Write your name here

Surname	Other names
MODEL ANSWERS	

Pearson Edexcel
Level 1 / Level 2
GCSE (9–1)

Centre Number | Candidate Number

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 ▶

P48147A

6/6/6/6/6/7/7/

P 4 8 1 4 7 A 0 1 2 0

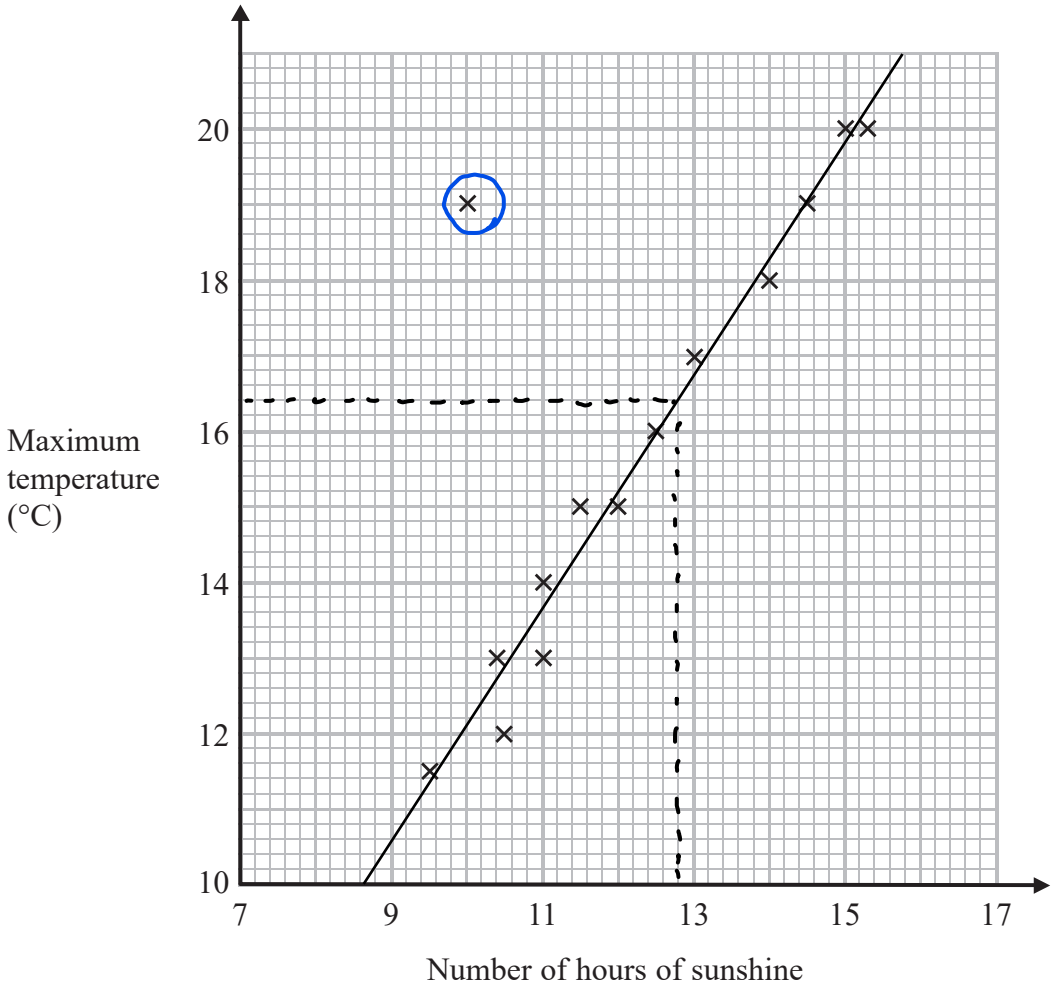
Pearson

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.

An outlier does not follow the trend of data.

(10 , 19)

(1)

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

Positive - as x increases, y increases.

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."

