KG WORKED SOLUTIONS

Write your name here LJH mark scheme

Surname | Other names

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
80

HA022716557

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 ▶

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

P 4 8 1 4 7 A 0 1 2 0

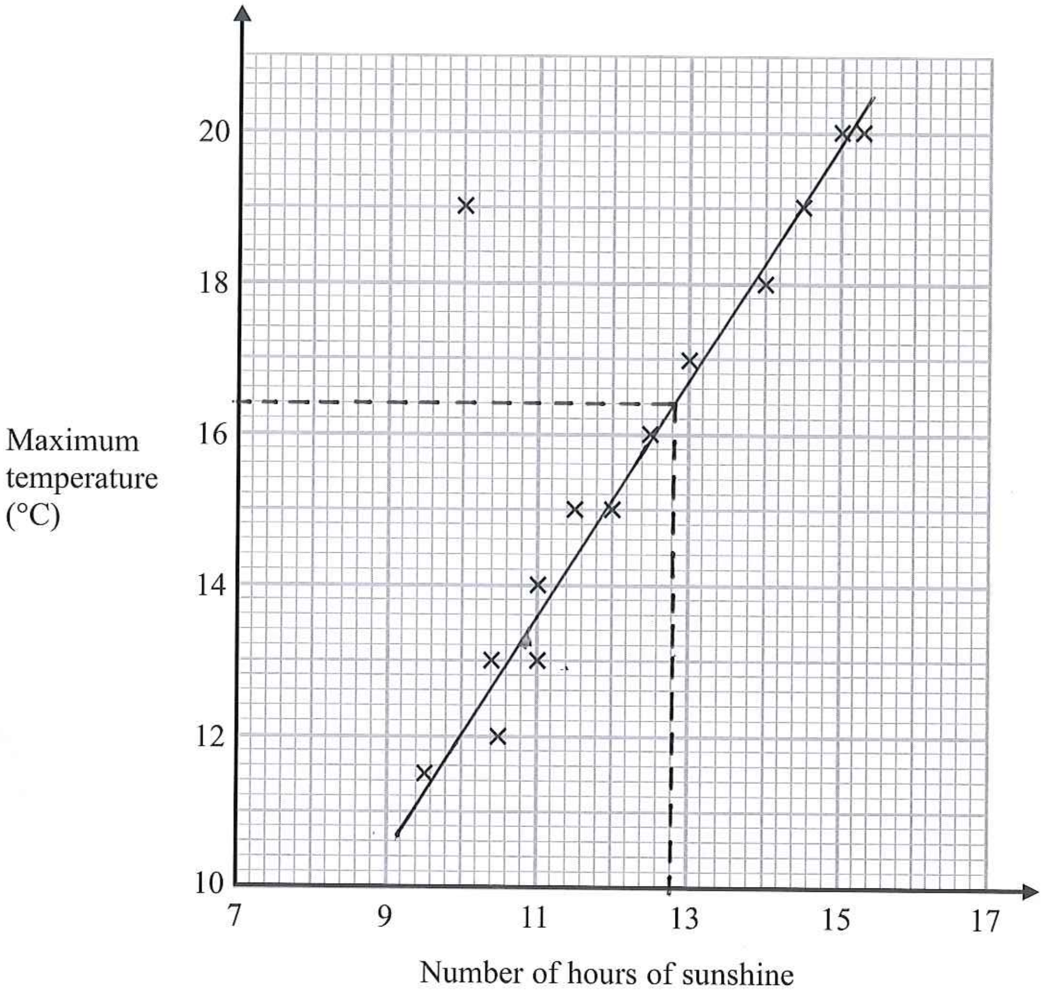
Pearson

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.

B1

(10 , 19)
(1)

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

B1

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.

B1 line of best fit (must have this)

(12·6 – 13)

A1

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.

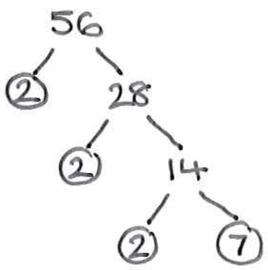
Yes. The more hours of sunshine, the higher the maximum temperature.

