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| Write your name here  |  |  |   |
| Surname   |  | Other names  |   |
| <b>Pearson Edexcel</b>  |  | Centre Number  | Candidate Number  |
| <b>Level 1 / Level 2</b>  |  | <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> | <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; display: inline-block;"></div> |
| <b>GCSE (9–1)</b>   |  |  |   |
| <h1 style="margin: 0;">Mathematics</h1> <h2 style="margin: 0;">Paper 1 (Non-Calculator)</h2>  |  | <h1 style="margin: 0; color: blue;">Solutions</h1>   |   |
|   |  | <b>Higher Tier</b>   |   |
| Thursday 25 May 2017 – Morning<br><b>Time: 1 hour 30 minutes</b>  |  | Paper Reference<br><b>1MA1/1H</b>  |   |
| <b>You must have:</b> 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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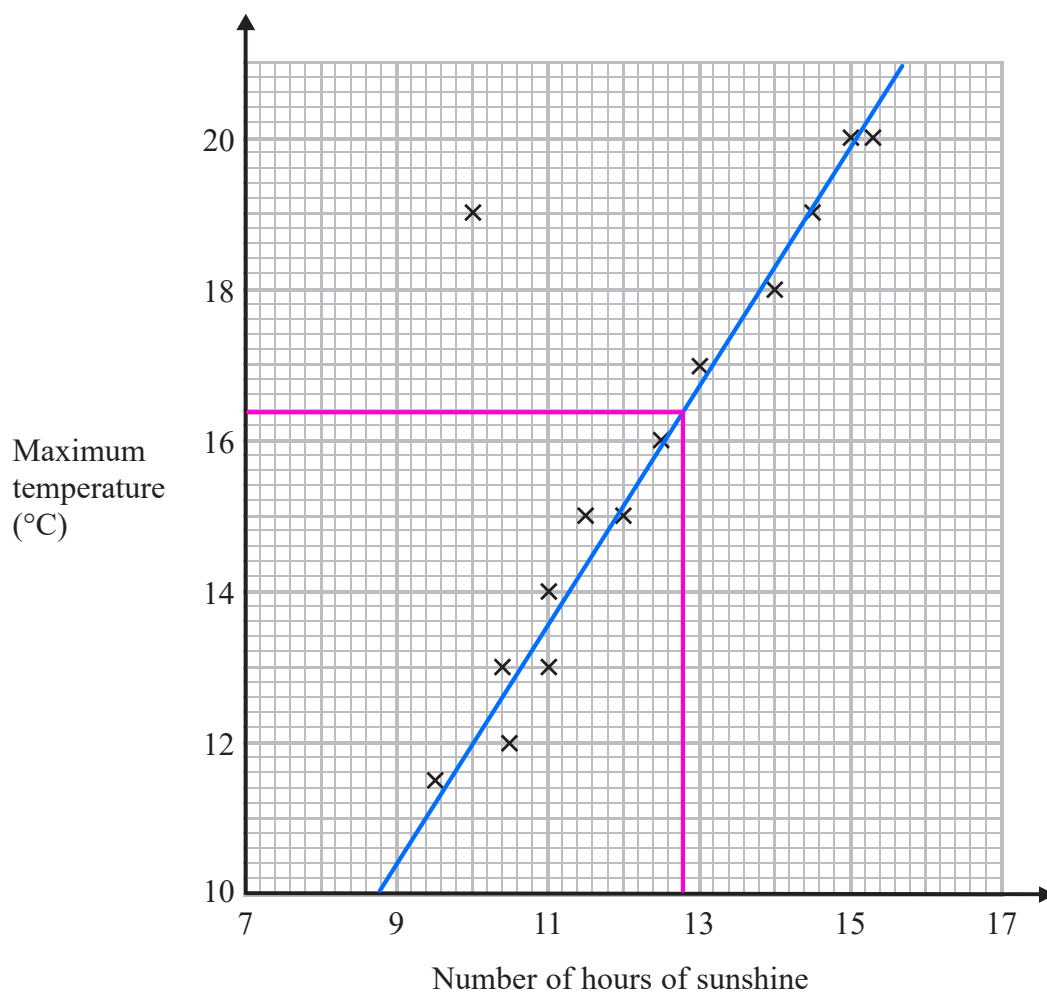
**Pearson**

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  $16.4^{\circ}\text{C}$ .

