Write your name here

Surname

Other names

**Pearson Edexcel**
**International GCSE**

Centre Number

Candidate Number

**Mathematics A**
**Level 1/2**
**Paper 2HR**

*Model Solutions*

**Higher Tier**

Thursday 7 June 2018 – Morning
**Time: 2 hours**

Paper Reference
**4MA1/2HR**

**You must have:**
Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser, calculator. 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.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may be used.**
- You must **NOT** write anything on the formulae page.
  Anything you write on the formulae page will gain NO credit.

## Information

- The total mark for this paper is 100.
- 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.
- Check your answers if you have time at the end.

*Turn over* ▶

Pearson

## International GCSE Mathematics
## Formulae sheet – Higher Tier

**Arithmetic series**

Sum to $n$ terms, $S_n = \dfrac{n}{2}\left[2a + (n-1)d\right]$

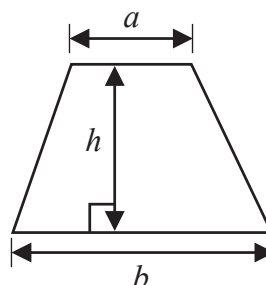**Area of trapezium** $= \dfrac{1}{2}(a+b)h$

**The quadratic equation**
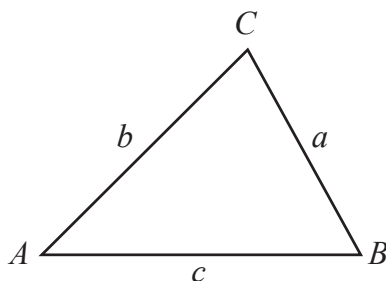
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

**Trigonometry**

**In any triangle $ABC$**
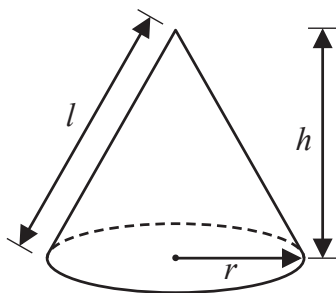
**Sine Rule** $\quad \dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

**Cosine Rule** $\quad a^2 = b^2 + c^2 - 2bc\cos A$

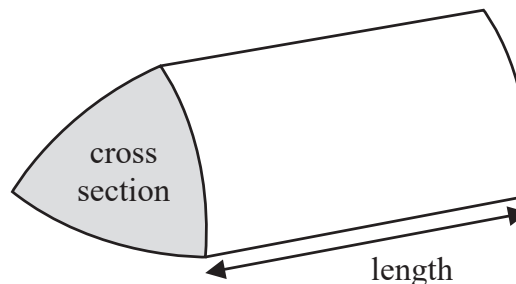**Area of triangle** $= \dfrac{1}{2}ab\sin C$

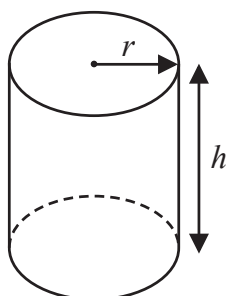**Volume of cone** $= \dfrac{1}{3}\pi r^2 h$

**Curved surface area of cone** $= \pi r l$

**Volume of prism**
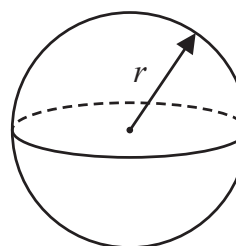$=$ area of cross section $\times$ length

**Volume of cylinder** $= \pi r^2 h$
**Curved surface area of cylinder** $= 2\pi r h$

**Volume of sphere** $= \dfrac{4}{3}\pi r^3$

**Surface area of sphere** $= 4\pi r^2$

*P59014A0224*

**Answer ALL TWENTY FOUR questions.**

**Write your answers in the spaces provided.**

**You must write down all the stages in your working.**

**1**  *x*, 10 and *y* are three integers written in order of size, starting with the smallest integer.

The mean of *x*, 10 and *y* is 11
The range of *x*, 10 and *y* is 7

Work out the value of *x* and the value of *y*.

$$\frac{x+10+y}{3} = 11 \longrightarrow x+10+y = 33$$

$$y - x = 7 \longrightarrow y = 7+x$$

$$x+10+y = 33$$
$$x+10+7+x = 33 \longrightarrow 2x+17 = 33 \longrightarrow 2x = 16$$
$$x = 8$$

$$y = x+7$$
$$= 8+7 = \underline{15}$$

*x* = ............ **8** ............

*y* = ............ **15** ............

**(Total for Question 1 is 2 marks)**

$$\boxed{\text{pressure} = \frac{\text{force}}{\text{area}}}$$

**2**  A box is put on a table.

The face of the box in contact with the table is in the shape of a rectangle, 2 m by 1.25 m.
The pressure on the table due to the box is 42 newtons/m²

Work out the force exerted by the box on the table.

Force = Pressure × Area

Area = 2 × 1.25 = 2.5 m²

F = 42 × 2.5 = 105 newtons

............ **105** ............ newtons

**(Total for Question 2 is 3 marks)**

**3** Behnaz makes candles.

She has 6.3 kilograms of wax and uses it all to make candles.
Each candle Behnaz makes uses 210 grams of wax.

Behnaz sells $\frac{2}{5}$ of the candles for $13 each.

She then reduces this price by 20% and sells the rest of the candles.

Work out the total amount of money Behnaz gets by selling all the candles she made.

