters are blue.

Ria takes at random two counters from the bag.

Work out the probability that Ria takes one counter of each colour.
You must show your working.



$$GB = \frac{7}{9} \times \frac{2}{8} = \frac{14}{72}$$

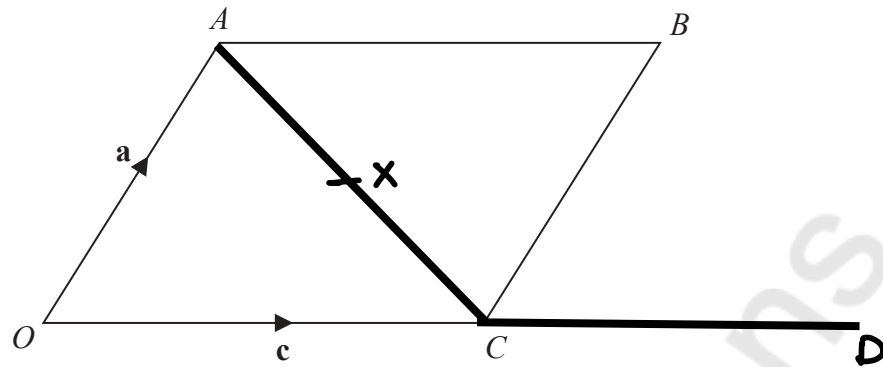
$$BG = \frac{2}{9} \times \frac{7}{8} = \frac{14}{72}$$

$$\frac{14}{72} + \frac{14}{72} = \frac{28}{72}$$

$$\frac{28}{72}$$

(Total for Question 17 is 4 marks)





$OABC$ is a parallelogram.

$$\vec{OA} = \mathbf{a} \text{ and } \vec{OC} = \mathbf{c}$$

X is the midpoint of the line AC .

OCD is a straight line so that $OC : CD = k : 1$

Given that $\vec{OD} = 3\mathbf{c} - \frac{1}{2}\mathbf{a}$

find the value of k .

$$\vec{OD} = \vec{OC} + \vec{CD} \quad \longrightarrow \quad 3\mathbf{c} - \frac{1}{2}\mathbf{a} = -\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{c} + \vec{CD}$$

$$\vec{OC} = \frac{1}{2}\vec{AC}$$

$$\begin{aligned} \vec{AC} &= \vec{AO} + \vec{OC} \\ &= -\mathbf{a} + \mathbf{c} \end{aligned}$$

$$\begin{aligned} \vec{OC} &= \frac{1}{2}(-\mathbf{a} + \mathbf{c}) \\ &= -\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{c} \end{aligned}$$

$$+\frac{1}{2}\mathbf{a} \quad +\frac{1}{2}\mathbf{a}$$

$$3\mathbf{c} = \frac{1}{2}\mathbf{c} + \vec{CD}$$

$$-\frac{1}{2}\mathbf{c} \quad -\frac{1}{2}\mathbf{c}$$

$$2\frac{1}{2}\mathbf{c} = \vec{CD}$$

$$OC : CD$$

$$\div 2\frac{1}{2} \left(\begin{array}{l} 1\mathbf{c} : 2\frac{1}{2}\mathbf{c} \\ \frac{2}{5}\mathbf{c} : 1\mathbf{c} \end{array} \right) \div 2\frac{1}{2}$$

$$\frac{2}{5} : 1$$

$$k = \frac{2}{5}$$

(Total for Question 19 is 4 marks)



20 Solve algebraically the simultaneous equations

$$\begin{aligned} x^2 + y^2 &= 25 \\ y - 3x &= 13 \end{aligned} \longrightarrow y = 3x + 13$$

$$x^2 + (3x + 13)^2 = 25$$

$$x^2 + (3x + 13)(3x + 13) = 25$$

$$x^2 + 9x^2 + 78x + 169 = 25$$

$$10x^2 + 78x + 169 = 25$$

$$ - 25 \quad - 25$$

$$10x^2 + 78x + 144 = 0$$

$$\div 2 \quad \div 2 \quad \div 2 \quad \div 2$$

$$5x^2 + 39x + 72 = 0$$

$$5x^2 + 15x + 24x + 72 = 0$$

$$5x(x + 3) + 24(x + 3)$$

$$(5x + 24)(x + 3) = 0$$

$$5x + 24 = 0$$

$$ - 24 \quad - 24$$

$$x + 3 = 0$$

$$ - 3 \quad - 3$$

$$\frac{5x}{5} = \frac{-24}{5}$$

$$x = -3$$

$$x = \frac{-24}{5}$$

$$y = 3\left(\frac{-24}{5}\right) + 13$$

$$y = 3(-3) + 13$$

$$= \frac{-72}{5} + 13$$

$$= -9 + 13$$

$$= 4$$

$$= \frac{-72}{5} + \frac{65}{5}$$

$$= \frac{-7}{5}$$

$$x = \frac{-24}{5}, y = \frac{-7}{5}, x = -3, y = 4$$

(Total for Question 20 is 5 marks)

