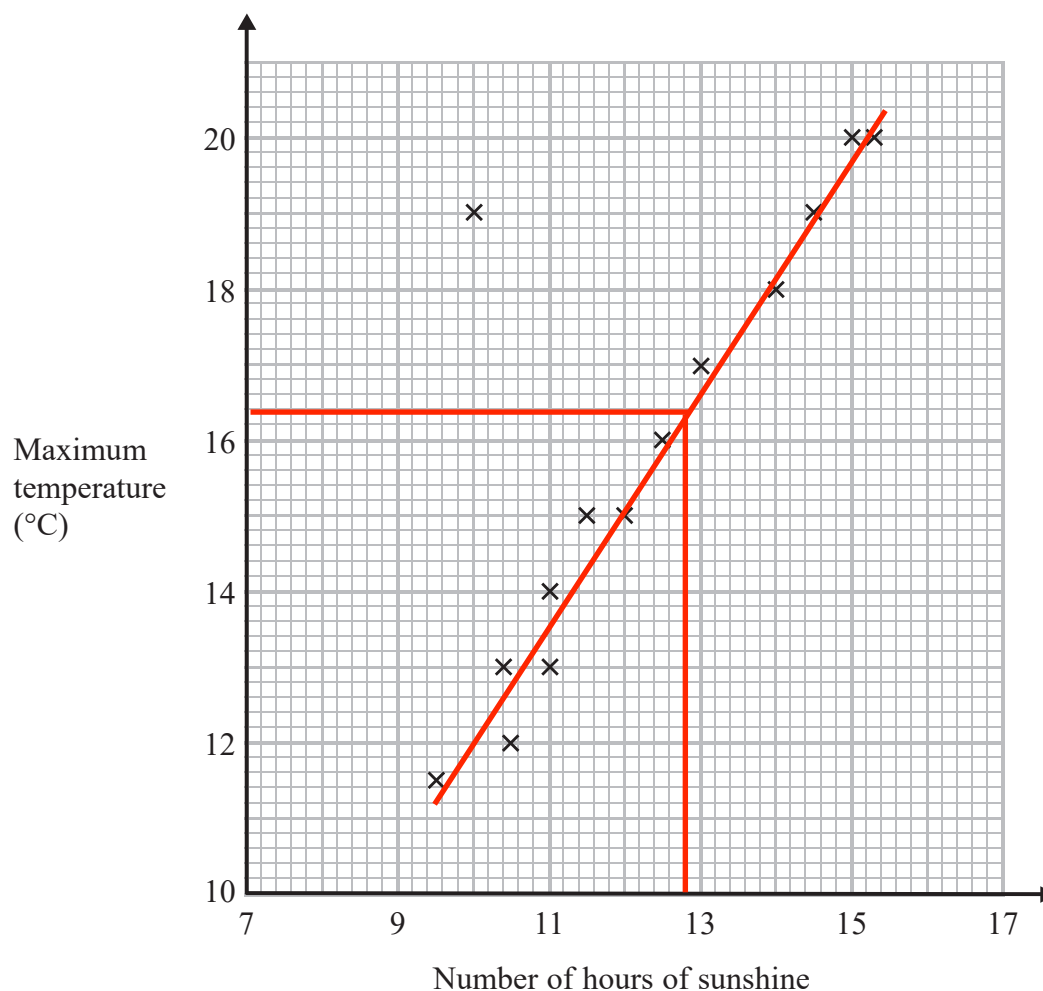


- 1 The scatter graph shows the maximum temperature and the number of hours of sunshine in fourteen British towns on one day.



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.

Tip: When estimating you need to draw a line of best fit

12.8
(12 to 13) (2) hours

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.