6·3 kg = 6300 grams

$\frac{6300}{210}$ = 30 candles

$\frac{2}{5}$ × 30 = 12 sold for $13 = 12 × $13 = $156

30 − 12 sold 20% cheaper → 18 × $13 × 0.8 = $187.2

$156 + $187.2 = $343.2

$ ........**343.2**........

**(Total for Question 3 is 4 marks)**

**4** (a) Expand and simplify $3(c - 7) + 2(3c + 4)$

$$3(c-7) + 2(3c+4)$$
$$= 3c - 21 + 6c + 8$$
$$= 9c - 13$$

....................9c−13.................... 

(2)

(b) Expand and simplify $(x + 7)(x - 2)$

$$(x+7)(x-2)$$
$$= x^2 + 7x - 2x - 14$$
$$= x^2 + 5x - 14$$

....................$x^2 + 5x - 14$.................... 

(2)

(c) Factorise fully $28y^2 - 21y$

$$28y^2 - 21y$$
$$HCF \text{ is } 7y \longrightarrow 7y(4y-3)$$

....................$7y(4y-3)$.................... 

(2)

(d) Solve $\dfrac{7x - 2}{4} = 3x + 1$

Show clear algebraic working.

$$7x - 2 = 4(3x+1)$$
$$7x - 2 = 12x + 4$$
$$-6 = 5x$$
$$\frac{-6}{5} = x$$

$x =$ ..............$\dfrac{-6}{5}$.............. 

(3)

**(Total for Question 4 is 9 marks)**

**5**   Abelie flew by plane from Dubai to Rome.

The flight time was 6 hours 42 minutes.
The average speed of the plane was 650 kilometres per hour.

Work out the distance the plane flew.

$\text{Distance} = \text{speed} \times \text{Time}$

$\text{Time} \rightarrow 6 \text{ hours } 42 \text{ mins} = 6 + \frac{42}{60} \text{ hours}$

$\left(6 + \frac{42}{60}\right) \times 650 = \underline{\underline{4355}} \text{ km}$

........................4355........................kilometres

**(Total for Question 5 is 3 marks)**

**6**   Hiran invests 20 000 rupees in an account for 3 years at 1.5% per year compound interest.

Work out the total amount of money in the account at the end of 3 years.
Give your answer to the nearest rupee.

$20000 \times (1.015)^3 = 20913.5675$
$\phantom{20000 \times (1.015)^3} = \underline{\underline{20914}}$

........................20914........................rupees

**(Total for Question 6 is 3 marks)**

**7** (a) Simplify fully $\dfrac{20x^2y^6}{4x^2y^2}$

$\dfrac{20x^2y^6}{4x^2y^2} = \underline{\underline{5y^4}}$

.................... $5y^4$ ....................

**(2)**

(b) Make $e$ the subject of the formula $h = 3e + f$

$h = 3e + f \;\longrightarrow\; 3e = h - f$
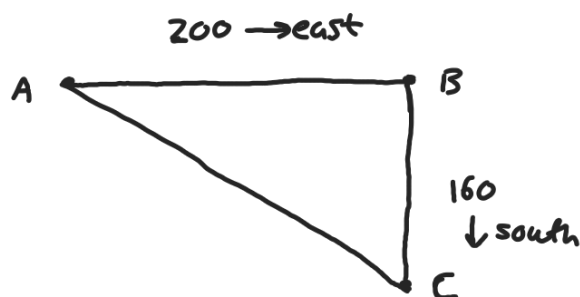
$e = \dfrac{h - f}{3}$

$e = \dfrac{h - f}{3}$

**(2)**

**(Total for Question 7 is 4 marks)**

**8** From point $A$, Stanley walks $200\,\text{m}$ due east to point $B$.
From $B$, he then walks $160\,\text{m}$ due south to point $C$.

Work out the length of $AC$.
Give your answer correct to 3 significant figures.

$200 \rightarrow \text{east}$

A    B

$160 \downarrow \text{south}$

C

$(AB)^2 + (BC)^2 = (AC)^2$

$(200)^2 + (160)^2 = (AC)^2$

$65600 = (AC)^2$

$AC = \sqrt{65600} = \underline{\underline{256\,\text{M}}}$

.................... 256 .................... metres

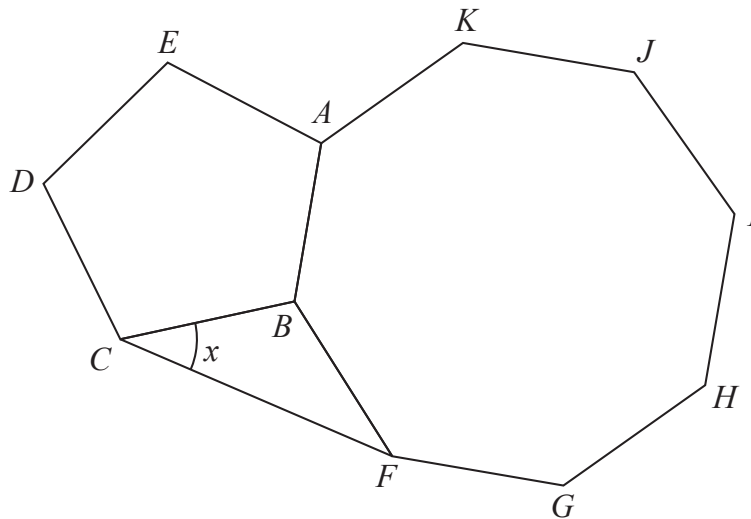**(Total for Question 8 is 3 marks)**

**9**



Diagram **NOT** accurately drawn

The diagram shows a regular pentagon, *ABCDE*, a regular octagon, *ABFGHIJK*, and an isosceles triangle, *BCF*.

