

Write your name here			
Surname		Other names	
Pearson Edexcel		Centre Number	
Level 1 / Level 2		Candidate Number	
GCSE (9–1)			
Mathematics Paper 1 (Non-Calculator)			
Higher Tier			
Thursday 25 May 2017 – Morning		Paper Reference	
Time: 1 hour 30 minutes		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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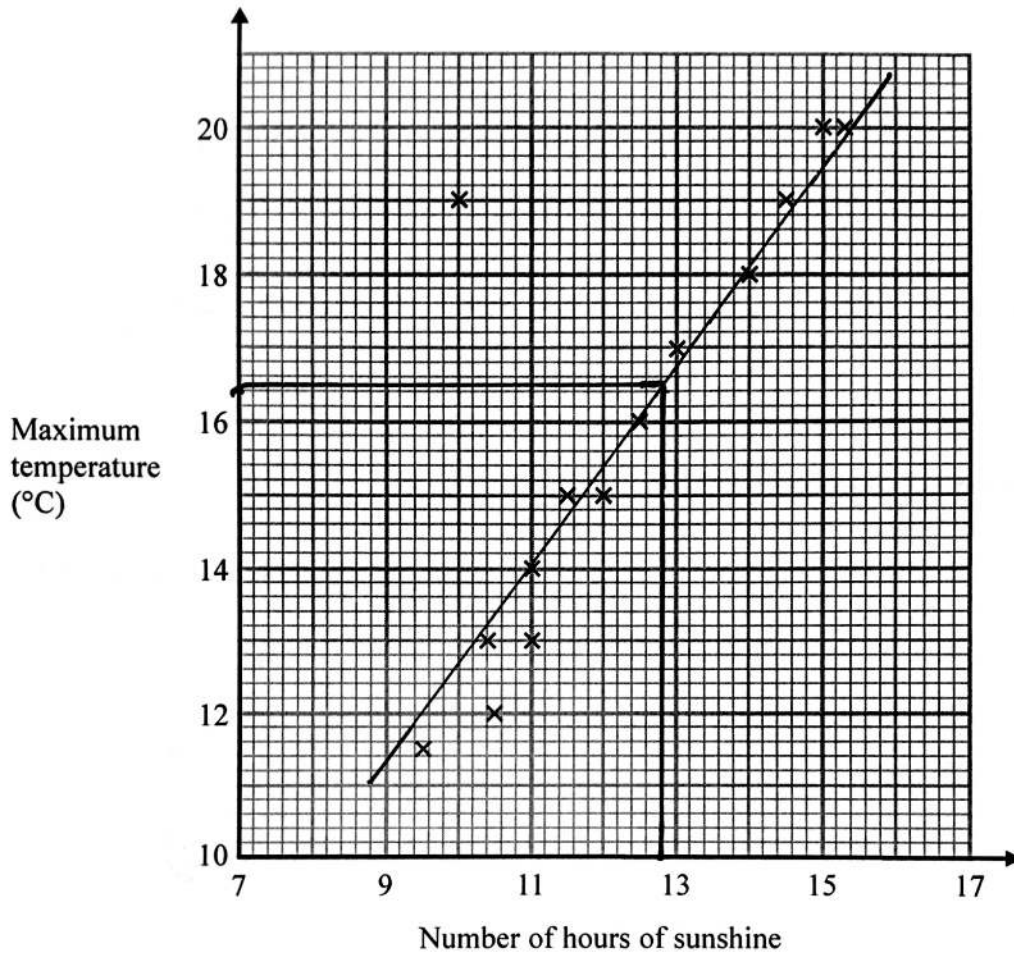

Pearson

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.”

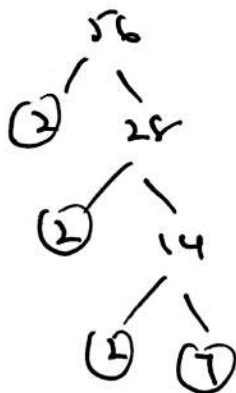
(d) Does the scatter graph support what the weatherman says?
Give a reason for your answer.

only 14 towns, on one day - not enough data

(1)

(Total for Question 1 is 5 marks)

2 Express 56 as the product of its prime factors.



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

(Total for Question 2 is 2 marks)



3 Work out 54.6×4.3

$$\begin{array}{r} 546 \\ \times 43 \\ \hline \end{array}$$

$$\begin{array}{r} \times 500 \quad 40 \quad 6 \\ 40 \quad 3 \quad 1 \\ \hline \end{array}$$

$$\underline{\underline{234.78}}$$

(Total for Question 3 is 3 marks)

