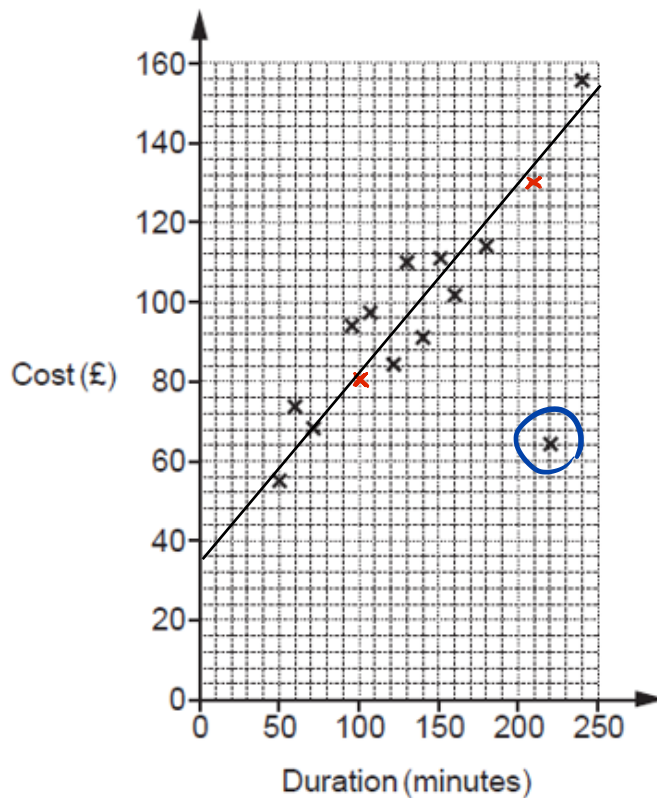# GCSE (9-1) Mathematics

J560/06 Paper 6 (Higher Tier)

Question Set 5

1 **(a)**

A travel agent records the duration and cost of the 15 flights he sold on one day.
The data for the first 13 flights are plotted on the scatter diagram.

The data for the final two flights is: $\quad$ 60+40 =100mins
$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad$ ‖

Duration	210 minutes	1 hour 40 minutes
Cost	£130	£80

Plot these flights on the scatter diagram. [2]

1 **(b)** **(b)** The cost of one of the 15 flights had been discounted in a sale.

Circle the most likely flight on the scatter diagram. [1]

1 **(c)** **i** **(c)** **(i)** Draw a line of best fit on the scatter diagram. [1]

1 **(c)** **ii** **(ii)** Use your line of best fit to estimate the duration of a flight costing £90.

(c)(ii) .... 115 .... minutes [1]