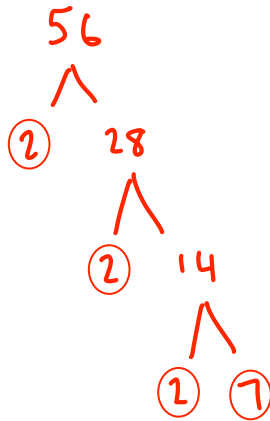
yes, there is a positive correlation

(1)

(Total for Question 1 is 5 marks)



- 2 Express 56 as the product of its prime factors.



$$2^3 \times 7$$

(Total for Question 2 is 2 marks)

3 Work out 54.6×4.3

$$\begin{array}{r} 54.6 \\ \times 4.3 \\ \hline 1638 \\ \times \times \\ 21840 \\ \times \times \\ \hline 2347.8 \end{array}$$

$$54.6 \times 4.3 = 234.78$$

$$234.78$$

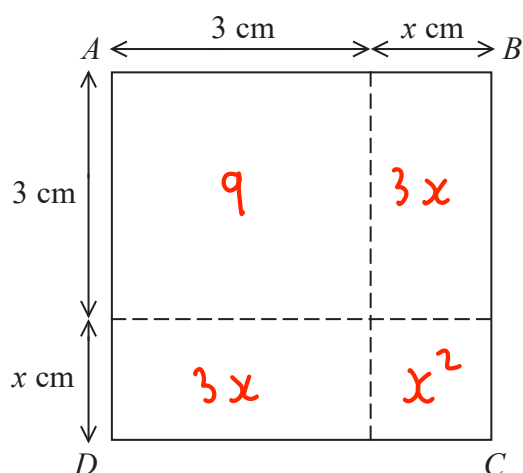
(Total for Question 3 is 3 marks)

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4



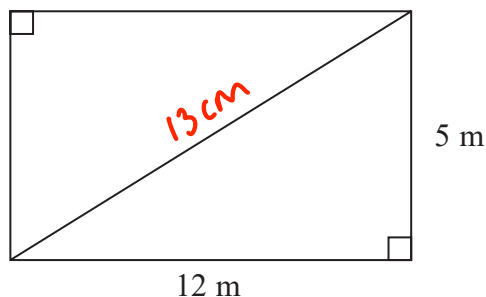
The area of square $ABCD$ is 10 cm^2 .

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

$$\begin{array}{rcl}
 x^2 + 3x + 3x + 9 & = & 10 \\
 x^2 + 6x + 9 & = & 10 \\
 -9 & & -9 \\
 \hline
 x^2 + 6x & = & 1
 \end{array}$$

(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.

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

$$144 + 25 = c^2$$

$$169 = c^2$$

$$\sqrt{169} = \sqrt{c^2}$$

$$13 = c$$

$$\begin{array}{r} 12 \\ 12 \\ + 13 \\ 5 \\ 5 \\ \hline 47 \text{ cm} \end{array}$$

$$47 \times 1.5 = 70.5$$

$$\begin{array}{r} 47 \\ \times 15 \\ \hline 235 \\ 470 \\ \hline 705 \end{array}$$

..... 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.

Tip: Parallel lines have the same gradient

$$L_1 : \text{Gradient} = 3$$

$$\begin{array}{rcl}
 L_2 : & 3y - 9x + 5 & = 0 \\
 & -5 & -5 \\
 & 3y - 9x & = -5 \\
 & +9x & +9x \\
 & 3y & = 9x - 5 \\
 & \div 3 & \div 3 \\
 & y & = 3x - \frac{5}{3}
 \end{array}$$

$$\text{Gradient} = 3$$

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.

$$\begin{array}{rcl} 30 \times 60 & = & 1800 \\ 20 \times 54 & = & 1080 \\ \hline & & 720 \end{array}$$

$$720 \div 10 = 72$$

72

(Total for Question 7 is 3 marks)

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- 8 (a) Write 7.97×10^{-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.

$$4 \overline{) 2.52}$$

$$= 0.63 \times 10^8$$

$$= 6.3 \times 10^7$$

6.3×10^7

(2)

(Total for Question 8 is 3 marks)

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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?

$$\begin{array}{lcl} \div 12 & 120\% & = 600 \\ \downarrow & 10\% & = 50 \\ \times 10 & 100\% & = 500 \end{array} \qquad \begin{array}{lcl} & & \downarrow \div 12 \\ & & \downarrow \times 10 \end{array}$$

£ 500

(Total for Question 9 is 2 marks)



