

Answer **all** the questions.

- 1 Ping chooses four numbers.

The mode of these four numbers is 8, the range is 7 and the mean is 11.

Find Ping's four numbers.

$$\text{Total} = 11 \times 4 = 44 \checkmark$$

$$\begin{array}{rcl} 8+8+ & + & = 44 \\ & - & = 28 \end{array}$$

$$\boxed{8} \quad \boxed{8} \quad \boxed{13} \quad \boxed{15} \checkmark$$

..... [3]

- 2 A box contains only red, blue and green pens.
The ratio of red pens to blue pens is 5 : 9.
The ratio of blue pens to green pens is 1 : 4.

Calculate the percentage of pens that are blue.

R	B	G	
5	9	36	5 x 9 ✓
	1	4	

$$B = \frac{9}{50} \times 100 \quad \checkmark \checkmark$$

$$18 \checkmark$$

..... % [4]

- 3 Asha worked out $\frac{326.8 \times (6.94 - 3.4)}{59.4}$.

She got an answer of 19.5, correct to 3 significant figures.

Write each number correct to 1 significant figure to decide if Asha's answer is reasonable.

$$\checkmark\checkmark \frac{300 \times (7-3)}{60} = \frac{30 \times 4}{6} = \frac{120}{6} = 20$$

so yes $19.5 \approx 20$ ✓

[3]

- 4 (a) Show that $a^5 \times (a^3)^2$ can be expressed as a^{11} .

[2]

$$a^5 \times a^6 = a^{5+6} = a^{11}$$

✓ ✓

- (b) Write $\frac{1}{125} \times 25^9$ as a power of 5.

$$\checkmark 5^{-3} \times (5^2)^9$$

$$= 5^{-3} \times 5^{18}$$

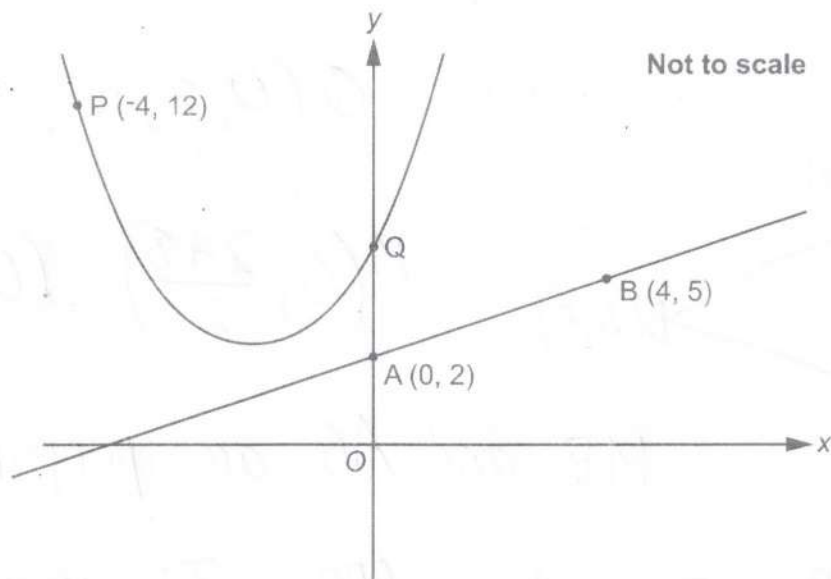
✓

(b)

$$5^{15}$$

[3]

- 5 The diagram shows a straight line that passes through points A and B, and a curve that passes through points P and Q.



- (a) Find the equation of the straight line.

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

$$c = 2$$

✓

✓

$$y = \frac{3}{4}x + 2$$

(a) [3]

- (b) The equation of the curve is $y = x^2 + kx + 8$.

Find the value of k .

$$12 = (-4)^2 + (-4k) + 8$$

✓✓

$$4 = 16 - 4k$$

$$-12 = -4k$$

3

✓

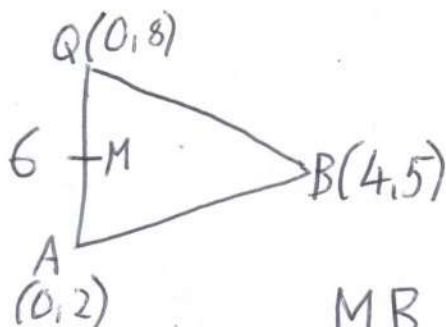
(b) $k =$ [3]

- (c) Diann draws line BQ.
She says

Triangle ABQ is isosceles.