(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, most points recording high temp also  
record a lot of sunshine

(1)

(Total for Question 1 is 5 marks)

2 Express 56 as the product of its prime factors.

$$\begin{array}{r} 2 \overline{)56} \\ 2 \overline{)28} \\ 2 \overline{)14} \\ 7 \overline{)7} \\ 1 \end{array}$$

$$56 = 2 \times 2 \times 2 \times 7$$

(Total for Question 2 is 2 marks)

$$\text{or } 2^3 \times 7$$



3 Work out  $54.6 \times 4.3$

$$\begin{array}{r} 54.6 \\ \times 4.3 \\ \hline 1638 \\ 21840 \\ \hline 234.78 \end{array}$$

$$234.78$$

|    |       |      |     |
|----|-------|------|-----|
|    | 500   | 40   | 6   |
| 40 | 20000 | 1600 | 240 |
| 3  | 1500  | 120  | 18  |

$$\begin{array}{r} 20000 \\ 1600 \\ 240 \\ 1500 \\ 120 \\ 18 \\ \hline 23478 \\ 234.78 \end{array}$$

(2 figures after points in question)  
(so 2 figures after point in answer)

$$234.78$$

(Total for Question 3 is 3 marks)

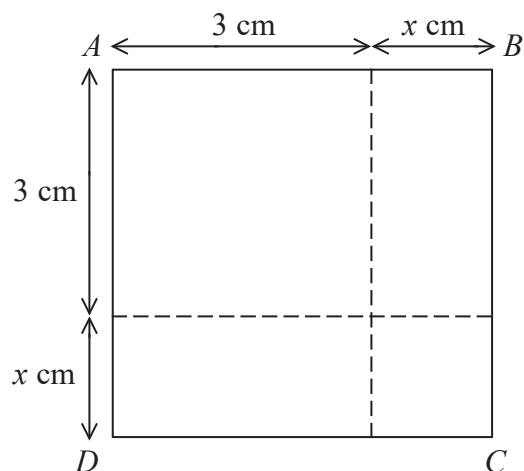
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4



The area of square  $ABCD$  is  $10 \text{ cm}^2$ .

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

$$\begin{aligned}
 \text{Area} &= (x+3)(x+3) \\
 &= x^2 + 3x + 3x + 9 \\
 &= x^2 + 6x + 9
 \end{aligned}$$

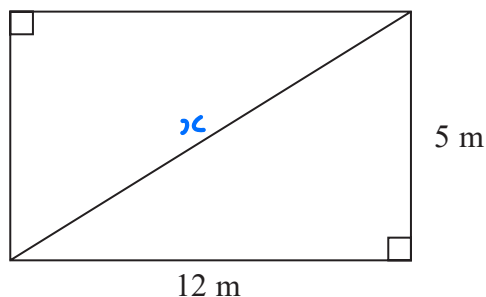
$$\begin{aligned}
 \therefore x^2 + 6x + 9 &= 10 \\
 x^2 + 6x &= 10 - 9 \\
 x^2 + 6x &= 1
 \end{aligned}$$


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(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.

By Pythagoras

$$x^2 = 5^2 + 12^2$$

$$x^2 = 25 + 144$$

$$x^2 = 169$$

$$x = \sqrt{169} = 13\text{ m}$$

Total length

$$= 12 + 5 + 12 + 5 + 13$$

$$= 47\text{ m}$$

$$\text{Weight} = 47 \times 1.5 \text{ kg}$$

$$= 47 + 23.5$$

$$= 70.5 \text{ kg}$$

70.5

kg

(Total for Question 5 is 5 marks)



- 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.

$$L_1 \quad y = 3x - 2$$
$$\text{gradient} = 3$$

$$L_2 \quad 3y - 9x + 5 = 0$$
$$3y = 9x - 5$$
$$y = 3x - \frac{5}{3}$$
$$\text{gradient} = 3$$