x	3x	+13
3x	9x ²	+39x
+13	+39x	+169

$$5 \times 72 = 360$$

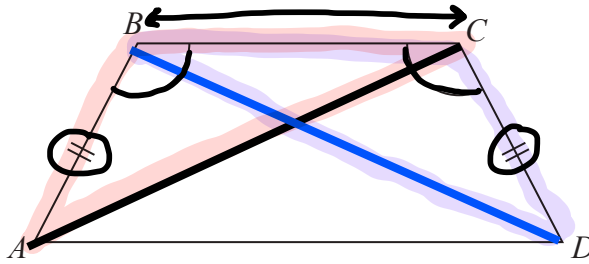
$$\begin{array}{r} \times 360 \\ + 39 \end{array}$$

1	360
2	180
3	120
4	90
5	72
6	60
8	45
9	40
10	36
12	30

$$\boxed{+15 + 24} = +39$$



21 $ABCD$ is a quadrilateral.



$$AB = CD.$$

$$\text{Angle } ABC = \text{angle } BCD.$$

Prove that $AC = BD$.

$$AB = CD \quad (\text{side})$$

$$\text{Angle } ABC = \text{Angle } BCD \quad (\text{angle})$$

BC is common to triangle ABC and triangle BCD (side)

Triangle ABC and triangle BCD are congruent - SAS

$$AC = BD$$

(Total for Question 21 is 4 marks)

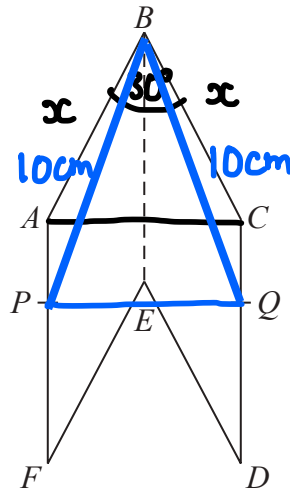
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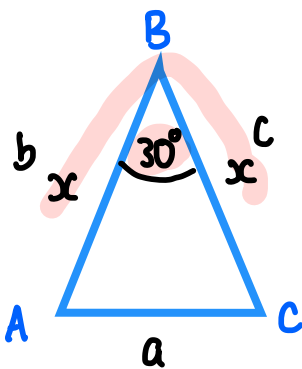
22 The diagram shows a hexagon $ABCDEF$.



$ABEF$ and $CBED$ are congruent parallelograms where $AB = BC = x$ cm.
 P is the point on AF and Q is the point on CD such that $BP = BQ = 10$ cm.

Given that angle $ABC = 30^\circ$,

prove that $\cos PBQ = 1 - \frac{(2 - \sqrt{3})x^2}{200}$



$$PQ = AC$$

$\frac{PBQ}{\cos A} = \frac{b^2 + c^2 - a^2}{2bc}$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\begin{aligned} \cos PBQ &= \frac{(10)^2 + (10)^2 - (2x^2 - 2x^2 \frac{\sqrt{3}}{2})}{2(10)(10)} \\ &= \frac{200 - (2x^2 - \cancel{2x^2} \frac{\sqrt{3}}{2})}{200} \end{aligned}$$

200

$$\begin{aligned} \frac{AC}{a^2} &= b^2 + c^2 - 2bc \cos A \\ a^2 &= x^2 + x^2 - 2(x)(x) \cos(30) \\ \sin &\sqrt{\begin{array}{c|cccc} 0 & 30 & 45 & 60 & 90 \\ \hline 0 & 1 & 2 & 3 & 4 \\ \cos & 4 & 3 & 2 & 1 & 0 \end{array}} \\ &= \frac{2}{2} \end{aligned}$$

$$\cos(30) = \frac{\sqrt{3}}{2}$$

$$a^2 = 2x^2 - 2x^2 \frac{\sqrt{3}}{2}$$

$$\begin{aligned} &= \frac{1 - 2x^2 - \sqrt{3}x^2}{200} \\ &= 1 - \frac{(2 - \sqrt{3})x^2}{200} \end{aligned}$$

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS



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