C1 any sensible reason

(1)

(Total for Question 1 is 5 marks)

2 Express 56 as the product of its prime factors.



P1 any correct process to find prime factors of 56

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

A1

$2^3 \times 7$

(Total for Question 2 is 2 marks)

3 Work out 54.6 × 4.3

```
  546
×  43
 1638
21840
23478
```

P1 any correct first step of any process to perform long multiplication

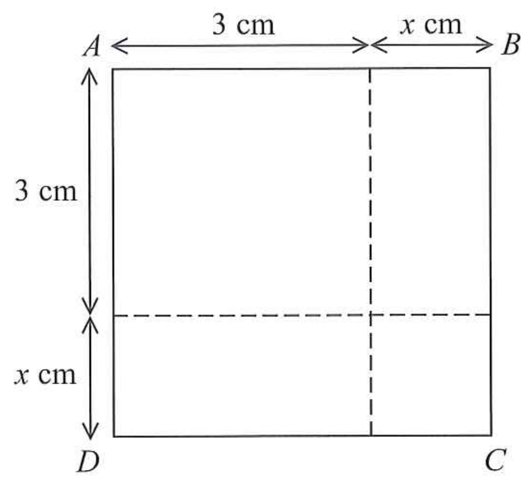
M1 fully correct calculation OR one error made (condone one error only)

A1 cao

234.78

(Total for Question 3 is 3 marks)

4



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

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

$(x+3)^2 = 10$ M1 use of $(x+3)$

$x^2+6x+9=10$ E9 M1 fully correct expansion

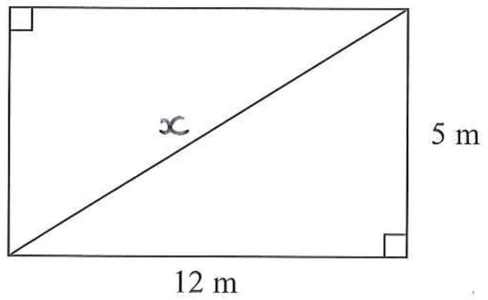
$x^2+6x=1$ A1 * correct manipulation

(Total for Question 4 is 3 marks)

P 4 8 1 4 7 A 0 5 2 0

Turn over

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.

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

$= 169$

$x = \underline{13\text{ m}}$ A1

P1 correct process (pythagoras' theorem) to find length of diagonal

Total length $= 2\times5 + 2\times12 + \text{"}13\text{"}$

$= 47$ m

M1 adds all pieces of metal together

Total weight $= \text{"}47\text{"} \times 1.5$ M1

$= 70.5$ kg

A1 cao

70.5 kg

(Total for Question 5 is 5 marks)

P 4 8 1 4 7 A 0 6 2 0

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_2: $3y - 9x + 5 = 0$

$3y = 9x - 5$

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

C1

gradient = 3

L_1: $y = 3x - 2$

$\boxed{\text{gradient} = 3}$ B1

L_1 and L_2 have the same gradient. The two lines are parallel.

(Total for Question 6 is 2 marks)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

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.

Total class marks = 60×30

= 1800

Total girls' marks = 54×20

B1 sight of 1800 or 1080

= 1080

Total boys' marks = "1800" − "1080"

M1 method to find total boys' marks

= 720

Mean boys' mark = $720 \div 10$

= 72

Bar modelling

$\frac{\text{total class score}}{30} = 60$ [×30

total class score = 1800

← mean = 60 →

← 30 →

Boys	Girls

←10→ ← 20 →

← mean = 54 →

$\frac{\text{total girls score}}{20} = 54$ [×20

total girls score = 1080

← Total 1800 →

10 Boys	20 Girls

← 1080 →

Boys total score = 1800 − 1080
= 720

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

72

A1 cao

(Total for Question 7 is 3 marks)

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

B1

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.

$$\frac{2.52}{4} \times \frac{10^5}{10^{-3}} = 0.63 \times 10^8$$

$$= 6.3 \times 10^7$$

M1 correct use of index laws

A1 cao

6.3×10^7

(2)

(Total for Question 8 is 3 marks)