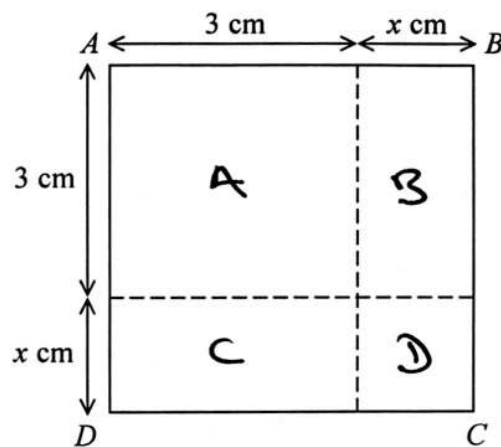
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4



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

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

$$A + B + C + D = 10$$

$$9 + 3x + 3x + x^2 = 10$$

$$x^2 + 6x + 9 = 10$$

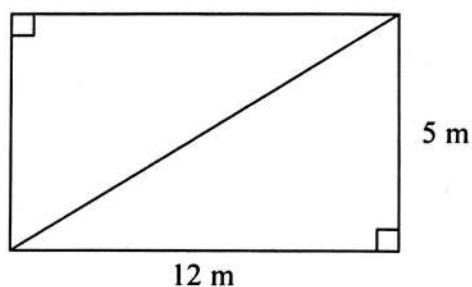
$$\underline{\underline{x^2 + 6x = 1}}$$

(Total for Question 4 is 3 marks)



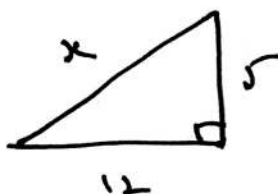
P 4 8 1 4 7 A 0 5 2 0

- 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.



$$\begin{aligned} x^2 &= 5^2 + 12^2 \\ &= 25 + 144 \\ x^2 &= 169 \\ x &= 13 \end{aligned}$$

$$\begin{array}{r} 47 \\ \times 1.5 \\ \hline 235 \\ 470 \\ \hline 70.5 \end{array}$$

Total length

$$24 + 10 + 13 = 47 \text{ m}$$

$$47 \times 1.5 = \underline{\underline{70.5 \text{ kg}}}$$

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.

If parallel - the gradient is the same

$$L_1 \Rightarrow y = 3x - 2$$

↗
gradient

$$L_2 \Rightarrow 3y - 9x + 5 = 0$$

+ 9x - 5

$$3y = 9x - 5$$

÷ 3

$$y = \frac{9x - 5}{3}$$

$$+ 9x - 5$$

$$\div 3$$

$$y = \frac{9x}{3} - \frac{5}{3}$$

(Total for Question 6 is 2 marks)

$$y = 3x - \frac{5}{3}$$

↗
gradient.



- 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.

$$\text{Class Mean} = \frac{\text{Total}}{\text{Number}} \Rightarrow 60 = \frac{\text{Total}}{30} \therefore \text{Total} = 1800 \text{ marks}$$

$$\text{Girls Mean} = \frac{\text{Total}}{\text{Number}} \Rightarrow 54 = \frac{\text{Total}}{20} \therefore \text{Total} = 1080 \text{ marks}$$

$$\begin{aligned} \text{Boys mark} &= \text{Total} - \text{Girls} \\ &= 1800 - 1080 \\ &= 720 \end{aligned}$$

$$\text{Boys Mean} = \frac{\text{Total}}{\text{Number}} = \frac{720}{10} = 72$$

72

(Total for Question 7 is 3 marks)

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

0.00000797

(1)

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

$$(2.52 \div 4) \times (10^5 \div 10^{-3})$$

$$0.63 \times 10^8$$

$$6.3 \times 10^7$$

$$\begin{array}{r} 0.63 \\ 4 \overline{) 2.52} \\ \underline{5} \\ 5 \\ \underline{5} \\ 0 \end{array}$$

5 - -3

$$6.3 \times 10^7$$

(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?

$$\begin{aligned}
 600 &= 120\% \text{ Net} \\
 600 &= 1.2 \text{ Net} \\
 \frac{600}{1.2} &= \text{Net} \\
 \frac{6000}{12} &= \text{Net}
 \end{aligned}$$

£ 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.

$$\begin{aligned}
 &(x+1) \left[(x+2)(x+3) \right] \\
 &(x+1) \left[x^2 + 5x + 6 \right]
 \end{aligned}$$

$$\underline{x^3} + \underline{5x^2} + \underline{6x} + \underline{x^2} + \underline{5x} + \underline{6}$$