Same gradient  $\therefore$  parallel

(Total for Question 6 is 2 marks)



- 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.

$$10 + 20 = 30 \text{ students}$$

$$\begin{aligned} \text{Mean for class} &= 60 & \therefore \text{total class marks} \\ & & = 30 \times 60 = 1800 \end{aligned}$$

$$\begin{aligned} \text{Mean for girls} &= 54 & \therefore \text{total girls' marks} \\ & & = 20 \times 54 = 1080 \end{aligned}$$

$$\begin{array}{r} \text{Total boys' marks} = 1800 \\ \quad \quad \quad 1080 \\ \hline \quad \quad \quad 720 \end{array}$$

$$\text{Mean boys' mark} = \frac{720}{10} = 72 \quad \quad \quad 72$$

(Total for Question 7 is 3 marks)

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

$$0.00000797$$

(1)

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

$$\begin{aligned} & \frac{2.52 \times 10^5}{4 \times 10^{-3}} \\ &= 0.63 \times 10^8 \\ &= 6.3 \times 10^7 \end{aligned}$$

$6.3 \times 10^7$

(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?

$$600 \div 1.2 = 500$$

£ 500

(Total for Question 9 is 2 marks)

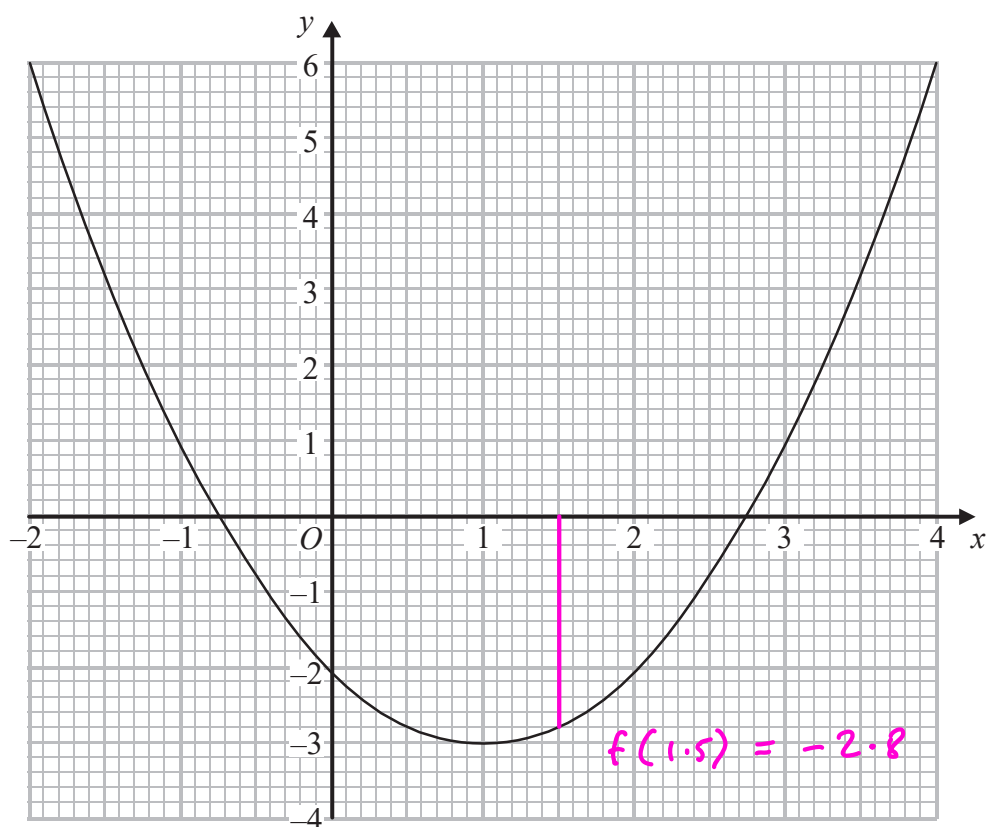
- 10 Show that  $(x+1)(x+2)(x+3)$  can be written in the form  $ax^3 + bx^2 + cx + d$  where  $a$ ,  $b$ ,  $c$  and  $d$  are positive integers.