1 **(d)**

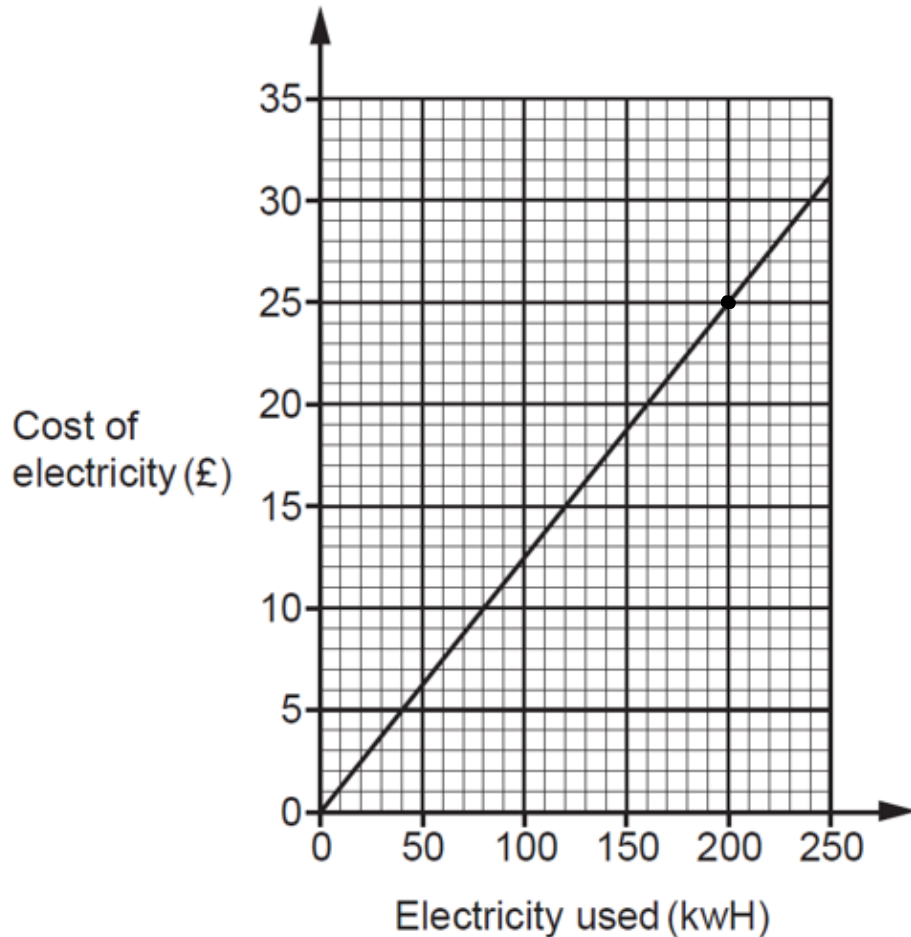**(d)** Explain why the travel agent should not use his records to estimate the cost of a 7 hour flight.

7 hours (420mins) is too far off from the data range used in his records thus estimation of the cost based on extrapolation of the line of best fit would be [1] unreliable.

2 **(a)**

The graph shows the cost of electricity with Company A.

Use the information in the graph to estimate the cost of electricity for a customer who uses 450 kwH of electricity.

[3]

$y = ax$ no b since the line goes through $(0,0)$

$(200, 25)$

$25 = 200a$

$a = \dfrac{25}{200} = 0.125$

$y = 0.125x$

$y = 0.125 \times 450$

$= 56.25$

£ 56.25

2 (b)

(b) Company B charges 14.3 pence per kwH of electricity used.

If Company B's cost of electricity was plotted on the same axes as Company A's cost of electricity, which line would be steeper?
Explain how you know.

A: £0.125 = 12.5p per kwH

Company ....B..... would have the steeper line because ....company B.............

.....charges more per kWH than company A.................

.... **[3]**

3 (a)

Nina estimates the value of $\sqrt{\left(\dfrac{3.93 \times 393}{0.546 \times 220}\right)^3}$ by rounding each number to 1 significant figure.

(a) Show that Nina's answer is 64. **[3]**

$$\sqrt{\left(\frac{4 \times 400}{0.5 \times 200}\right)^3} = \sqrt{16^3} = \sqrt{4096} = \boxed{64}$$

(b)

(b) Calculate the error in her estimated answer as a percentage of the exact answer.

Exact answer = 46.1057...

Error = 64 − 46.1057 = 17.8942...

$$\frac{17.8942}{46.1057} \times 100 = 38.811...$$

(b) ....38.81............... % **[4]**

4 (a)

(a) Work out the size of the exterior angle of a regular 12-sided polygon.

$360 \div 12 = \boxed{30°}$

- *or* -

$12 - 3 = 9$

$180 \times 10 = 1800°$ = total interior angle of polygon

$1800 \div 12 = 150°$ = one interior angle

$180 - 150 = \boxed{30°}$

(a) ....30°...................° [2]

4 (b)

(b) Use your answer to part (a) to write down the size of the interior angle of a regular 12-sided polygon.