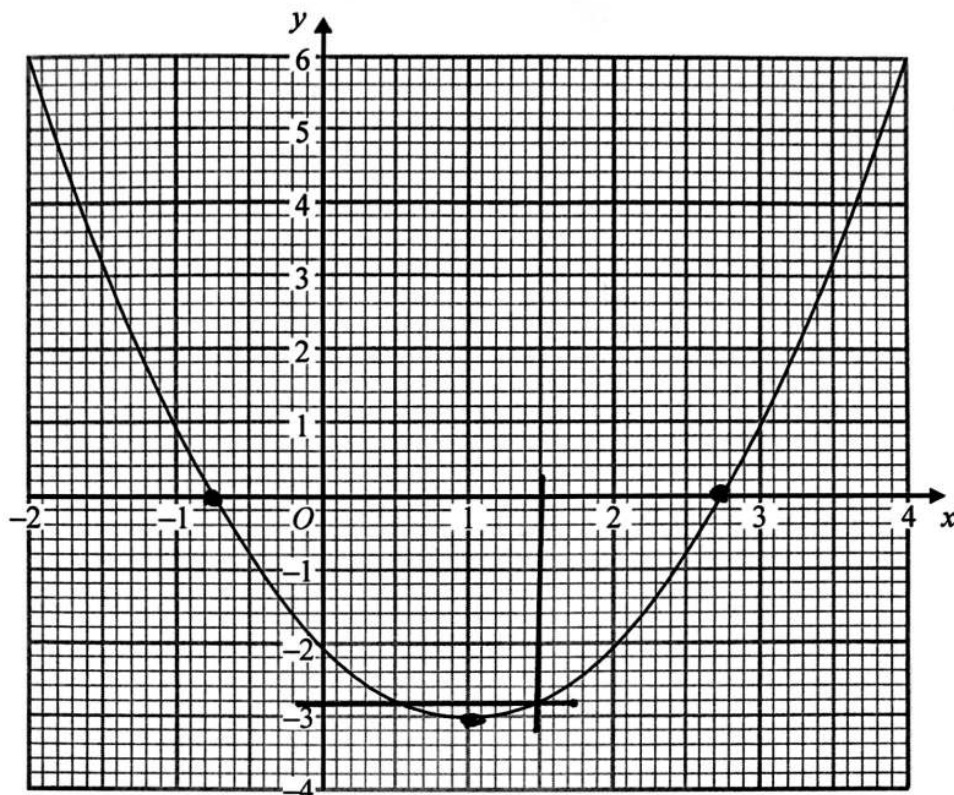
$$x^3 + 6x^2 + 11x + 6$$

$$a = 1 \quad b = 6 \quad c = 11 \quad d = 6$$

(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 $f(x) = 0$

-0.7, +2.7
(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 $81^{-\frac{1}{2}}$

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

$$\frac{1}{\sqrt{81}}$$

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

(2)

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

$$\left[\left(\frac{64}{125}\right)^{\frac{1}{3}}\right]^2$$

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

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

(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 .

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

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

$$9 = k$$

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

(2)

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

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

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

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

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

(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.

White shapes $\frac{3}{10}$ white circles $\frac{4}{9}$ white squares $\frac{5}{9}$ white circles $\frac{3}{10} \times \frac{4}{9} = \frac{12}{90} = \frac{4}{30} = \frac{2}{15}$ $\frac{2}{15} + \frac{2}{10}$ $\frac{4}{30} + \frac{6}{30} = \frac{10}{30}$	Black shapes $\frac{7}{10}$ black circles $\frac{2}{5}$ black squares $\frac{5}{10}$ black circles $\frac{2}{5} \times \frac{7}{10} = \frac{14}{50} = \frac{7}{25}$
--	--

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

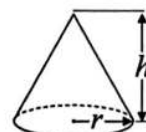
(Total for Question 14 is 4 marks)



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

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

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



$$\text{Vol} = \frac{1}{3} \pi r^2 h$$

$$100 = \frac{1}{3} \cdot 3 \cdot 5^2 \cdot h$$

$$100 = 25h$$

$$4 = h$$

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.

Rounded up! actual height smaller

(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.

$$n^2 - 2 - [(n - 2)(n - 2)]$$

$$n^2 - 2 - [n^2 - 4n + 4]$$

$$\cancel{n^2} - 2 - \cancel{n^2} + 4n - 4$$

$$4n - 6$$

$$2(2n - 3)$$

Always an even number as 2 is a factor.