$$\begin{aligned} & (x+1)(x+2)(x+3) \\ &= (x^2 + x + 2x + 2)(x+3) \\ &= (x^2 + 3x + 2)(x+3) \\ &= x^3 + 3x^2 + 2x \\ & \quad + 3x^2 + 9x + 6 \\ &= x^3 + 6x^2 + 11x + 6 \end{aligned}$$

(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  $f(x) = 0$

$x = -0.75$  ,  $x = 2.75$   
(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  $81^{-\frac{1}{2}}$

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

$$\frac{1}{9}$$

(2)

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

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

$$= \left(\frac{4}{5}\right)^2 = \frac{16}{25}$$

$$\frac{16}{25}$$

(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  $x$ .

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

$$\begin{aligned} x &= 1 \\ y &= 9 \end{aligned} \quad 9 = \frac{k}{1^2}$$

$$9 = k$$

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

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

(2)

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

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

$$16x^2 = 9$$

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

$$x = \sqrt{\frac{9}{16}} = \pm \frac{3}{4}$$

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

(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.

$$\begin{array}{l}
 \text{WHITE : BLACK} \\
 3 : 7 \\
 = 9 : 21 \\
 \begin{array}{cc}
 \text{WC : WS} & \text{BC : BS} \\
 = 4 : 5 & = 2 : 5
 \end{array} \\
 \text{WC : WS : BC : BS} \\
 = 4 : 5 : 6 : 15 \\
 \text{Circles} = 10 \text{ parts out of } 30 \\
 = \frac{10}{30} = \frac{1}{3}
 \end{array}$$

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

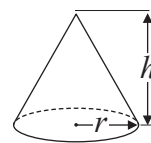
(Total for Question 14 is 4 marks)



- 15 A cone has a volume of  $98 \text{ cm}^3$ .  
The radius of the cone is  $5.13 \text{ cm}$ .

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

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



$$100 \approx \frac{1}{3} \times 3 \times 5^2 h$$

$$\frac{100}{5^2} \approx h$$

$$\frac{100}{25} \approx h$$

$$h \approx 4 \text{ cm} \quad (3)$$

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.

$$98 = \frac{1}{3} \times 3.14 \times 5.13^2 h$$

$$\frac{98 \times 3}{3.14 \times 5.13^2} = h$$

My estimate will be more  
as I used larger numerator  
and smaller denominator (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.

$$\begin{aligned} & n^2 - 2 - (n - 2)^2 \\ &= n^2 - 2 - (n^2 - 4n + 4) \\ &= n^2 - 2 - n^2 + 4n - 4 \\ &= 4n - 6 \\ &= 2(2n - 3) \end{aligned}$$

Divisible by 2 since 2 is a factor  
 $\therefore$  even

(Total for Question 16 is 4 marks)



17 There are 9 counters in a bag.

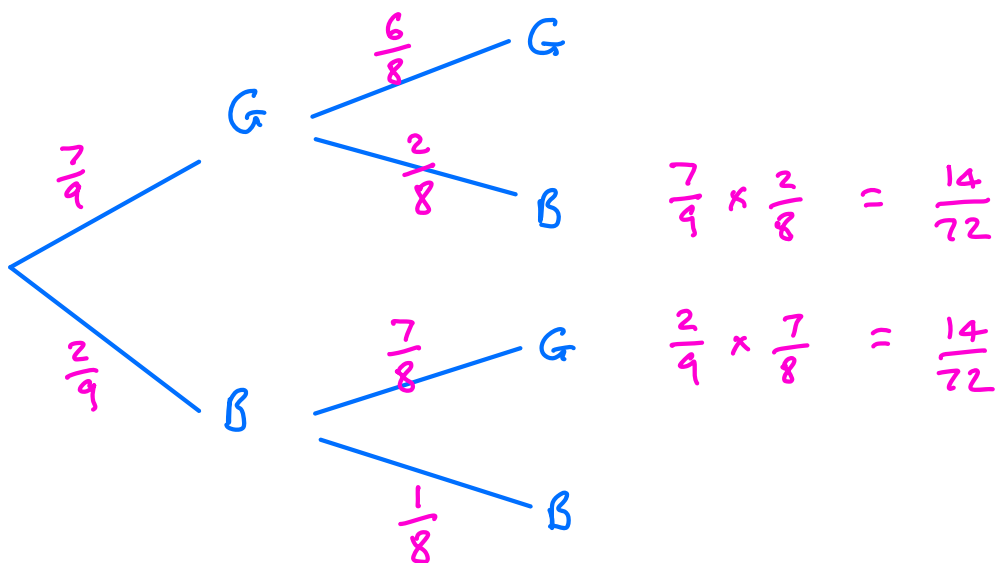
7 of the counters are green.