P48147A0820

9 Jules buys a washing machine.

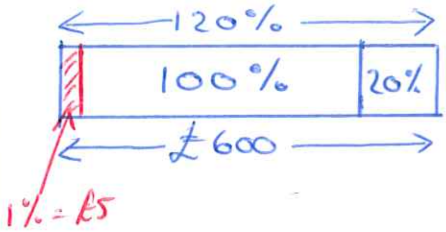
20% VAT is added to the price of the washing machine.
Jules then has to pay a total of £600

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

$600 \div 1.2 = 6000 \div 12$ P1 any correct process

$= 500$

Bar modelling (popular method for these questions)



$120\% = £600$

$\div 120$ $\div 120$

$1\% = £5$

$\times 100$ $\times 100$

$100\% = £500$

£ 500 A1 cao

(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.

$(x+1)(x+2)(x+3) = (x+1)(x^2+5x+6)$ M1 correct expansion of any two brackets

M1 ft correct expansion of linear x "quadratic"

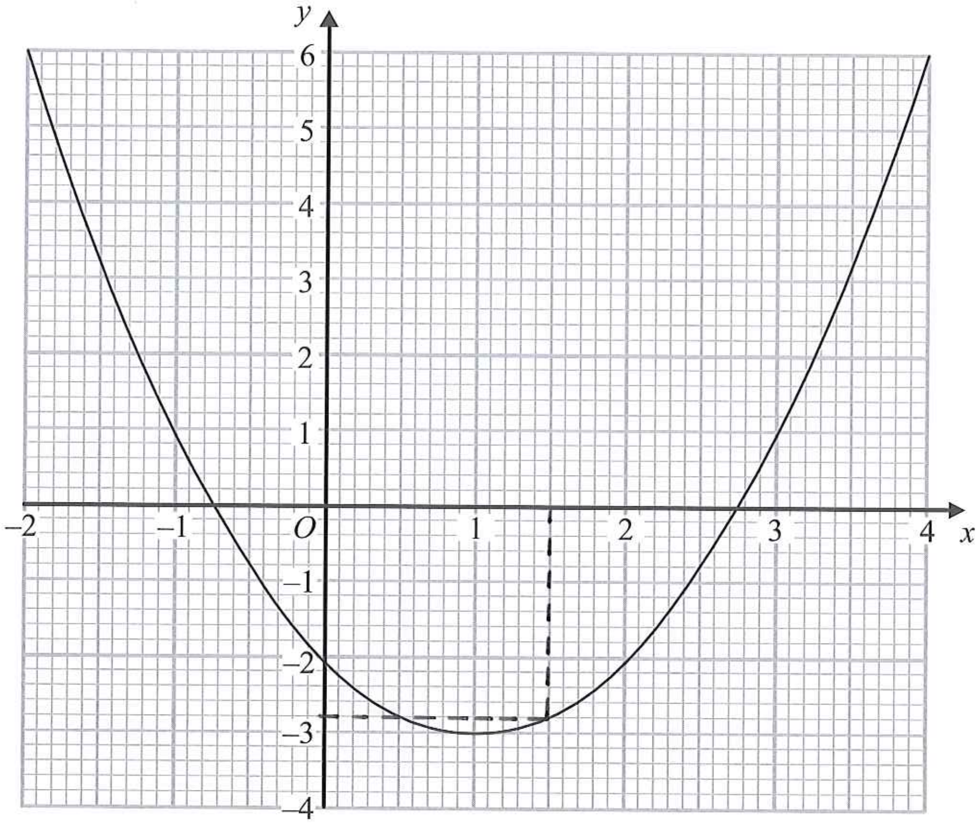
$= x^3+5x^2+6x+x^2+5x+6$

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

A1 fully correct solution
$a=1,\ b=6,\ c=11,\ d=6$

(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.

B1

(1 , −3)
(1)

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

B1

2·75, −0·75
(1)

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

Encourage use of guidelines on graph.