(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.

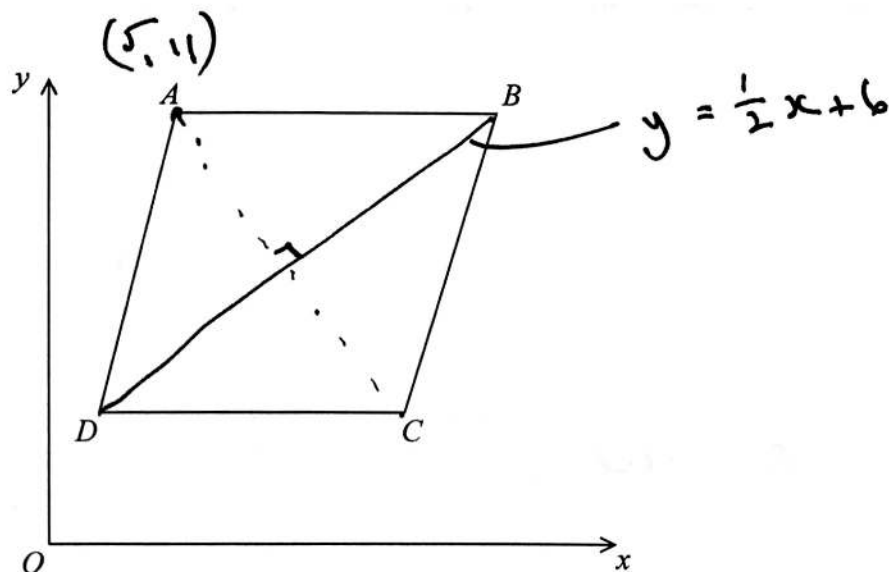
You must show your working.

$$\begin{array}{l}
 \begin{array}{c} \frac{7}{9} \rightarrow G \\ \frac{2}{9} \rightarrow B \end{array} \quad \begin{array}{c} \frac{6}{8} \rightarrow G \\ \frac{2}{8} \rightarrow B \end{array} \quad GB \quad \frac{7}{9} \times \frac{2}{8} = \frac{14}{72} \\
 \begin{array}{c} \frac{7}{8} \rightarrow G \\ \frac{1}{8} \rightarrow B \end{array} \quad BG \quad \frac{2}{9} \times \frac{7}{8} = \frac{14}{72} \\
 \text{Probability } \frac{14}{72} + \frac{14}{72} = \frac{28}{72} = \frac{7}{18}
 \end{array}$$

(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 .

$$DB \Rightarrow y = \frac{1}{2}x + 6$$

$$AC \Rightarrow y = -2x + c$$

$$\text{At } (5, 11)$$

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

$$11 = -10 + c$$

$$\underline{21 = c}$$

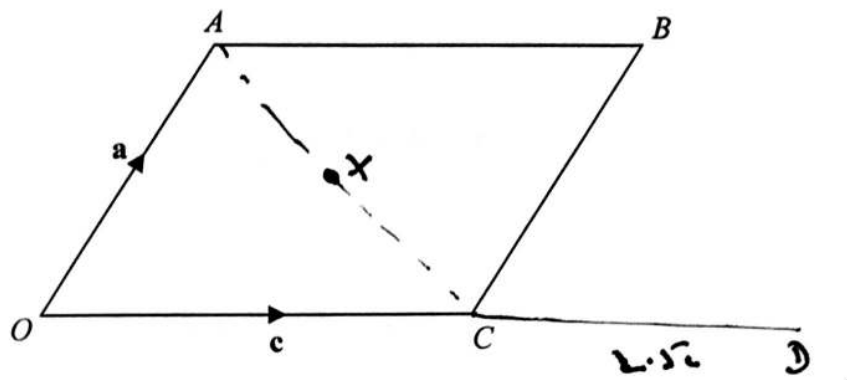
Line AC

$$\underline{\underline{y = -2x + 21}}$$

(Total for Question 18 is 4 marks)



P 4 8 1 4 7 A 0 1 5 2 0



$OABC$ is a parallelogram.