Work out the size of angle *x*.

Interior angle of pentagon → $\dfrac{(180 \times 3)}{5} = 108°$

Interior angle of octagon → $\dfrac{(180 \times 6)}{8} = 135°$

$CBF = 360 - (135 + 108)$

$\quad\quad = 117°$

$180 - 117 = 2x$

$\quad\quad 63 = 2x$

$\quad\quad x = 31.5$

31.5 °

(Total for Question 9 is 4 marks)

**10** *ABCD* is a trapezium.

B ——— 16 cm ——— C

12.5 cm

A ——— 24.3 cm ——— D

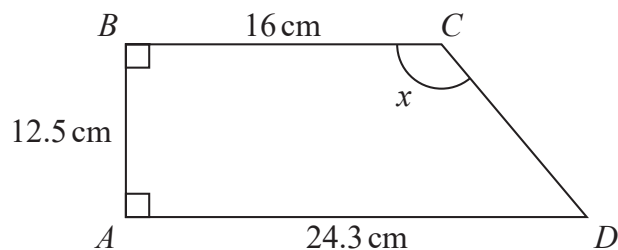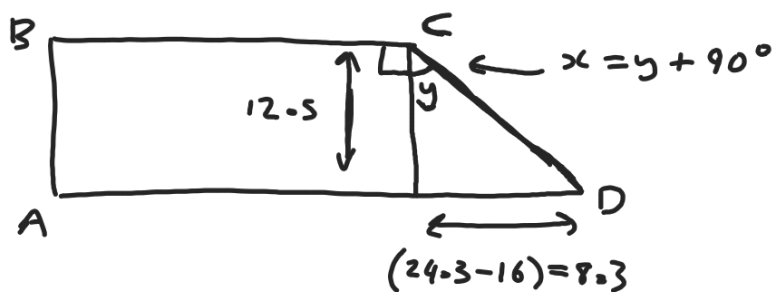Diagram **NOT** accurately drawn

Work out the size of angle *x*.
Give your answer correct to 1 decimal place.

$x = y + 90°$

12.5

$(24.3 - 16) = 8.3$

$$\text{Tan } y = \frac{8.3}{12.5}$$

$$y = \tan^{-1}\left(\frac{8.3}{12.5}\right) = 33.58\ldots$$

$$y + 90° = x$$

$$33.55\ldots + 90 = 123.6°$$

123.6 °

**(Total for Question 10 is 4 marks)**

*Turn over* ▶

**11** The table shows information about the amount of money spent on holiday by each of 120 families.

| Money spent (£*m*) | Frequency |
|---|---|
| $0 < m \leqslant 100$ | 10 |
| $100 < m \leqslant 200$ | 36 |
| $200 < m \leqslant 300$ | 34 |
| $300 < m \leqslant 400$ | 20 |
| $400 < m \leqslant 500$ | 15 |
| $500 < m \leqslant 600$ | 5 |

← highest number

(a) Write down the modal class.

highest
frequency

$100 < m \leqslant 200$

**(1)**

(b) Complete the cumulative frequency table for the information in the table.

| Money spent (£*m*) | Cumulative frequency |
|---|---|
| $0 < m \leqslant 100$ | 10 |
| $0 < m \leqslant 200$ | 46 |
| $0 < m \leqslant 300$ | 80 |
| $0 < m \leqslant 400$ | 100 |
| $0 < m \leqslant 500$ | 115 |
| $0 < m \leqslant 600$ | 120 |

10 + 36
46 + 34
80 + 20
100 + 15
115 + 5

**(1)**

PhysicsAndMathsTutor.com

(c) On the grid, draw a cumulative frequency graph for your table.