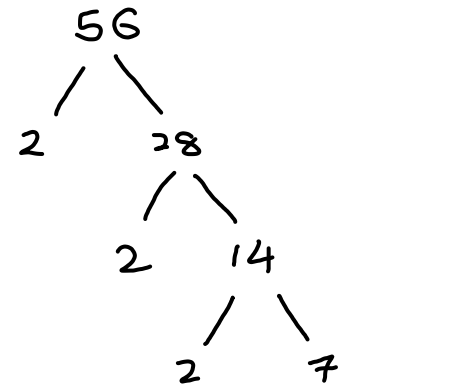
(d) Does the scatter graph support what the weatherman says?
Give a reason for your answer.

Yes, as the number of hours of sunshine increases, the maximum temperature increases.

(1)

(Total for Question 1 is 5 marks)

2 Express 56 as the product of its prime factors.



$= 2 \times 2 \times 2 \times 7 = 2^3 \times 7$

$2^3 \times 7$

(Total for Question 2 is 2 marks)

3 Work out 54.6×4.3

Using grid method

×	50	4	0.6
4	200	16	2.4
0.3	15	1.2	0.18

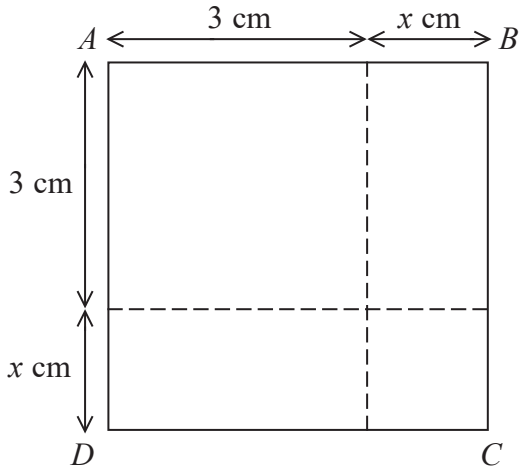
Sum all nos in the grid:

$200 + 16 + 15 + 2.4 + 1.2 + 0.18 = 234.78$

234.78

(Total for Question 3 is 3 marks)

4



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

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

Area of square = (length of side)^2

$= (x+3)^2$

$= (x+3)(x+3)$ Expand brackets

$= x^2 + 3x + 3x + 9$ collect like terms.

$= x^2 + 6x + 9$

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

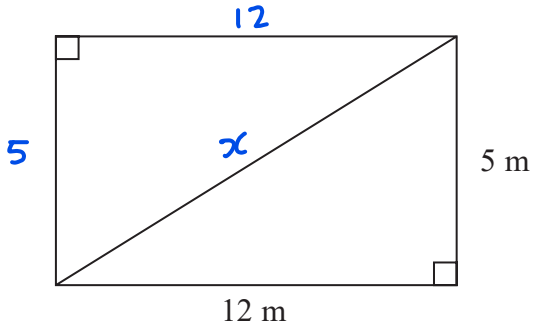
$-9 \qquad -9$

$1 = x^2 + 6x$

$x^2 + 6x = 1$

(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.

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

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

$x = \sqrt{144+25}$

$= \sqrt{169}$

$= 13$

Total length $= 12+5+12+13+5$

$= 47\text{ m}$

Total weight $= 47(1.5)$

$= 70.5\text{ kg}$

70.5 kg

(Total for Question 5 is 5 marks)

6 The equation of the line L_1 is $y = 3x - 2$ ①
The equation of the line L_2 is $3y - 9x + 5 = 0$ ②

Show that these two lines are parallel.

× Parallel lines have equal gradients.

gradient of L_1 is 3.

L_2: $3y - 9x + 5 = 0$ ↓ $+9x - 5$

$3y = 9x + 5$ ↓ $\div 3$

$y = 3x + \frac{5}{3}$ $y = mx + c$, m = gradient.

gradient of L_2 is 3

Gradient of L_1 = Gradient of L_2. ∴ Lines are 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.