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

find the value of k .

$$\begin{aligned}
 \vec{CO} &= \vec{CX} + \vec{XO} \\
 &= \frac{1}{2}(\vec{CA}) \\
 &= \frac{1}{2}(\vec{CO} + \vec{OA}) \\
 &= \frac{1}{2}(-\mathbf{c} + \mathbf{a}) \\
 &= \frac{1}{2}(\mathbf{a} - \mathbf{c})
 \end{aligned}$$

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

$$\begin{aligned}
 \vec{CD} &= \frac{1}{2}\mathbf{a} - \frac{1}{2}\mathbf{c} + 3\mathbf{c} - \frac{1}{2}\mathbf{a} \\
 \vec{CD} &= 2.5\mathbf{c}
 \end{aligned}$$

$$OC : CD$$

$$k : 1$$

$$1 : 2.5 \quad \leftarrow \text{want to be 1}$$

$$2 : 5$$

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

$$0.4 : 1$$

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

$k = \dots\dots\dots$

(Total for Question 19 is 4 marks)



20 Solve algebraically the simultaneous equations

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

$$y - 3x = 13$$

$$y = 13 + 3x$$

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

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

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

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

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

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

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

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

$$x = -3$$

when $x = -3$

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

$$y = 4$$

$$x = -3$$

$$y = 4$$

$$\begin{array}{r} 10 \\ 36 \overline{) 360} \end{array} \begin{array}{r} 15 \\ 24 \\ \hline \end{array}$$

$$-\frac{48}{10}$$

$$x = \frac{-24}{5} = -4.8$$

when $x = -4.8$

$$y = 13 + 3(-4.8)$$

$$y = 13 - 14.4$$

$$y = -1.4$$

$$x = -4.8$$

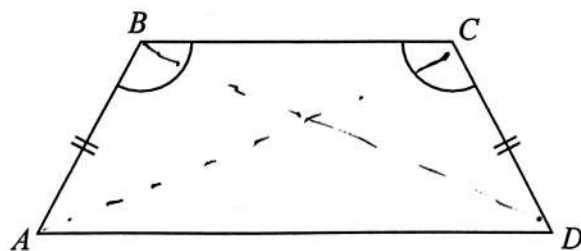
$$y = -1.4$$

(Total for Question 20 is 5 marks)



P 4 8 1 4 7 A 0 1 7 2 0

21 $ABCD$ is a quadrilateral.



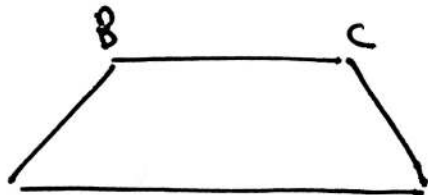
$$AB = CD.$$

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

Prove that $AC = BD$.

$$AB = CD$$

$$\angle ABC = \angle BCD.$$



BC is common to both

$$\begin{array}{c} S \quad A \\ / \quad / \\ AB = CD \quad \angle ABC \\ \quad \quad \quad = \angle BCD \end{array}$$

$$\begin{array}{c} S \\ | \\ DC = BC \end{array}$$

$$\therefore AC = BD.$$

(Total for Question 21 is 4 marks)

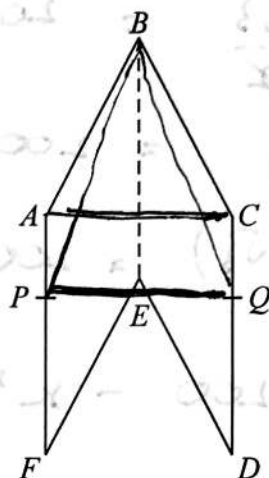


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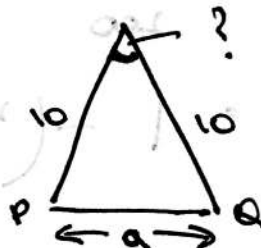
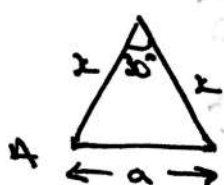
22 The diagram shows a hexagon $ABCDEF$.



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



$$\begin{aligned} a^2 &= b^2 + c^2 - 2bc \cos A \\ &= x^2 + x^2 - 2 \cdot x \cdot x \cdot \cos 30^\circ \\ &= 2x^2 - 2x^2 \cos 30^\circ \end{aligned}$$

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

$$2x^2 - 2x^2 \cos 30^\circ = 10^2 + 10^2 - 2 \cdot 10 \cdot 10 \cdot \cos A$$

$$2x^2 - 2x^2 \cdot \frac{\sqrt{3}}{2} = 200 - 200 \cos A$$

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

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS



P 4 8 1 4 7 A 0 1 9 2 0

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

$$2x^2 - x^2\sqrt{3} = 200 - 200 \cos A$$

$$200 \cos A + x^2(2 - \sqrt{3}) = 200$$

$$200 \cos A = 200 - x^2(2 - \sqrt{3})$$

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

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

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

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

where $A = \angle PQR$

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