↳ Plot at upper bound

**(2)**



Cumulative frequency

Money spent (£)
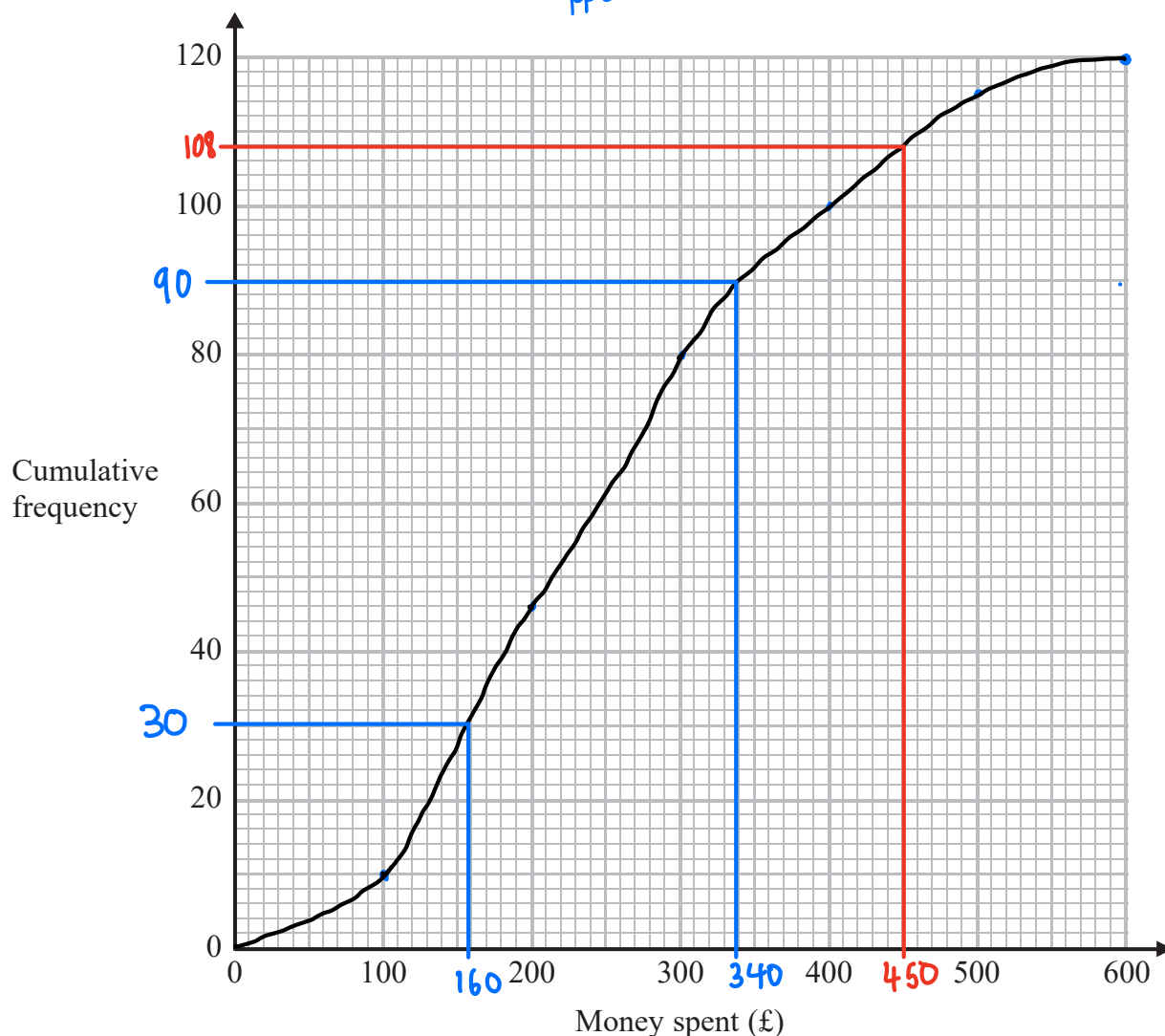
(d) Use your graph to find an estimate for the interquartile range.

IQR = UQ − LQ

UQ is at $\frac{3}{4}$ of 120 = 90  − 340

LQ is at $\frac{1}{4}$ of 120 = 30  − 160

340 − 160 = 180

£ ......180......

**(2)**

(e) Use your graph to find an estimate for the number of families that spent more than £450 on holiday.  ① Draw line from £450

More than 450 = 120 − 108 = 12

...... 12 ......

**(2)**

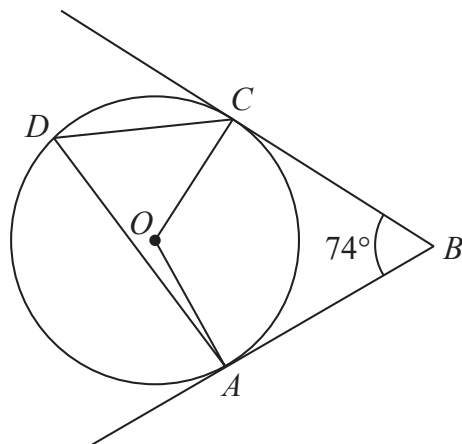**(Total for Question 11 is 8 marks)**

*P59014A01124*

**12**



Diagram **NOT**
accurately drawn

*A*, *C* and *D* are points on a circle, centre *O*.
*AB* and *CB* are tangents to the circle.

Angle *ABC* = 74°

Work out the size of angle *ADC*.
Show your working clearly.

$$COA = 360 - (2 \times 90 + 74) = 106$$

$$ADC = \frac{106}{2} = 53°$$

.................................. °

**(Total for Question 12 is 3 marks)**

**13** The straight line $\mathbf{L}_1$ has equation $y = 6 - 2x$

The straight line $\mathbf{L}_2$ is perpendicular to $\mathbf{L}_1$ and passes through the point $(4, 7)$

Find the coordinates of the point where the line $\mathbf{L}_2$ crosses the $x$-axis.

$L_1$ gradient $\rightarrow -2$

$L_2$ perpendicular gradient $\rightarrow \frac{1}{2}$

$L_2 \rightarrow y = 1/2x + c$

sub $(4,7)$ in

$7 = 1/2(4) + c \rightarrow 7 = 2 + c$

$c = 5$

$\underline{y = 1/2 x + 5}$

Line intercepts $x$-axis when $y = 0$

$0 = 1/2x + 5$

$-5 = 1/2x$

$\underline{\underline{x = -10}}$

( ....**−10**.... , ....**0**.... )

**(Total for Question 13 is 4 marks)**

**14** $128 = 4^{2x} \times 2^x$

Work out the value of $x$.