B1

−2.8
(1)

(Total for Question 11 is 3 marks)

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DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

12 (a) Find the value of $81^{-\frac{1}{2}}$ $= \frac{1}{\sqrt{81}} = \frac{1}{9}$

M1

$\frac{1}{9}$ A1

(2)

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

B1 either 16 or 25 seen

$= \frac{16}{25}$

$\frac{16}{25}$ A1

(2)

(Total for Question 12 is 4 marks)

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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.

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

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

P1 correct process to find k

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

$k = 9$

$y = \frac{9}{x^2}$ A1 cao

(2)

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

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

M1 correct substitution ft

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

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

$\frac{3}{4}$ A1 cao

(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.

B1 sight of $\frac{3}{10}$ W or $\frac{7}{10}$ B

W : B
3 : 7

White
C : S
4 : 5

Black
C : S
2 : 5

P1 correct process to find fraction of either white or black circles

$$\frac{4}{9} \times \frac{3}{10} + \frac{2}{7} \times \frac{7}{10} = \frac{2}{15} + \frac{1}{5}$$

$$= \frac{2}{15} + \frac{3}{15}$$

$$= \frac{5}{15}$$

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

M1 fully correct method to find fraction circles

Bar Modelling

White 3/10 | Black 7/10

W	W	W	B	B	B	B	B	B	B

A1 cao

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

(Total for Question 14 is 4 marks)

C	C	C	C	S	S	S	S	S

$\frac{4}{9}$ of $\frac{3}{10}$ are white circles

$$\frac{\cancel{4}^{2}}{\cancel{9}_{3}} \times \frac{\cancel{3}^{1}}{\cancel{10}_{5}} = \frac{2}{15}$$

white circles

C	C	S	S	S	S	S

$\frac{2}{7}$ of $\frac{7}{10}$ are Black circles

$$\frac{\cancel{2}^{1}}{\cancel{7}} \times \frac{\cancel{7}^{1}}{\cancel{10}_{5}} = \frac{1}{5}$$

Black Circles

White circles + Black Circles

$$\frac{2}{15} + \frac{1^{\times 3}}{5_{\times 3}}$$

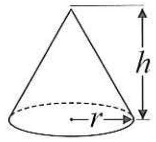
$$= \frac{2}{15} + \frac{3}{15}$$

$$= \frac{5}{15}$$

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

15 A cone has a volume of 98 cm³.
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.

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

B1 use of formula with values of r and h

$25h \approx 100$

M1 use of r = 5, π = 3, h = 100

$h \approx 4$

A1

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.

My estimate will be more than John's answer as I underestimated π and the radius and overestimated the volume.

C1

(1)

(Total for Question 15 is 4 marks)

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16 n is an integer greater than 1

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

$n^2 - 2 - (n-2)^2 = n^2 - 2 - (n^2 - 4n + 4)$ M1 attempts expansion of $(n-2)^2$

$= n^2 - 2 - n^2 + 4n - 4$ M1 ft fully correct simplification

$= 4n - 6$

$= 2(2n - 3)$ A1

$\therefore$ 2 is a factor and so $n - 2 - (n-2)^2$ is even.   C1

(Total for Question 16 is 4 marks)

P 4 8 1 4 7 A 0 1 3 2 0

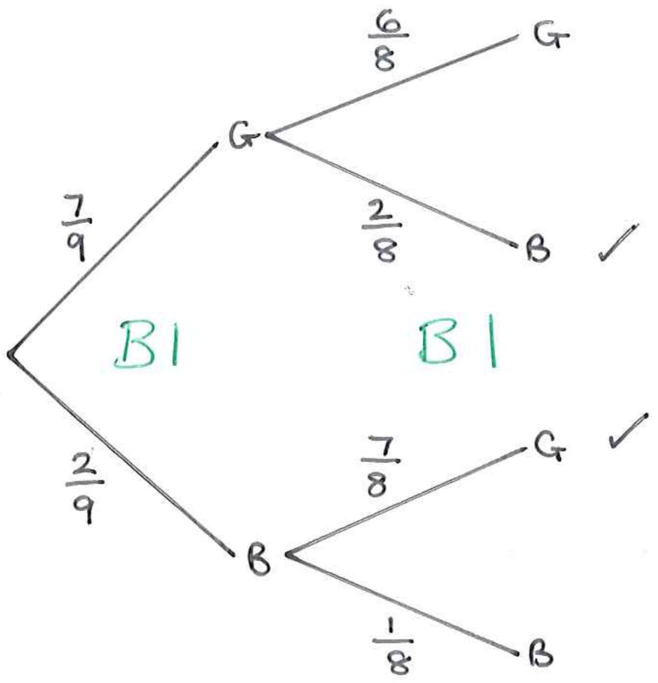
Turn over

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.