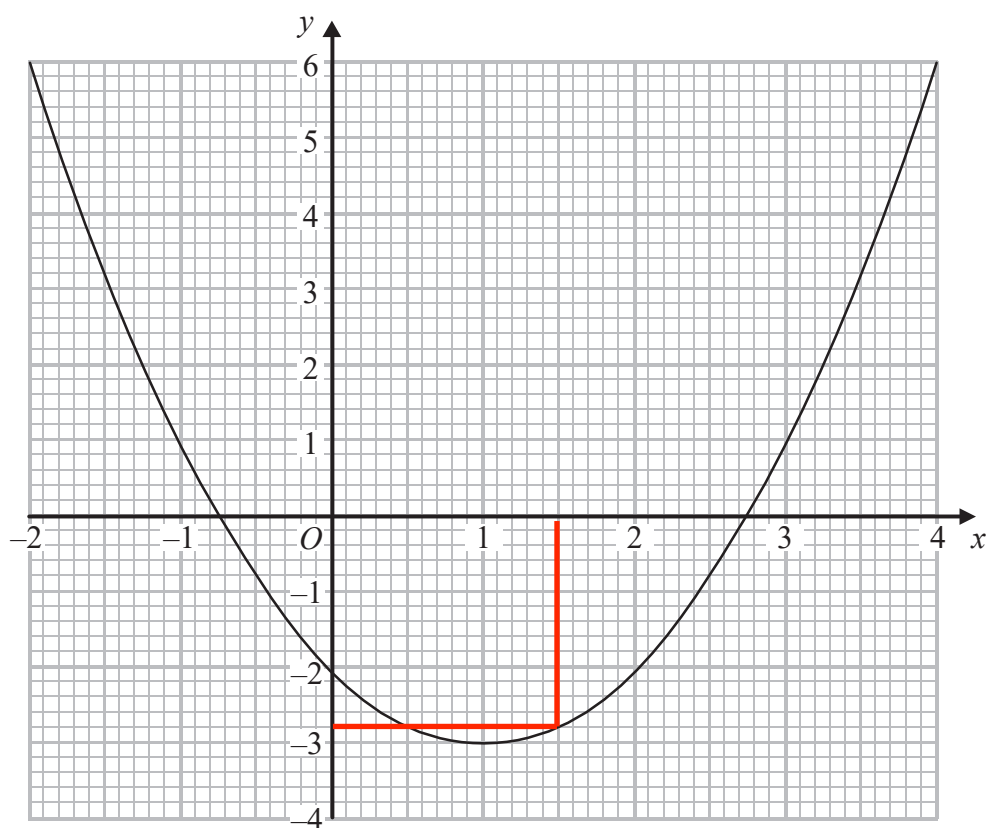
- 10 Show that $(x+1)(x+2)(x+3)$ can be written in the form $ax^3 + bx^2 + cx + d$ where a, b, c and d are positive integers.

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

(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 $f(x) = 0$

-0.75, 2.75
(-0.7 to -0.8, 2.7 to 2.8)
(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 $81^{-\frac{1}{2}}$

$$\sqrt{81} = 9$$

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

(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 .

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

$$\begin{array}{l} y = \frac{k}{x^2} \\ 9 = \frac{k}{(1)^2} \\ x_1 \quad x_1 \\ 9 = k \end{array}$$

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

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

(2)

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

$$\begin{array}{l} 16 = \frac{9}{x^2} \\ \times x^2 \quad \times x^2 \\ 16x^2 = 9 \\ \div 16 \quad \div 16 \\ x^2 = \frac{9}{16} \\ \sqrt{} \quad \sqrt{} \\ x = \frac{3}{4} \end{array}$$

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

(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.

$$\begin{array}{rcl}
 & WS & : \quad BS \\
 \times 3 \downarrow & 3 & : \quad 7 \\
 & 9 & : \quad 21 \quad \downarrow \times 3
 \end{array}$$

	C : S		C : S
(9 parts)✓	4 : 5		2 : 5 = 7 parts
			6 : 15 = 21 parts ✓

$$\begin{array}{rcl}
 WC & : WS & : BC : BS \\
 (4) & : 5 & : (6) : 15
 \end{array}$$

$$10/30$$

(Total for Question 14 is 4 marks)

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

- 15 A cone has a volume of 98 cm^3 .

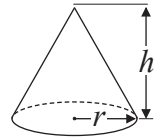
The radius of the cone is 5.13 cm . 5 cm

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

$$\pi = 3.14 \dots = 3$$

$$\begin{array}{r|l} \frac{1}{3} (3) (5)^2 \times h & = 100 \\ 25h & = 100 \\ \div 25 & \div 25 \\ h & = 4 \end{array}$$

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



$$\frac{4}{(3.5 \text{ to } 4.5)} \text{ cm}$$

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.