$180 - 30 = \boxed{150°}$

(b) ....150...................° [1]

5 (a) i

Here are two functions.

Function A: Input $\longrightarrow$ ×3 $\longrightarrow$ +15 $\longrightarrow$ Output

Function B: Input $\longrightarrow$ +11 $\longrightarrow$ ×2 $\longrightarrow$ Output
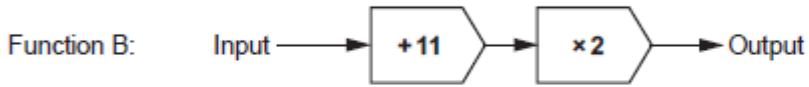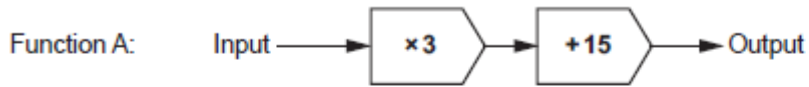
(a) (i) Jo chooses a number, x.
She inputs x into each function.
The two outputs are equal.

Work out the value of x.

$$3x + 15 = (x + 11) \times 2$$

$$3x + 15 = 2x + 22$$

$$x = 7$$

(a)(i) x = ... 7 .... [4]

5 (a) ii

(ii) Explain why there is no other input that gives two outputs that are equal.

$3x + 15 = 2x + 22$ has only one solution
which is $x = 7$ when equation is solved [1]

5 (b)

(b) Here is function C.

Function C: Input ──→ [+p] ─→ [×q] ──→ Output
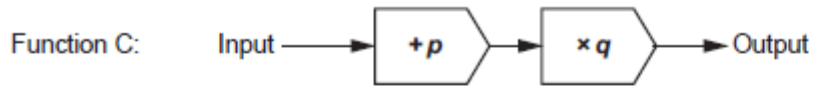
Kai chooses values for p and q so that if he inputs **any** number into both function A and function C, he will **always** get two outputs that are equal.

Find the value of p and the value of q.

$$3x + 15 = (x + p) \times q \longleftarrow x = 0, 1$$

$$\begin{bmatrix} 15 = pq \\ 3 + 15 = (1 + p)q \\ 18 = q + pq \end{bmatrix} \longleftarrow$$

$$18 = q + 15$$

$$q = 18 - 15 = \boxed{3}$$

$$15 = p \times 3$$

$$\boxed{p = 5}$$

(b) $p =$ ....5............

 $q =$ ....3............ [3]

6 The base of a cone is fixed to the top of a cylinder to make a decoration.
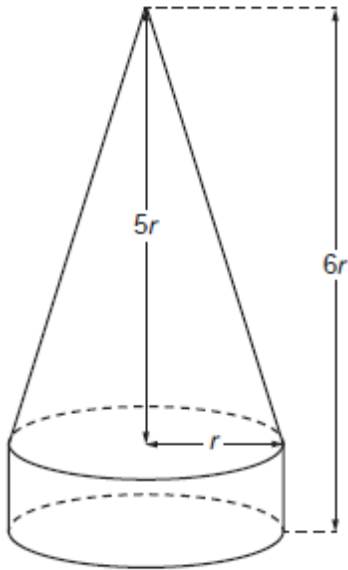
The radius of the base of the cone and of the cylinder is r cm.
The cone's height is $5r$ cm.
The total height of the decoration is $6r$ cm.
The total volume of the decoration is $225\,\text{cm}^3$.

Calculate the value of r.
Show your working.

[The volume V of a cone with radius r and height h is $V = \dfrac{1}{3}\pi r^2 h$.]

volume of cone : $\dfrac{1}{3}\pi r^2 \times 5r = \dfrac{5}{3}\pi r^3$

volume of cylinder : $\pi r^2 \times r = \pi r^3$

total volume $= \dfrac{5}{3}\pi r^3 + \pi r^3 = \dfrac{8}{3}\pi r^3 = 225$

$r = 2.9947$

$r = \underline{\qquad 2.99 \qquad}$ **[5]**

7 (a)

The diagram shows a circle, centre O.