$128 = 4^{2x} \times 2^x$

$128 = (2^2)^{2x} \times 2^x$

$128 = (2)^{4x} \times (2)^x$

$128 = (2)^{4x+x}$

$128 = (2)^{5x}$

$2^7 = 2^{5x}$

$7 = 5x$

$\underline{\underline{x = 7/5 = 1.4}}$

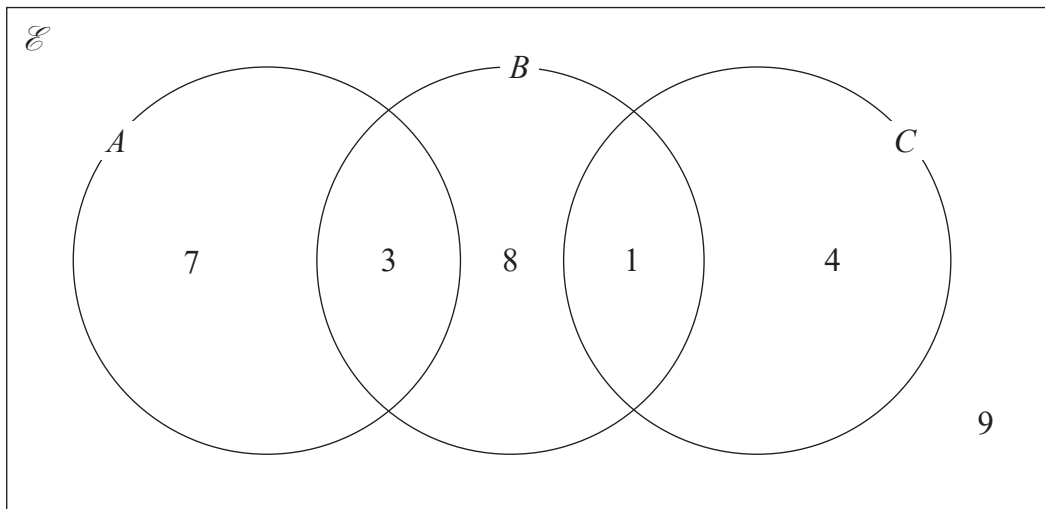$x = $ ....**1.4**....

**(Total for Question 14 is 3 marks)**

**15** The Venn diagram shows a universal set, $\mathscr{E}$, and sets $A$, $B$ and $C$.



7, 3, 8, 1, 4 and 9 represent the **numbers** of elements.

Find

(i)  $n(A \cup B)$

$$7 + 3 + 8 + 1 = \underline{19}$$

.............19.............

(ii) $n(A' \cap C)$

$$1 + 4 = \underline{5}$$

.............5.............

(iii) $n(A' \cup B')$

$$7 + 8 + 4 + 1 + 9 = \underline{29}$$

.............29.............

**(Total for Question 15 is 3 marks)**

**16** There are 8 counters in a bag.
There is a number on each counter.

$$\boxed{1} \quad \boxed{1} \quad \boxed{2} \quad \boxed{4} \quad \boxed{4} \quad \boxed{5} \quad \boxed{5} \quad \boxed{5}$$
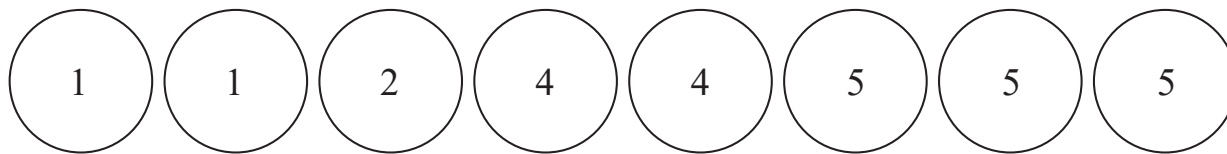
Fiona takes at random **three** of the counters.
She adds the numbers on the **three** counters to get her total.

Work out the probability that her total is an odd number.

$$\frac{a}{8} \times \frac{b}{7} \times \frac{c}{6}$$

$P(\text{odd, odd, odd}) \rightarrow \frac{5}{8} \times \frac{4}{7} \times \frac{3}{6} = \frac{5}{28}$

$P(\text{odd, even, even}) \rightarrow \frac{5}{8} \times \frac{3}{7} \times \frac{2}{6} = \frac{5}{56}$

$P(\text{even, odd, even}) \rightarrow \frac{3}{8} \times \frac{5}{7} \times \frac{2}{6} = \frac{5}{56}$

$P(\text{even, even, odd}) \rightarrow \frac{3}{8} \times \frac{2}{7} \times \frac{5}{6} = \frac{5}{56}$

$\frac{5}{28} + 3 \times \frac{5}{56} = \frac{25}{56}$

............25/56............

**(Total for Question 16 is 4 marks)**

*Turn over* ▶

**17** (a) Use algebra to show that $0.4\overset{\cdot\cdot}{3}\overset{\cdot\cdot}{6} = \dfrac{24}{55}$

$100x = 43.63\overset{\cdot}{6}3\ 63\ \ldots$

$\phantom{100}x = \phantom{4}0.43\overset{\cdot}{6}3\ 63\ \ldots$

$\overline{99x = 43.2}$

$99x = 43.2$

$x = \dfrac{43-2}{99} = \dfrac{432}{990} \quad = \dfrac{24}{55}$

**(2)**

(b) Show that $\dfrac{\sqrt{20} + \sqrt{80}}{\sqrt{3}}$ can be expressed in the form $\sqrt{a}$ where $a$ is an integer.