More, I rounded the volume up, and π and the radius down. And so I divided a larger number by a smaller one

(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.

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

$\therefore$ always even as always a multiple of 2

(Total for Question 16 is 4 marks)

17 There are 9 counters in a bag.

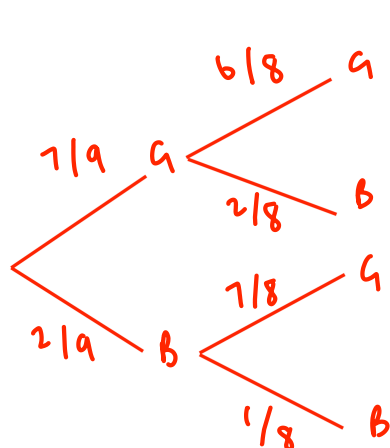
7 of the counters are green.

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.



$$P(G, B) = \frac{7}{9} \times \frac{2}{8} = \frac{14}{72}$$

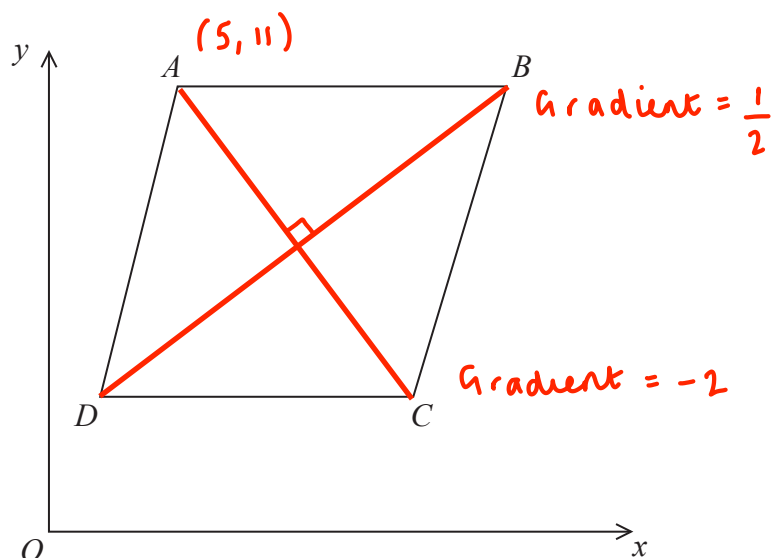
$$P(B, G) = \frac{2}{9} \times \frac{7}{8} = \frac{14}{72}$$

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

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

(Total for Question 17 is 4 marks)

18



$ABCD$ 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 .

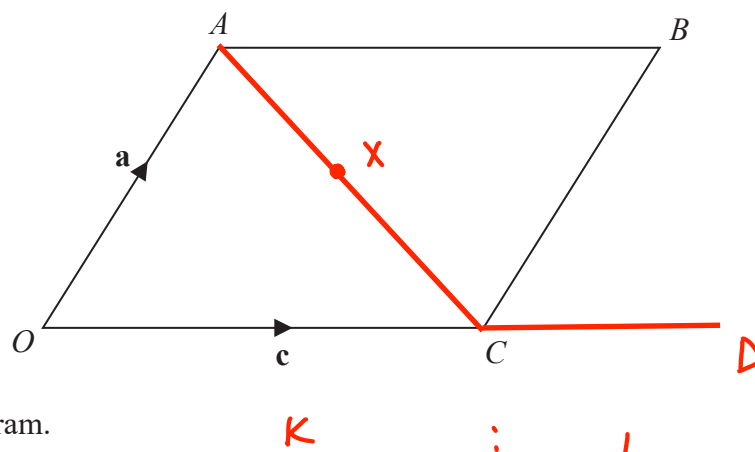
Perpendicular lines

$$\begin{aligned}
 AC &\rightarrow y = -2x + c \\
 11 &= -2(5) + c \\
 11 &= -10 + c \\
 +10 & \quad +10 \\
 21 &= c \\
 y &= -2x + 21
 \end{aligned}$$

$$y = -2x + 21$$

(Total for Question 18 is 4 marks)

19



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$OABC$ 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 .

$$\vec{AC} = -\mathbf{a} + \mathbf{c}$$

$$\vec{AX} = \vec{XC} = -\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{c}$$