Sum of all marks //

mean = Sum of scores / class size

$60 = \frac{\Sigma \text{Marks}}{10+20}$

$\Sigma \text{Marks} = 60 \times 30 = 1800$

Sum of girls marks //

$54 = \frac{\Sigma \text{Girls Marks}}{20}$

$\Sigma \text{Girls Marks} = 54 \times 20 = 1080$

$\Sigma \text{Marks} = \Sigma \text{Boys Marks} + \Sigma \text{Girls marks}$

$1800 = \Sigma \text{Boys Marks} + 1080$

$\Sigma \text{Boys Marks} = 1800 - 1080 = 720$

Boys mean $= \frac{720}{10} = 72$

72

(Total for Question 7 is 3 marks)

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

6 5 4 3 2 1

0.000007 97

0.00000797

Decimal point move 6 places to the left.

(1)

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

$\frac{2.52 \times 10^{5}}{4 \times 10^{-3}}$

① Split into powers and normal numbers

$\frac{2.52}{4} = 0.63$

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

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

$0.63 \times 10^{8} = 6.3 \times 10^{7}$

6.3×10^{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?

Total + VAT = 600

100% + 20% = 600

120% = 600

Find 100% : $600 \times \frac{100}{120} = 500$

£ 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.

$(x+1)(x+2)(x+3)$ Expand the first 2 brackets

$= (x^2+2x+x+2)(x+3)$ Simplify the first bracket.

$= (x^2+3x+2)(x+3)$ Expand the remaining brakets

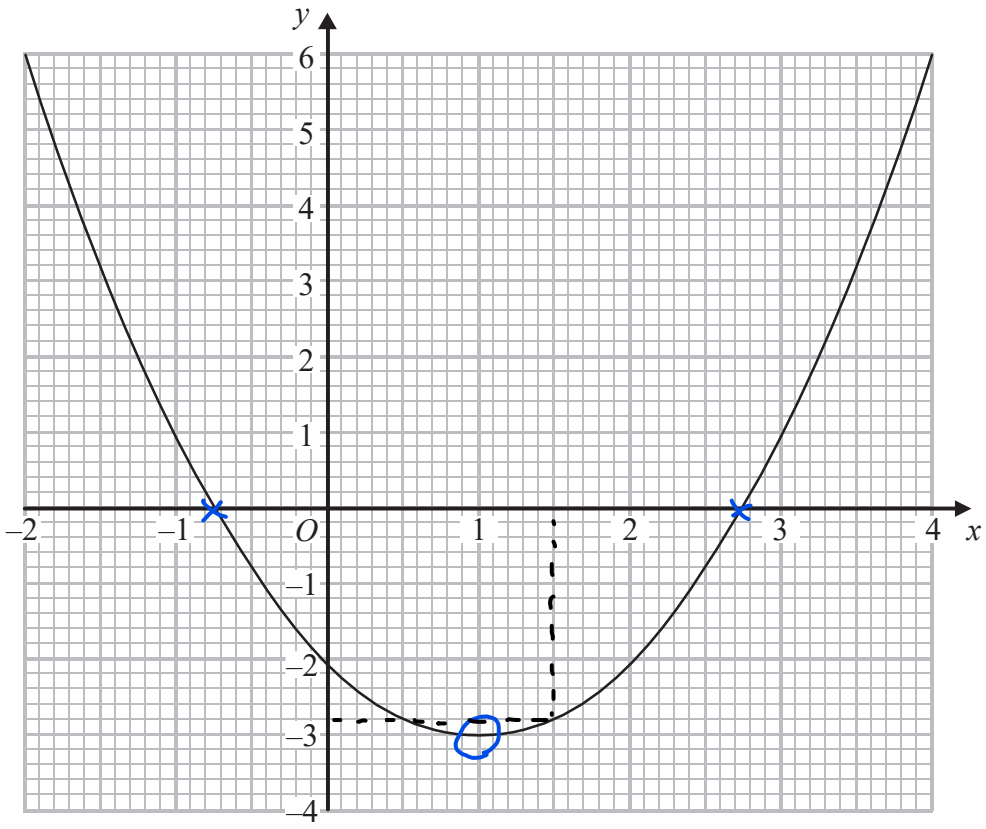
$= x^3+3x^2+2x+3x^2+9x+6$ Bring like powers together

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

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

(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.

where gradient is 0

(1 , −3)

(1)

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

Roots → where the graph cuts the x-axis.