Show your working clearly.

$\dfrac{\sqrt{20} + \sqrt{80}}{\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}} \rightarrow \dfrac{\sqrt{60} + \sqrt{240}}{\sqrt{9}} \rightarrow \dfrac{\sqrt{15}\sqrt{4} + \sqrt{16}\sqrt{15}}{3} \rightarrow \dfrac{2\sqrt{15} + 4\sqrt{15}}{3}$

$\dfrac{6\sqrt{15}}{3} = 2\sqrt{15} = \sqrt{4}\sqrt{15} = \sqrt{60} = \sqrt{a}$

$\underline{\underline{a = 60}}$

**(3)**

**(Total for Question 17 is 5 marks)**

P 5 9 0 1 4 A 0 1 6 2 4

**18** Solve the simultaneous equations

$$① \quad 2x^2 + 3y^2 = 14$$

$$② \quad x = 2y - 3$$

Show clear algebraic working.

Sub ② in ① → $2(2y-3)^2 + 3y^2 = 14$

$(2y-3)(2y-3) = 4y^2 - 12y + 9$

$2(4y^2 - 12y + 9) + 3y^2 = 14$

$8y^2 - 24y + 18 + 3y^2 = 14$

$11y^2 - 24y + 4 = 0$

$a = 11 \quad b = -24 \quad c = 4$

$\dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \rightarrow \quad \dfrac{--24 \sqrt{(-24)^2 - (4 \times 11 \times 4)}}{2 \times 11} \quad \rightarrow \quad \dfrac{24 \pm \sqrt{400}}{22}$

$y = \dfrac{24 + \sqrt{400}}{22} = \underline{\underline{2}} \qquad x = 2y - 3 \rightarrow x = \underline{\underline{1}}$

$y = \dfrac{24 - \sqrt{400}}{22} = \underline{\underline{\dfrac{2}{11}}} \qquad x = 2y - 3 \rightarrow x = \underline{\underline{\dfrac{-29}{11}}}$

$x = 1 \qquad y = 2$

$x = \dfrac{-29}{11} \qquad y = \dfrac{2}{11}$

**(Total for Question 18 is 5 marks)**

*Turn over* ▶

**19** $a = \dfrac{p - q}{t}$

$p = 8.4$ correct to 2 significant figures.
$q = 6.3$ correct to 2 significant figures.
$t = 0.27$ correct to 2 significant figures.

Work out the upper bound for the value of $a$.
Show your working clearly.
Give your answer correct to 1 decimal place.

$8.35 < p < 8.45$

$6.25 < q < 6.35$

$0.265 < t < 0.275$

$a = \dfrac{8.45 - 6.25}{0.625} = \underline{\underline{8.3}}$

.................... 8.3 ....................

**(Total for Question 19 is 3 marks)**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**20** Solve the inequality $4x^2 - 5x - 6 > 0$
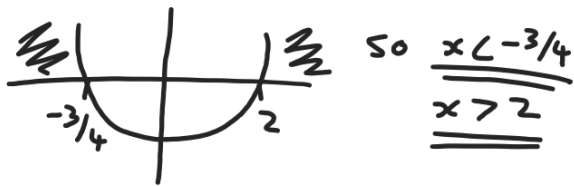
$$4x^2 - 5x - 6 > 0$$