Is Diann correct?
You must show all your working.

$$Q(0, 8) \quad \checkmark$$



$$M\left(0, \frac{2+8}{2}\right) = (0, 5) \quad \checkmark$$

MB and AQ are perpendicular $\checkmark$

By symmetry ABQ is isosceles $\checkmark$

etc

[4]

- 6 y is inversely proportional to x.
y = 0.04 when x = 80.

Find the value of y when x = 32.

$$y = \frac{K}{x}$$

$$0.04 = \frac{K}{80} \quad \checkmark$$

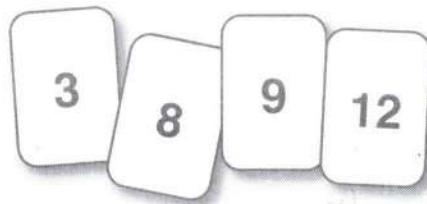
$$K = 3.2 \quad \checkmark$$

$$y = \frac{3.2}{32}$$

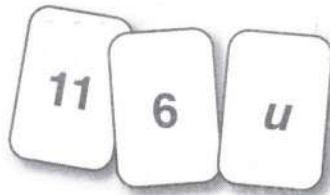
$$y = 0.1 \quad \checkmark$$

[3]

- 7 Edsel has four number cards.



Sharon has three number cards.
 u represents a number that Sharon knows.



Edsel and Sharon each pick one of their cards at random.
 They calculate the **difference** between the numbers on their cards.
 This is their sample space.

		Edsel			
		3	8	9	12
Sharon	6	3	2	3	6
	11	8	3	2	1
	u	11	6	r	t

Work out the values of r and t .

$$u = 14$$

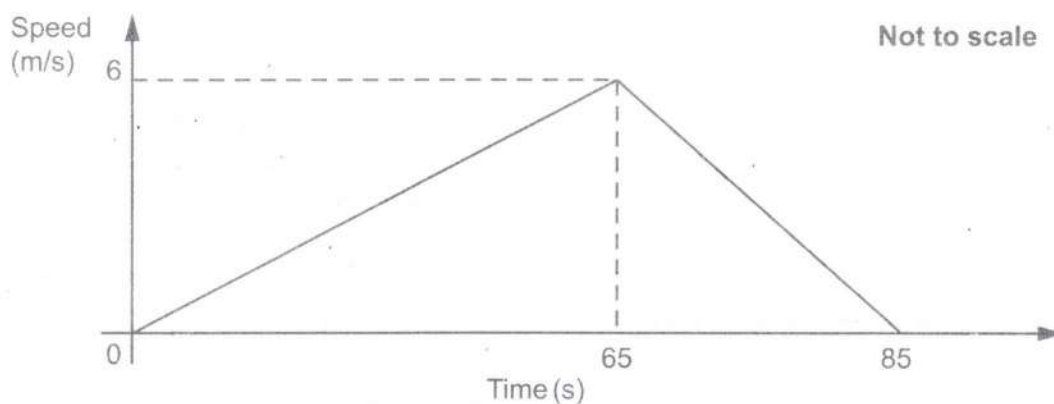


$$r = 5$$

$$t = 2$$

[4]

- 8 The graph shows the speed of a tram as it travels from the library to the town hall.



- (a) Calculate the deceleration of the tram as it approaches the town hall.

$$\frac{6}{20}$$

(a) 0.3 m/s² [2] ✓ ✓ OE

- (b) Calculate the distance travelled by the tram between the library and the town hall.

$$A = \frac{1}{2}bh$$

$$= \frac{1}{2} \times 85 \times 6$$

(b) 255 m [3] ✓ ✓ ✓

- (c) What was the maximum speed of the tram as it travelled between the library and the town hall?

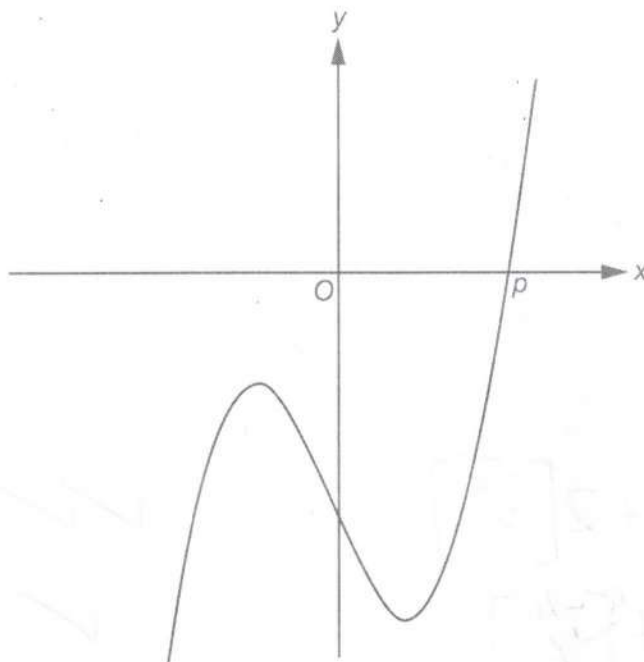
Give your answer in kilometres per hour.