−0.75 and 2.75

(1)

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

Draw a vertical line from $x = 1.5$ to the graph and read the respective y value

−2.8

(1)

(Total for Question 11 is 3 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

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

First, deal with the ½: $81^{\frac{1}{2}} = \sqrt{81} = 9$

Now, the negative: $9^{-1} = \frac{1}{9}$

$\frac{1}{9}$

(2)

(b) Find the value of $\left(\frac{64}{125}\right)^{\frac{2}{3}} = \frac{64^{2/3}}{125^{2/3}} = \frac{\left(\sqrt[3]{64}\right)^2}{\left(\sqrt[3]{125}\right)^2} = \frac{4^2}{5^2} = \frac{16}{25}$

First find the cubed root as this is the denominator

Then square

$\frac{16}{25}$

(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.

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

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

Sub $x = 3$ $y = 1$ $\quad 1 = \frac{k}{(3)^2}$

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

×9 ↓ ↓ ×9

$9 = k$

$y = 9/x^2$

(2)

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

Sub $y = 16$ in eqⁿ

$16 = \frac{9}{x^2} \Rightarrow x^2 = \frac{9}{16} \Rightarrow x = \frac{\sqrt{9}}{\sqrt{16}} = \frac{3}{4}$

× x^2 / 16

$3/4$

(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 : Black
3 : 7

White - C : S
4 : 5

Black - C : S
2 : 5

Assume there are 300 shapes in total:

White : $\frac{3}{10} \times 300 = 90$ (Total whites)

C : S
4 : 5
×10 ↓ ↓ ×10
40 : 50
40 circles

Black : $\frac{7}{10} \times 300 = 210$ (Total Blacks)

C : S
2 : 5
×30 ↓ ↓ ×30
60 : 150
60 circles

Total circles = 40 + 60 = 100

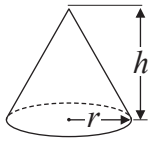
Total circles → $\frac{100}{300} = \frac{1}{3}$ ← Total shapes

$\frac{1}{3}$

(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.

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



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

$98 \approx 100$
$5.13 \approx 5$
$\pi \approx 3.14 \approx 3$
} approximated to 1 sf

$\therefore \quad 100 = \frac{1}{3}\pi(5)^2 h$

$100 = \frac{1}{3} \times 3 \times 25 \times h$

$100 = 25h$

$h = 4$

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 v would be smaller for John and the π and r will be larger. $\therefore$ When the numerator is small and the denominator is large, our estimate will be larger.

$\frac{\text{Small}}{\text{large}}$ = Small. (for John)

(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.

Expanding; $n^2 - 2 - [(n-2)(n-2)]$ Expand the brackets

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

$= n^2 - 2 - [n^2 - 4n + 4]$ Expand the square bracket.

$= n^2 - 2 - n^2 + 4n - 4$

$= 4n - 6$

$= 2(2n - 3)$ x To prove can be divisible by 2.

$4n - 6$ is always even as it can be divided by 2.

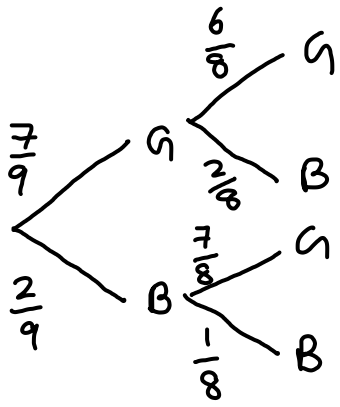
(Total for Question 16 is 4 marks)

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.