$$-8 \times 3 = -24$$
$$-8 + 3 = -5$$

$$4x^2 - 8x + 3x - 6 > 0$$
$$4x(x-2) + 3(x-2) > 0$$

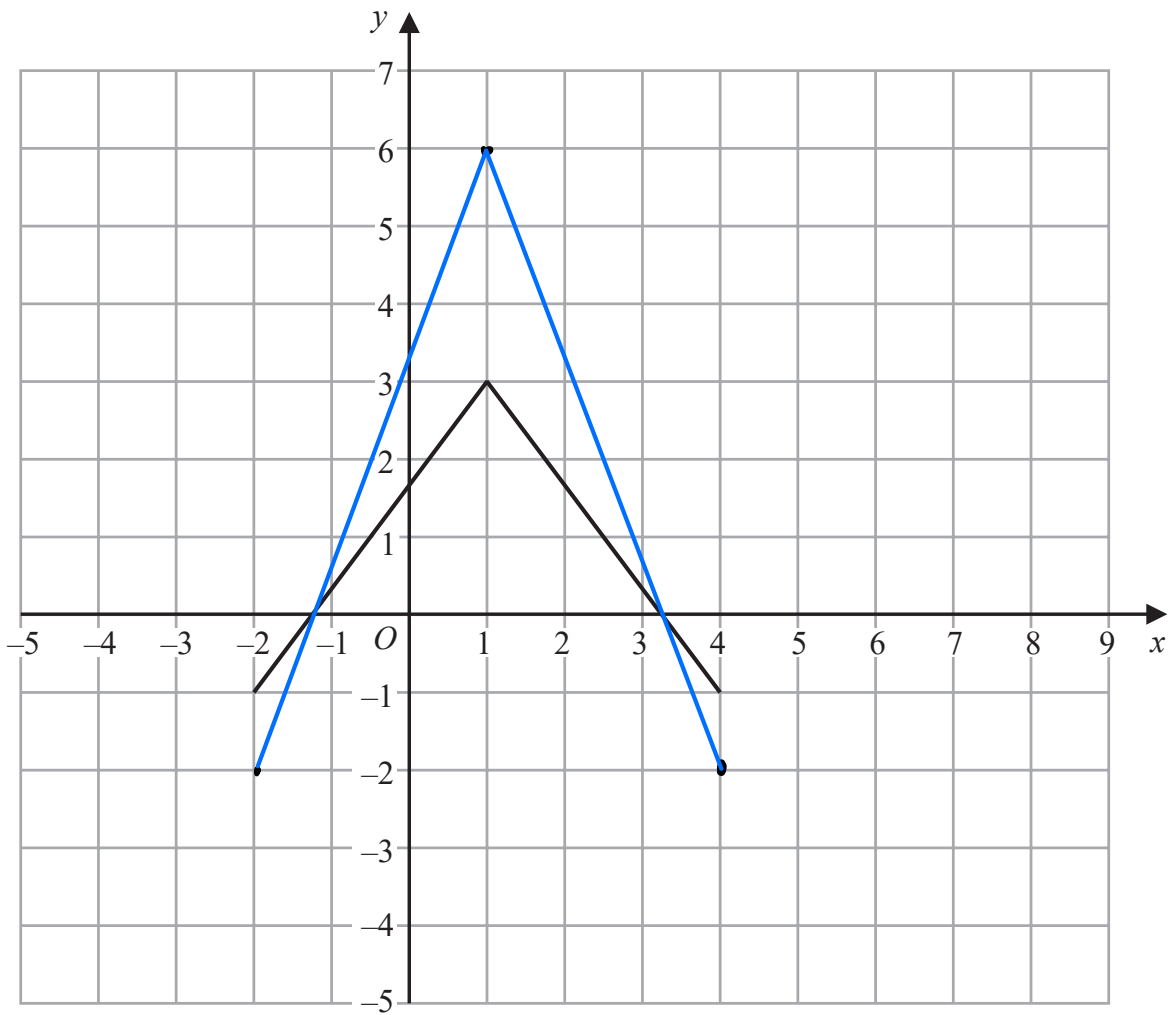$$(x-2)(4x+3) > 0$$

$$x = 2 \qquad x = \frac{-3}{4}$$

so $\underline{\underline{x < -3/4}}$
$\underline{\underline{x > 2}}$

$x < {}^{-3}/4 \quad x > 2$

**(Total for Question 20 is 4 marks)**

*Turn over*

**21** Here is the graph of $y = f(x)$



(a) On the grid above, draw the graph of $y = 2f(x)$
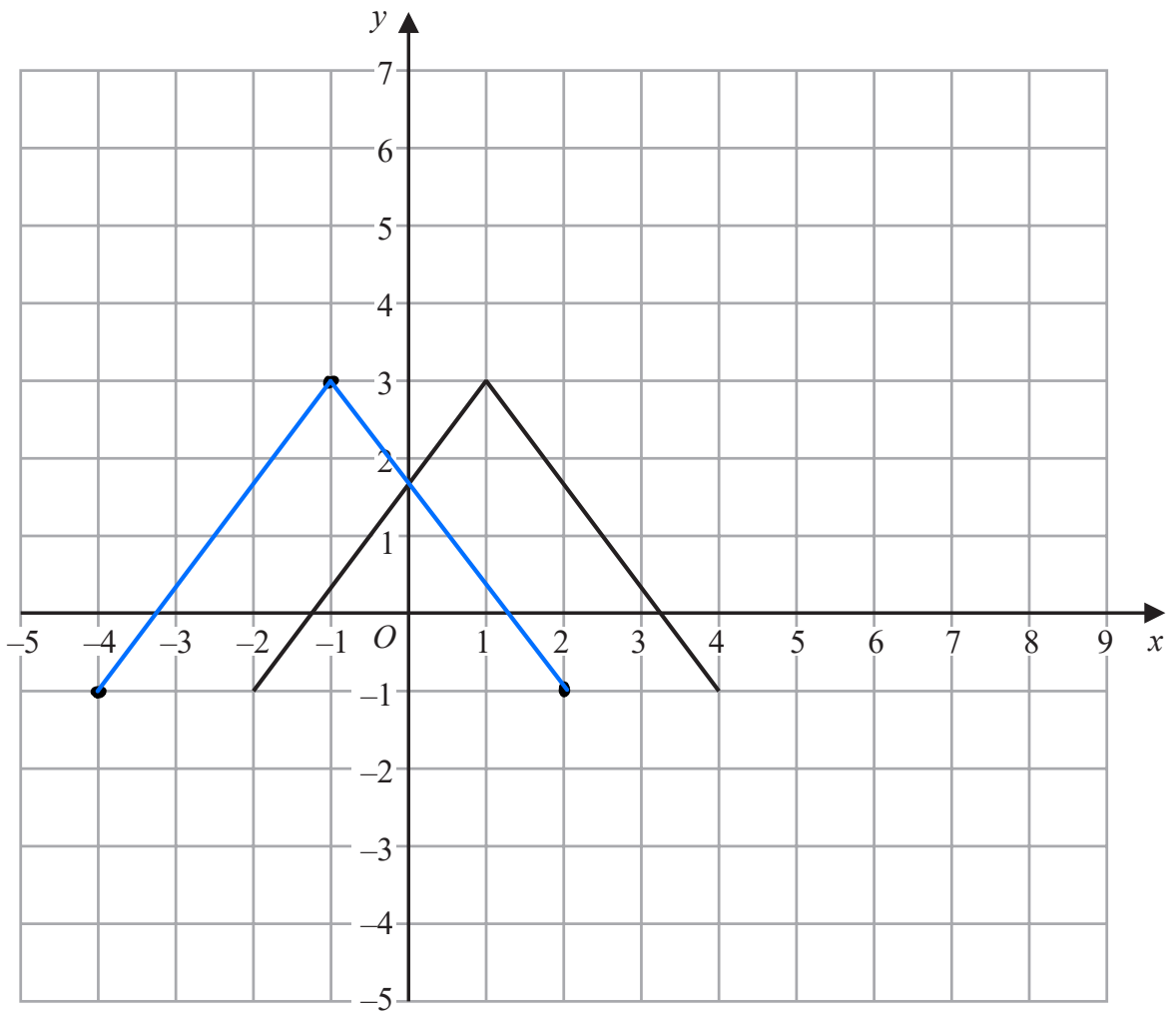
**(2)**