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.

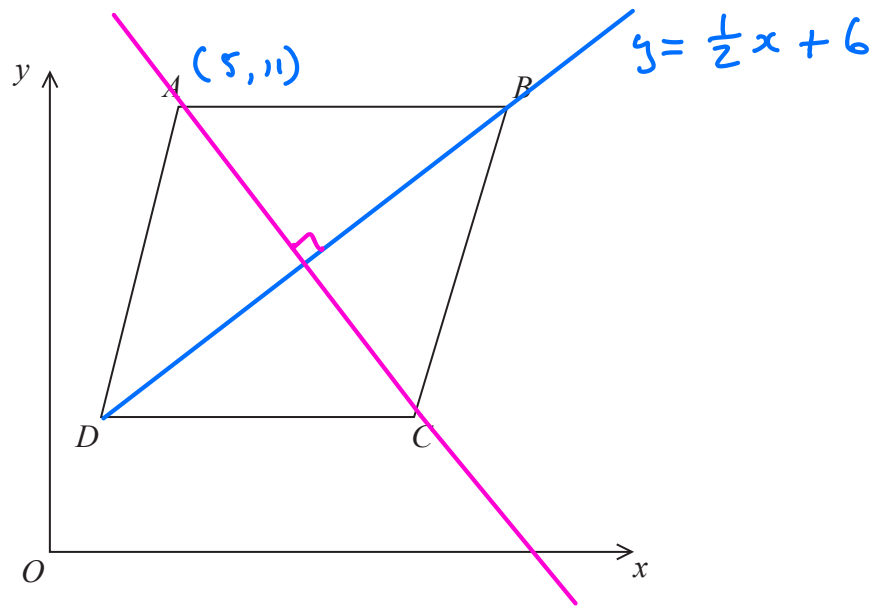


$$\text{Prob (One of each)} = \frac{14}{72} + \frac{14}{72} = \frac{28}{72} = \frac{7}{18}$$

$$\frac{28}{72} \text{ or } \frac{7}{18}$$

(Total for Question 17 is 4 marks)





$ABCD$  is a rhombus.

The coordinates of  $A$  are  $(5, 11)$

The equation of the diagonal  $DB$  is  $y = \frac{1}{2}x + 6$

Find an equation of the diagonal  $AC$ .

Diagonals of Rhombus  $\perp$

Gradient of  $AC = -2$  since gradient of  $BD = \frac{1}{2}$

$AC$

$$y = -2x + c$$

sub  
 $(5, 11)$

$$11 = -2(5) + c$$

$$11 = -10 + c$$

$$11 + 10 = c$$

$$21 = c$$

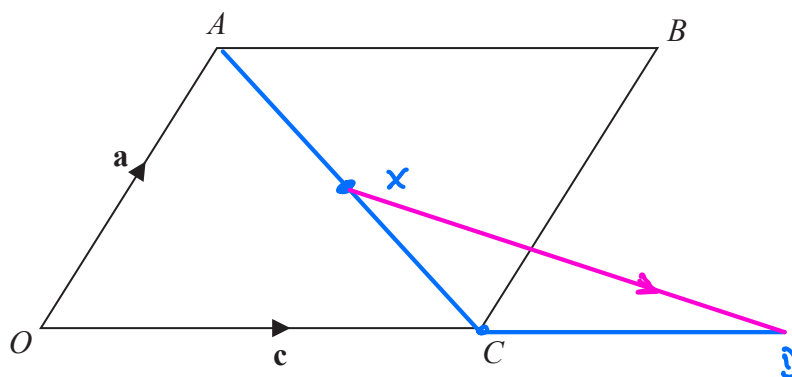
$AC$

$$y = -2x + 21$$

$$y = -2x + 21$$

(Total for Question 18 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  $OC : CD = k : 1$