Draw a tree diagram to illustrate the Probability distribution.

$$P(GB) + P(BG) = [P(G) \times P(B)] + [P(B) \times P(G)]$$

$$= \frac{7}{9} \times \frac{2}{8} + \frac{2}{9} \times \frac{7}{8}$$

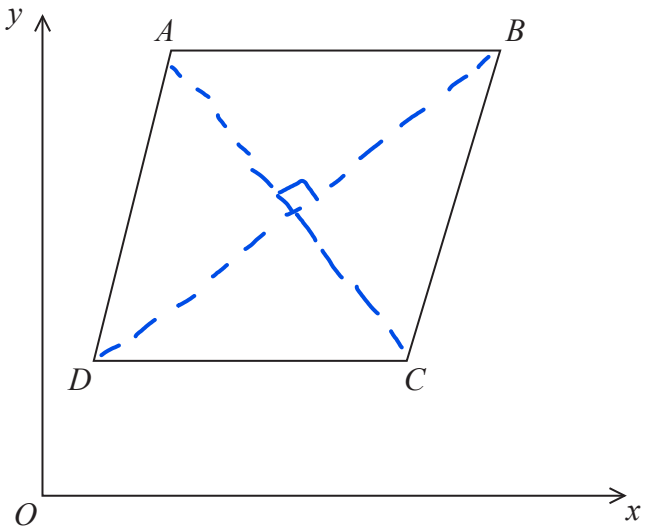
$$= \frac{14}{72} + \frac{14}{72}$$

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

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*.

DB is perpendicular to AC, as it is a rhombus.

Grad of DB = $\frac{1}{2}$ ← from $y = \frac{1}{2}x + 6$

Grad of AC = −2 ← negative reciprocal as its perpendicular

AC // $y = mx + c$

$y = -2x + c$

Sub (5, 11) to eqn ⇒ $11 = -2(5) + c$

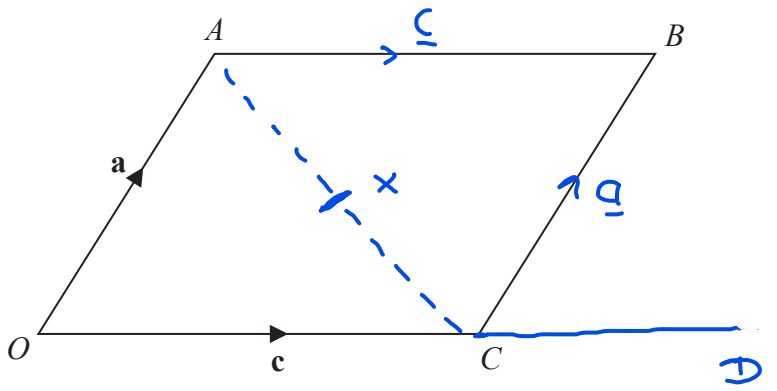
$c = 11 + 10$ (+10)

$= 21$

$y = -2x + 21$

(Total for Question 18 is 4 marks)

19



$OABC$ is a parallelogram.

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$

X is the midpoint of the line AC.
OCD is a straight line so that $OC : CD = k : 1$

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

find the value of k.

$\overrightarrow{AC} = \overrightarrow{AO} + \overrightarrow{OC}$
$= -\underset{\sim}{a} + \underset{\sim}{c}$
$= \underset{\sim}{c} - \underset{\sim}{a}$

$\overrightarrow{XD} = \overrightarrow{XC} + \overrightarrow{CD}$
$= \frac{1}{2}\overrightarrow{AC} + \overrightarrow{CD}$

Substitute $\overrightarrow{XD}$ and $\overrightarrow{AC}$

$3\underset{\sim}{c} - \frac{1}{2}\underset{\sim}{a} = \frac{1}{2}[\underset{\sim}{c} - \underset{\sim}{a}] + \overrightarrow{CD}$

$3\underset{\sim}{c} - \frac{1}{2}\underset{\sim}{a} = \frac{1}{2}\underset{\sim}{c} - \frac{1}{2}\underset{\sim}{a} + \overrightarrow{CD}$

Subject $\overrightarrow{CD}$

$\overrightarrow{CD} = 3\underset{\sim}{c} - \frac{1}{2}\underset{\sim}{a} - \frac{1}{2}\underset{\sim}{c} + \frac{1}{2}\underset{\sim}{a}$
$= 3\underset{\sim}{c} - \frac{1}{2}\underset{\sim}{c} - \frac{1}{2}\underset{\sim}{a} + \frac{1}{2}\underset{\sim}{a}$
$= 2.5\underset{\sim}{c}$

Compare ratios.