Points A, B and C lie on the circumference of the circle.
Line AOB is a diameter.
Line DAE is a tangent to the circle.
Angle CAE = 32°.

Not to scale
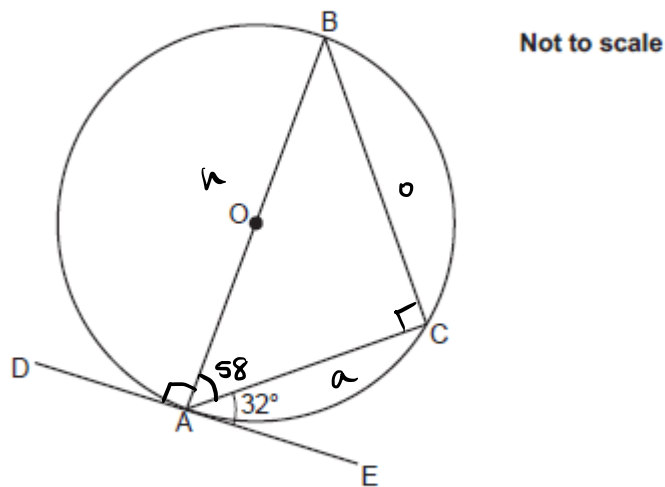
(a) Give a reason why angle ACB is a right angle.

The line crossing the origin (O) and its tangent makes
90° at ∠BAD.   According to alternate segment theorem [1]
∠ACB is same as ∠BAD thus ∠ACB is 90°.

7 (b)

(b) The radius of the circle is 8 cm.

Calculate length BC.

$$\overline{AB} = 8 \times 2 = 16$$

$$\sin 58 = \frac{O}{16}$$

$$O = 16 \times \sin 58$$

$$= 13.5687$$

(b) .... 13.57 .... cm [4]

8

Vector $\mathbf{m} = \begin{pmatrix} 2 \\ k \end{pmatrix}$ and vector $\mathbf{n} = \begin{pmatrix} 3 \\ 11 \end{pmatrix}$.

Vector $2\mathbf{m} + \mathbf{n}$ is parallel to $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$.

Find the value of k.

$$2\begin{pmatrix} 2 \\ k \end{pmatrix} + \begin{pmatrix} 3 \\ 11 \end{pmatrix} = \begin{pmatrix} 4 \\ 2k \end{pmatrix} + \begin{pmatrix} 3 \\ 11 \end{pmatrix} = \begin{pmatrix} 7 \\ 2k+11 \end{pmatrix}$$

$$\begin{pmatrix} 1 \\ -1 \end{pmatrix} \xrightarrow[\times 7]{\times 7} \begin{pmatrix} 7 \\ 2k+11 \end{pmatrix}$$

$2k + 11 = -1 \times 7$

$2k = -18$

$\boxed{k = -9}$

$k =$ ....-9........................ [4]

9   Write as a single fraction in its simplest form.

$$\frac{x}{x+2}+\frac{x+1}{x-2}-\frac{6x}{x^2-4}$$

$$= \frac{x}{x+2} + \frac{x+1}{x-2} - \frac{6x}{(x+2)(x-2)}$$

$$= \frac{x(x-2)+(x+1)(x+2)-6x}{(x+2)(x-2)}$$

$$= \frac{x^2-2x+x^2+3x+2-6x}{(x+2)(x-2)}$$

$$= \frac{2x^2-5x+2}{(x+2)(x-2)}$$

$$= \frac{(2x-1)(x-2)}{(x+2)(x-2)}$$

$$= \boxed{\frac{2x-1}{x+2}}$$

$$\frac{2x-1}{x+2}$$

.... **[6]**

Total Marks for Question Set 5: 50