$$6\text{m} \rightarrow 1\text{sec}$$

$$21600\text{m} \rightarrow 3600\text{sec (1hr)}$$

(c) 21.6 km/h [4] ✓ ✓ ✓

- 9 The graph of $y = x^3 - 7x - 12$ is shown below.
The root of the equation $x^3 - 7x - 12 = 0$ is p .



- (a) Calculate y when $x = 3$.

$$3^3 - 7 \times 3 - 12$$

(a) $y = \dots -6 \dots$ [1] ✓

- (b) Show that $3 < p < 4$.

$f(4) = 24$ change of sign hence $3 < p < 4$ [2]

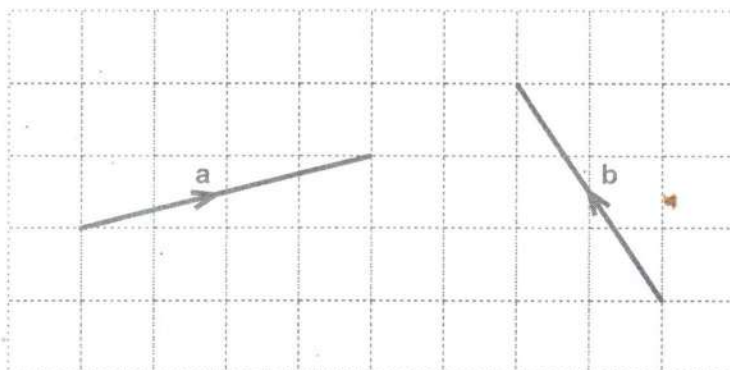
- (c) Find a smaller interval that contains the value of p .
You must show calculations to support your answer.

$$f(3.5) = 6.375$$

✓ OE ✓

(c) $3 < p < 3.5$ [3] ✓ ft

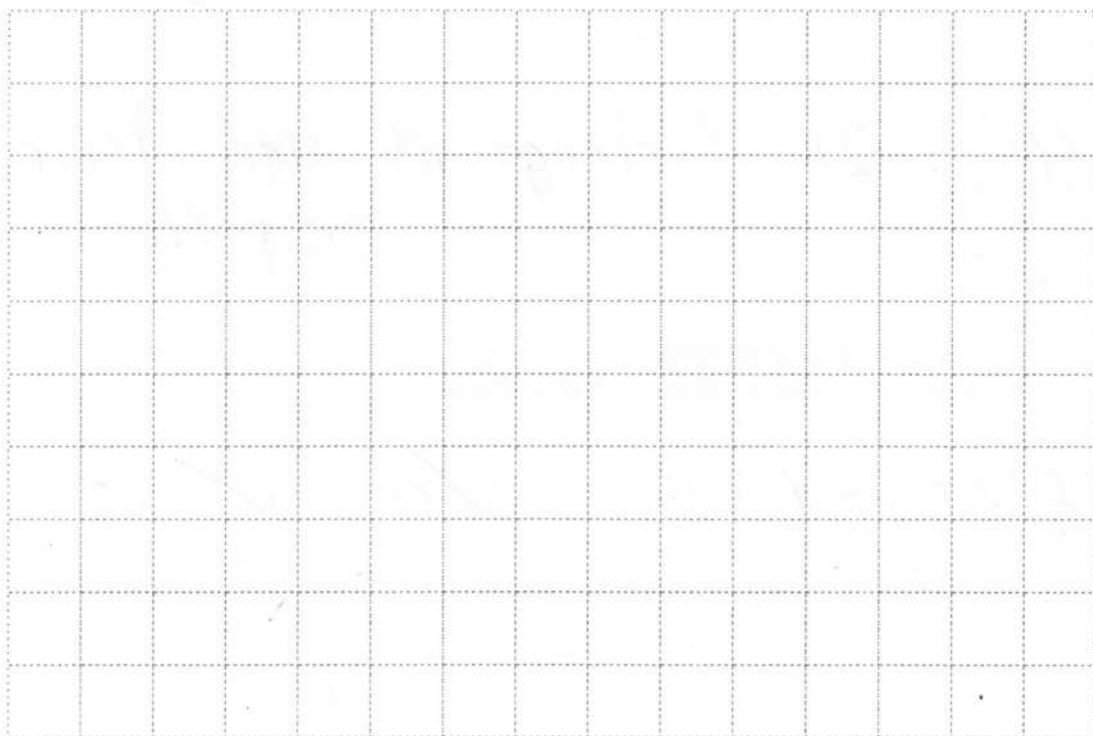
- 10 Two vectors, **a** and **b**, are shown on the 1 centimetre grid below.