Stretch y by 2.

y × 2.

*P59014A02024*

Here is the graph of $y = f(x)$



(b) On the grid above, draw the graph of $y = f(-x)$

(2)

Reflect in yaxis

$x \; x \; -1$

**(Total for Question 21 is 4 marks)**

*Turn over* ▶

P 5 9 0 1 4 A 0 2 1 2 4

**22** Express $\dfrac{4x^2 - 25}{5x^2 + 2x - 7} \times \left( \dfrac{2}{x - 3} - \dfrac{3}{2x - 5} \right)$ as a single fraction in its simplest form.

$$\dfrac{4x^2 - 25}{5x^2 + 2x - 7} \times \left( \dfrac{2}{x-3} - \dfrac{3}{2x-5} \right) \rightarrow \dfrac{(2x+5)(2x-5)}{(5x+7)(x-1)} \times \dfrac{2(2x-5)-3(x-3)}{(x-3)(2x-5)}$$

$$\dfrac{(2x+5)(2x-5)}{(5x+7)(x-1)} \times \dfrac{x-1}{(x-3)(2x-5)} \rightarrow \dfrac{2x+5}{(5x+7)(x-3)}$$

$$\dfrac{2x+5}{(5x+7)(x-3)}$$

.................................................................

**(Total for Question 22 is 4 marks)**

**23** $OAB$ is a triangle.

$$\overrightarrow{OA} = \mathbf{a} \qquad \overrightarrow{OB} = \mathbf{b}$$

$C$ is the midpoint of $OA$.
$D$ is the point on $AB$ such that $AD:DB = 3:1$
$E$ is the point such that $\overrightarrow{OB} = 2\overrightarrow{BE}$

Using a vector method, prove that the points $C$, $D$ and $E$ lie on the same straight line.
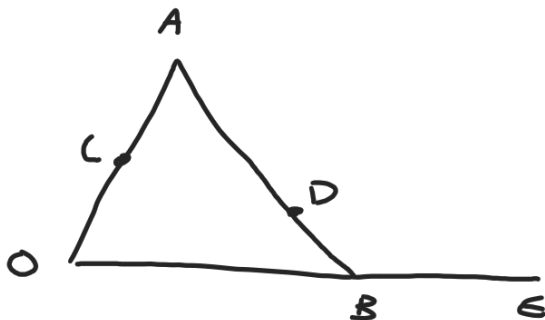


$\overrightarrow{AB} = b - a$

$\overrightarrow{AD} = 3/4(b-a)$

$\overrightarrow{CD} = 1/2a + 3/4(b-a) \quad = 3/4b - 1/4a$

$\overrightarrow{DE} = 1/4(b-a) + 1/2b = 3/4b - 1/4a$

$\overrightarrow{CD} = \overrightarrow{DE}$ so CDE is a straight line.

**(Total for Question 23 is 5 marks)**

*Turn over* ▶

**24** (a) Express $7 - 4x - x^2$ in the form $p - (x + q)^2$ where $p$ and $q$ are constants.

$$p - (x+2)^2$$

$$-(x+2)^2 = -(x^2+4x+4)$$
$$= -x^2 -4x -4$$

$$\text{So } \underline{\underline{P=11}} \qquad \underline{\underline{11-(x+2)^2}}$$

$$\underline{\underline{q=2}}$$

.............$11 - (x+2)^2$.............

**(2)**

(b) Use your answer to part (a) to solve the equation $7 - 4(y + 3) - (y + 3)^2 = 0$

Give your solutions in the form $e \pm \sqrt{f}$ where $e$ and $f$ are integers.

$$(y+3+2)^2 = 11$$
$$y+3+2 = \pm\sqrt{11}$$
$$\underline{\underline{y = -5 \pm \sqrt{11}}}$$

$$\underline{\underline{e=-5}} \qquad \underline{\underline{f=11}}$$

.............$y = -5 \pm \sqrt{11}$.............

**(3)**

The curve **C** has equation $y = 3 - 5(x + 1)^2$
The point $A$ is the maximum point on **C**.

(c) Write down the coordinates of $A$.

$$-5(x+1)^2 + 3$$

$$\underline{\underline{(-1,3)}}$$

( .............$-1$............. , .............$3$............. )

**(1)**

**(Total for Question 24 is 6 marks)**

**TOTAL FOR PAPER IS 100 MARKS**