$\frac{7}{9} \times \frac{2}{8} + \frac{2}{9} \times \frac{7}{8} = \frac{28}{72}$ m1

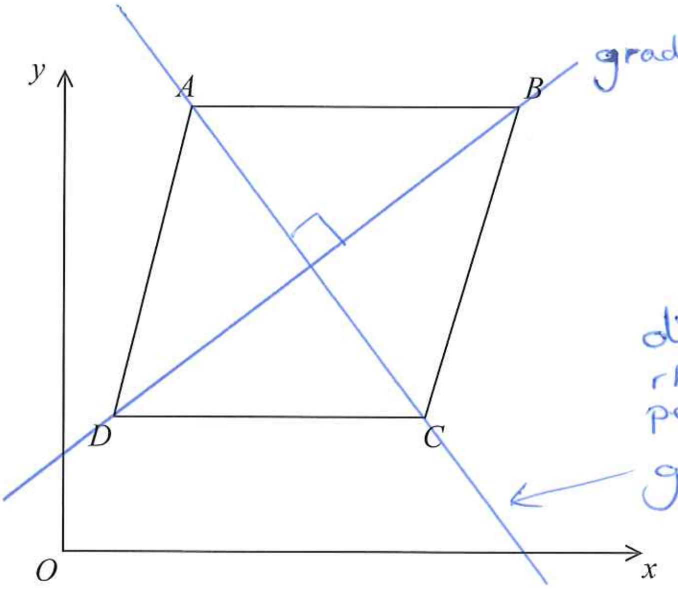
$= \frac{7}{18}$

any equivalent A1

$\frac{7}{18}$

(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*.

Gradient AC = -2 B1

$y - y_1 = m(x - x_1)$ where point $(x_1, y_1) = (5, 11)$

gradient $m = -2$

$y - 11 = -2(x - 5)$

M1 substitutes into any form of straight line equation

$y = -2x + 10 + 11$

$y = -2x + 21$

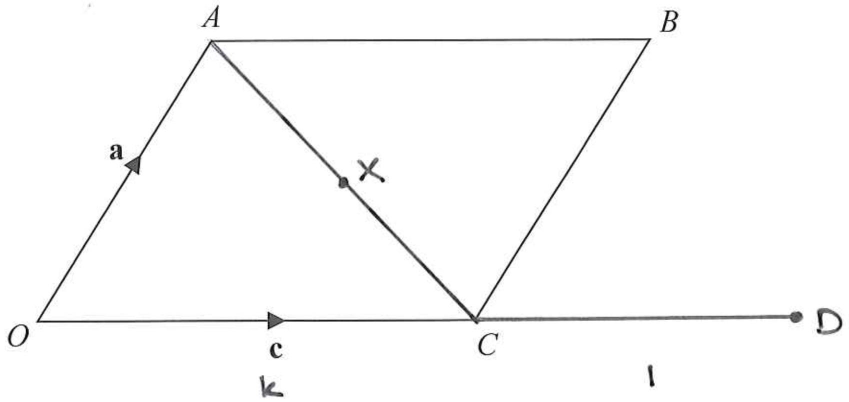
M1 simplifies sensibly

A1 oe

$y = -2x + 21$

(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*.