Show that the vector $\mathbf{a} + 2\mathbf{b}$ has length 7 cm.

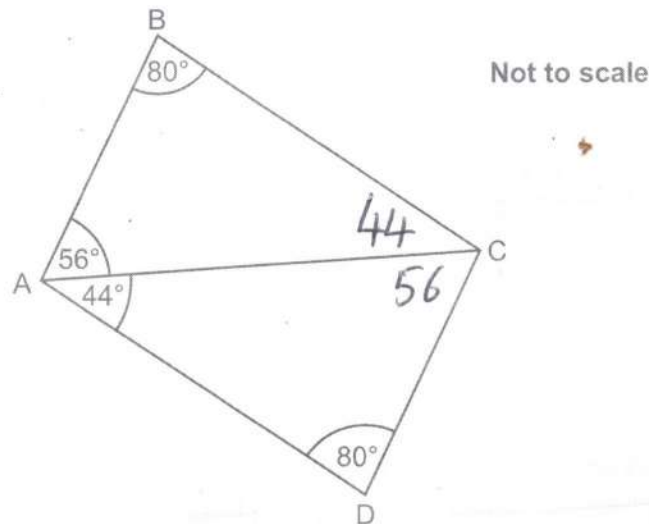
You may use the grid below.

$$\begin{aligned}
 & \begin{bmatrix} 4 \\ 1 \end{bmatrix} + 2 \begin{bmatrix} -2 \\ 3 \end{bmatrix} \\
 &= \begin{bmatrix} 4 \\ 1 \end{bmatrix} + \begin{bmatrix} -4 \\ 6 \end{bmatrix} \\
 &= \begin{bmatrix} 0 \\ 7 \end{bmatrix} \quad \text{so length} = 7\text{cm}
 \end{aligned}$$



[3]

11 The diagram below shows two triangles.



Prove that triangle ABC is congruent to triangle ACD.

$$\angle BCA = 180 - 80 - 56 = 44$$

(angles in a triangle sum to 180) OE ✓

$$\angle BCA = \angle DAC$$

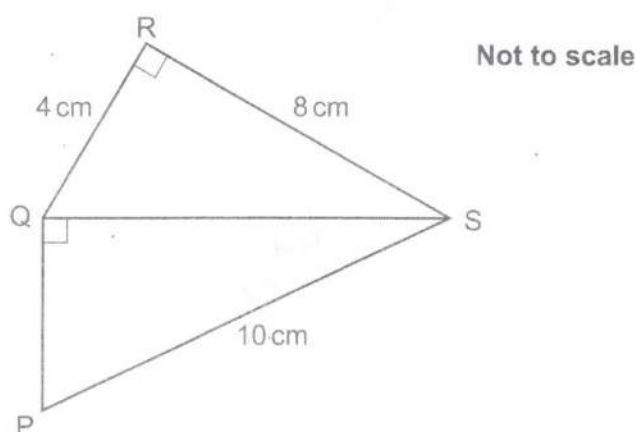
$$\angle DCA = \angle BAC$$

$$\angle ABC = \angle ADC$$

AC is common

Congruent due to ASA/AAS * ✓

- 12 The diagram below shows two right-angled triangles.