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

$$\therefore \vec{CD} = 2.5\mathbf{c}$$

$$\vec{OC} : \vec{CD}$$

$$\mathbf{c} : 2.5\mathbf{c}$$

$$\div 2.5 \left(\frac{1}{2.5} : 1 \right) \rightarrow \frac{10}{25} : 1$$

$$\frac{1}{2.5} = \frac{10}{25}$$

$$k = \frac{10}{25}$$

(Total for Question 19 is 4 marks)

20 Solve algebraically the simultaneous equations

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

$$y - 3x = 13$$

$$\rightarrow y = 13 + 3x$$

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

$$= 169 + 39x + 39x + 9x^2$$

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

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

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

$$-25 \quad -25$$

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

$$\div 2 \quad 5x^2 + 39x + 72 = 0 \quad \div 2$$

$$+39 \quad \times 360$$

24 and 15

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

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

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

$$x = -3 \quad \text{or} \quad x = -\frac{24}{5}$$

$$y = 13 + 3x$$

$$= 13 + 3(-3) = 13 - 9 = 4$$

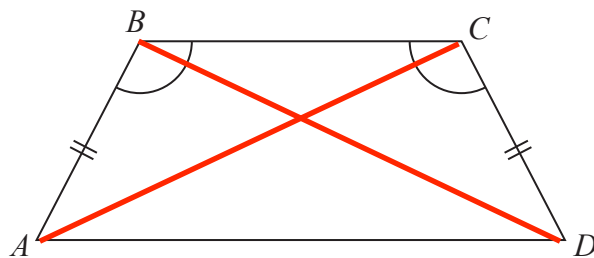
$$\text{OR} \quad = 13 + 3\left(-\frac{24}{5}\right) = 13 - \frac{72}{5} = \frac{65}{5} - \frac{72}{5} = -\frac{7}{5}$$

$$x = -3, y = 4$$

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

(Total for Question 20 is 5 marks)

21 $ABCD$ is a quadrilateral.



$$AB = CD.$$

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

Prove that $AC = BD$.

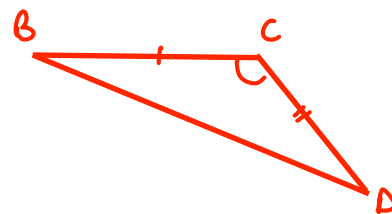
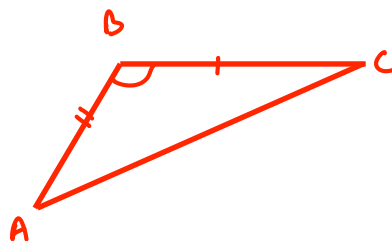
$$\angle ABC = \angle BCD$$

$$AB = CD$$

$$\text{They share } BC \therefore BC = BC$$

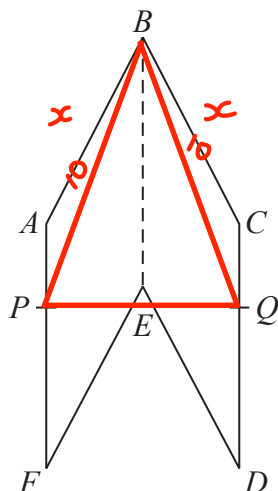
Congruent shapes (SAS)

$$\text{So } AC = BD$$



(Total for Question 21 is 4 marks)

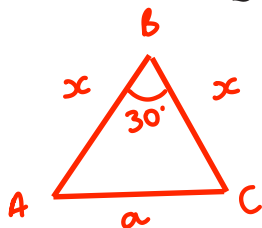
22 The diagram shows a hexagon $ABCDEF$.



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



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

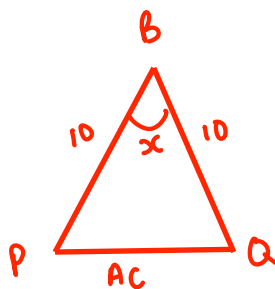
$$AC^2 = x^2 + x^2 - 2(x)(x) \times \cos(30)$$

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

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

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

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



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

$$= \frac{10^2 + 10^2 - (2x^2 - \sqrt{3}x^2)}{2 \times 10 \times 10}$$

$$= \frac{200 - 2x^2 + \sqrt{3}x^2}{200}$$

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

(Total for Question 22 is 5 marks)