$\boxed{\overrightarrow{AC} = -\underline{a} + \underline{c}}$ B1

$\overrightarrow{XC} = \frac{1}{2}(-\underline{a} + \underline{c}) = -\frac{1}{2}\underline{a} + \frac{1}{2}\underline{c}$

$\overrightarrow{CD} = \frac{1}{k}\underline{c}$

$= \overrightarrow{XC} + \overrightarrow{CD}$

$\overrightarrow{XD} = -\frac{1}{2}\underline{a} + \frac{1}{2}\underline{c} + \frac{1}{k}\underline{c}$

M1 fully correct method to find expression for $\overrightarrow{XD}$

$-\frac{1}{2}\underline{a} + \left(\frac{1}{2} + \frac{1}{k}\right)\underline{c} = 3\underline{c} - \frac{1}{2}\underline{a}$

M1 ft solves to find k

$\frac{1}{2} + \frac{1}{k} = 3$

$\frac{1}{k} = \frac{5}{2}$

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

A1 cao

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

(Total for Question 19 is 4 marks)

20 Solve algebraically the simultaneous equations

$$x^2 + y^2 = 25$$
$$y - 3x = 13$$

$x^2 + y^2 = 25$

$y = 3x + 13$

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

M1 correct use of substitution

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

M1 correct simplification

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

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

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

M1 factorises or uses formula to solve

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

A1 both x correct OR both y correct

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

$= -\frac{7}{5}$ $\quad$ $= 4$

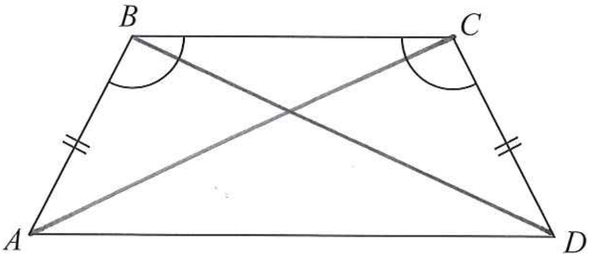
A1 all correct

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

OR $x = -3$ and $y = 4$.

(Total for Question 20 is 5 marks)

21 *ABCD* is a quadrilateral.



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

Prove that $AC = BD$.

Triangle ABC   Triangle ACD

BC = BC (shared side) B1

BA = CD (given)

$A\hat{B}C = B\hat{C}D$ (given)

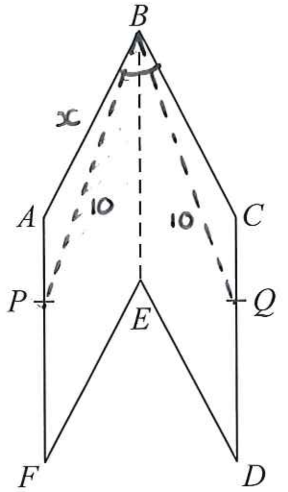
∴ Triangles ABC and ACD are congruent as two pairs of corresponding sides and the included angle are equal. C1

M1

∴ AC = BD. A1 *

(Total for Question 21 is 4 marks)

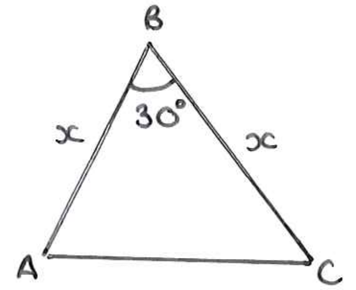
22 The diagram shows a hexagon *ABCDEF*.

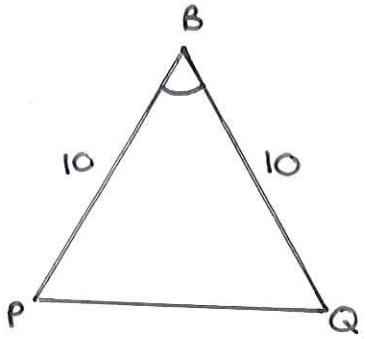


ABEF and *CBED* are congruent parallelograms where $AB = BC = x$ cm.
P is the point on *AF* and *Q* is the point on *CD* such that $BP = BQ = 10$ cm.

Given that angle $ABC = 30°$,

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





M1 use of cosine rule

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

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

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

$PQ^2 = x^2(2-\sqrt{3})$ A1

M1 use of cosine rule

$PQ^2 = 10^2 + 10^2 - 2 \times 10 \times 10 \cos PBQ$

$= 200 - 200 \cos PBQ$ A1

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

$200 \cos PBQ = 200 - x^2(2-\sqrt{3})$ A1

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

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

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