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

find the value of  $k$ .

$$\begin{aligned} \vec{OD} &= \vec{OA} + \vec{AX} + \vec{XD} \\ &= \underline{\mathbf{a}} - \frac{1}{2}\underline{\mathbf{a}} + \frac{1}{2}\underline{\mathbf{c}} + 3\underline{\mathbf{c}} - \frac{1}{2}\underline{\mathbf{a}} \\ &= \underline{\frac{7}{2}\mathbf{c}} \end{aligned}$$

$$\begin{aligned} \therefore OC : CD &= \underline{\mathbf{c}} : \underline{\frac{5}{2}\mathbf{c}} \\ &= \underline{1} : \underline{\frac{5}{2}} \\ &= \underline{2} : \underline{5} \\ &= \underline{\frac{2}{5}} : \underline{1} \end{aligned}$$

$$k = \underline{\frac{2}{5}} \text{ or } \underline{0.4}$$

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

(Total for Question 19 is 4 marks)





20 Solve algebraically the simultaneous equations

$$x^2 + y^2 = 25$$

$$y - 3x = 13$$

①  
②

From ②  $y = 3x + 13$

Sub for  $y$  in ①  $x^2 + (3x + 13)^2 = 25$

$$x^2 + 9x^2 + 78x + 169 - 25 = 0$$

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

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

$$5 \times 72 = 360$$

$$24 \times 15$$

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

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

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

Either  $5x + 24 = 0$  or  $x + 3 = 0$   
 $5x = -24$   $x = -3$   
 $x = -\frac{24}{5}$

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

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

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

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

$$y = -9 + 13$$

$$y = 4$$

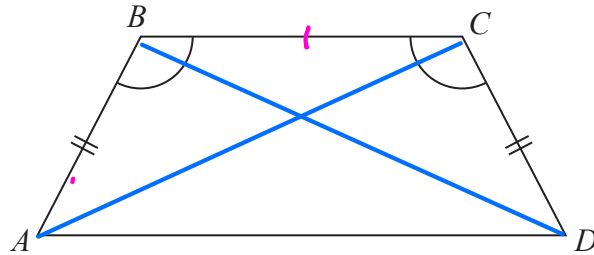
$$\begin{cases} x = -\frac{24}{5} \\ y = -\frac{7}{5} \end{cases}$$

$$\begin{cases} x = -3 \\ y = 4 \end{cases}$$

(Total for Question 20 is 5 marks)



21  $ABCD$  is a quadrilateral.



$$AB = CD.$$

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

Prove that  $AC = BD$ .

$BC$  common to  $\Delta s ABC, BCD$

$$AB = CD$$

$$\angle ABC = \angle BCD$$

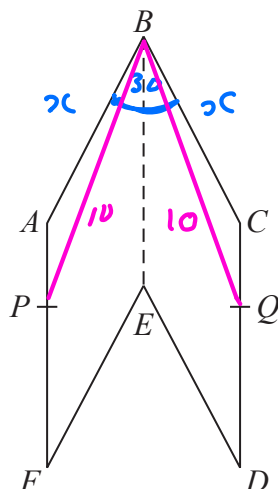
$\Delta s ABC$  are congruent S.A.S.  
D.C.B

$$\therefore AC = BD$$

(Total for Question 21 is 4 marks)



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

Cosine Rule in  $\triangle BAC$

$$AC^2 = x^2 + x^2 - 2 \times x \times x \cos 30$$

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

$$AC^2 = 2x^2 - \sqrt{3}x^2$$

But  $AC = PQ \quad \therefore PQ^2 = 2x^2 - \sqrt{3}x^2$   
 $= (2 - \sqrt{3})x^2$

Cosine Rule in  $\triangle PBQ$

$$\cos(\angle PBQ) = \frac{10^2 + 10^2 - PQ^2}{2 \times 10 \times 10}$$

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

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

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS



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