$OC : CD$
$k : 1$
$\underset{\sim}{c} : 2.5\underset{\sim}{c}$ $\div 2.5\underset{\sim}{c}$
$\frac{1}{2.5} : 1$
$\therefore k = \frac{1}{2.5} = \frac{2}{5}$

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

(Total for Question 19 is 4 marks)

20 Solve algebraically the simultaneous equations

$$x^2 + y^2 = 25 \quad (1)$$
$$y - 3x = 13 \quad (2)$$

Subject y in (2)

$y = 13 + 3x$ — (3)

Subs. (3) into (1)

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

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

$x^2 + 169 + 39x + 39x + 9x^2 = 25$

$10x^2 + 78x + 169 - 25 = 0$

$\div 2 \quad 10x^2 + 78x + 144 = 0$

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

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

$\Rightarrow 5x + 24 = 0$ $\quad \Rightarrow x + 3 = 0$

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

Sub x into (3)

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

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

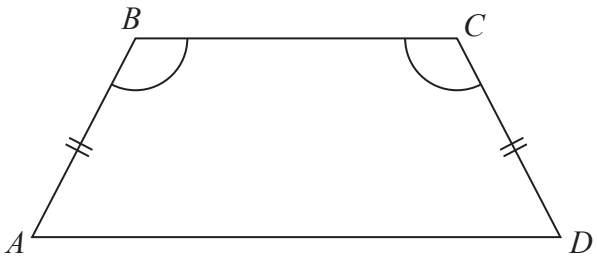
$= 13 - \frac{72}{5}$ $\quad = 13 - 9$

$= -7/5$ $\quad = 4$

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

(Total for Question 20 is 5 marks)

21 *ABCD* is a quadrilateral.



AB = *CD*.
Angle *ABC* = angle *BCD*.

Prove that *AC* = *BD*.

AB = CD (shown in diagram)

$B\hat{A}D = C\hat{D}A$

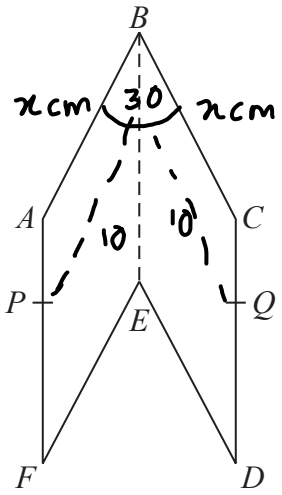
BC is a common side

Triangles are congruent under SAS.

∴ AC = BC.

(Total for Question 21 is 4 marks)

22 The diagram shows a hexagon *ABCDEF*.

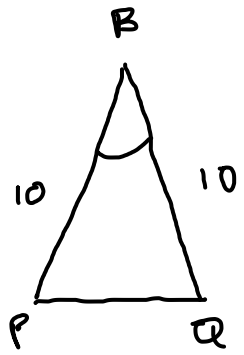


ABEF and *CBED* are congruent parallelograms where $AB = BC = x$ cm.
P is the point on *AF* and *Q* is the point on *CD* such that $BP = BQ = 10$ cm.

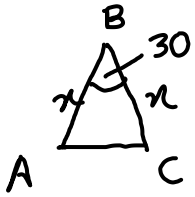
Given that angle $ABC = 30°$,

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

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



AC = PQ



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

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

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

$PQ^2 = 10^2 + 10^2 - 2(10)(10)\cos PBQ$

$x^2(2-\sqrt{3}) = 10^2 + 10^2 - 2(10)^2\cos PBQ$

$\cos PBQ = \frac{10^2 + 10^2 - (2-\sqrt{3})x^2}{2(10)^2} = \frac{200 - (2-\sqrt{3})x^2}{200}$

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

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

BLANK PAGE