Prove that triangles PQS and QRS are similar.

$$QS = \sqrt{4^2 + 8^2} = 4\sqrt{5} \quad \checkmark \checkmark$$

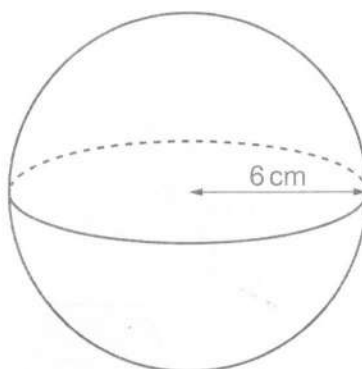
$$PQ = \sqrt{10^2 - (4\sqrt{5})^2} = 2\sqrt{5} \quad \checkmark$$

$$\begin{array}{l|l|l} \frac{RQ}{QP} = \frac{4}{2\sqrt{5}} & \frac{QS}{PS} = \frac{4\sqrt{5}}{10} & \frac{RS}{QS} = \frac{8}{4\sqrt{5}} \\ & = \frac{2\sqrt{5}}{5} & = \frac{2\sqrt{5}}{5} \end{array} \quad \checkmark$$

Same scale factor hence similar $\checkmark$

[5]

- 13 (a) Calculate the volume of a sphere with radius 6 cm.



[The volume V of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

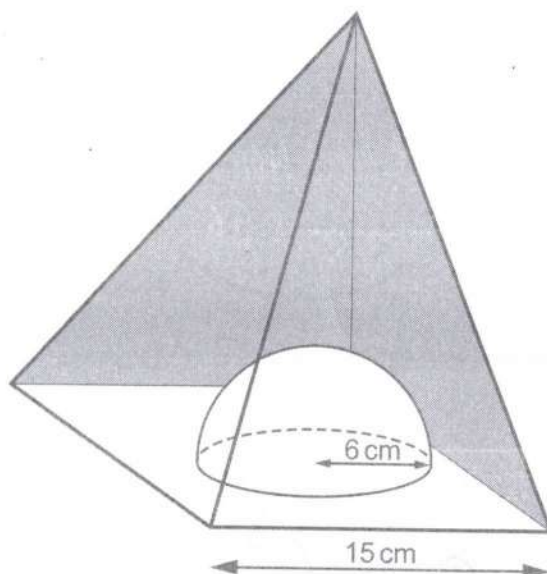
$$\frac{4}{3} \times \pi \times 6^3$$

✓

✓
etc

(a) 288π cm³ [2]

- (b) An ornament is made from a solid glass square-based pyramid. The base has side length 15 cm. A hemisphere with radius 6 cm is cut out of the base of the pyramid. This reduces the volume of glass contained in the ornament by 30%.



Calculate the perpendicular height of the pyramid.

[The volume of a pyramid is $\frac{1}{3} \times \text{area of base} \times \text{perpendicular height}$.

A hemisphere is half a sphere.]

$$288\pi \div 2 = 30\% \quad \checkmark$$

$$100\% = 480\pi \quad \checkmark$$

$$\frac{1}{3} \times 15^2 \times h = 480\pi \quad \checkmark$$

$$h = \frac{480\pi \times 3}{225} \quad \checkmark$$

$$\frac{32\pi}{5} \quad \checkmark$$

(b) cm [5]

[20.0 cr. → 20.1 cr.] Turn over

- 14 (a) Standard bricks have dimensions 21.5 cm by 10.3 cm by 6.5 cm, correct to 1 decimal place.

A house is built using 4663 standard bricks.

Joslin says

Placed end to end, the bricks from the house would definitely reach over 1 km.

Show that Joslin's statement is correct.

[4]

$$21.5 \text{ cm}, \text{ min} = 21.45 \text{ cm}$$

$$4663 \times 21.45 \div 100 \div 1000 = 1.0002135 \text{ km}$$

$$(> 1 \text{ km})$$

- (b) A standard brick should weigh 2.8 kg, correct to 1 decimal place.
A truck can carry a maximum load of 20 tonnes.

- (i) Calculate the maximum number of standard bricks that the truck should be able to carry.

$$2.8 < \begin{matrix} 2.85 \\ 2.75 \end{matrix}$$

$$\checkmark \frac{20 \times 1000}{2.85} = 7017.5...$$

$$\checkmark 2.85$$

$$[7017 \rightarrow 7020] \checkmark$$

(b)(i) [3]

- (ii) Explain why your answer to (b)(i) may not be possible to achieve.

Truck may not have enough room /
Safety regulations. ✓

[1]

- 15 Ratna invests £1200 for 2 years in a bank account paying $r\%$ per year compound interest. At the end of 2 years, the amount in the bank account is £1379.02.

Calculate r .

$$1200 \times x^2 = 1379.02 \quad \checkmark$$

$$x = \sqrt{\frac{1379.02}{1200}} \quad \checkmark \checkmark$$

$$x = 1.07199...$$

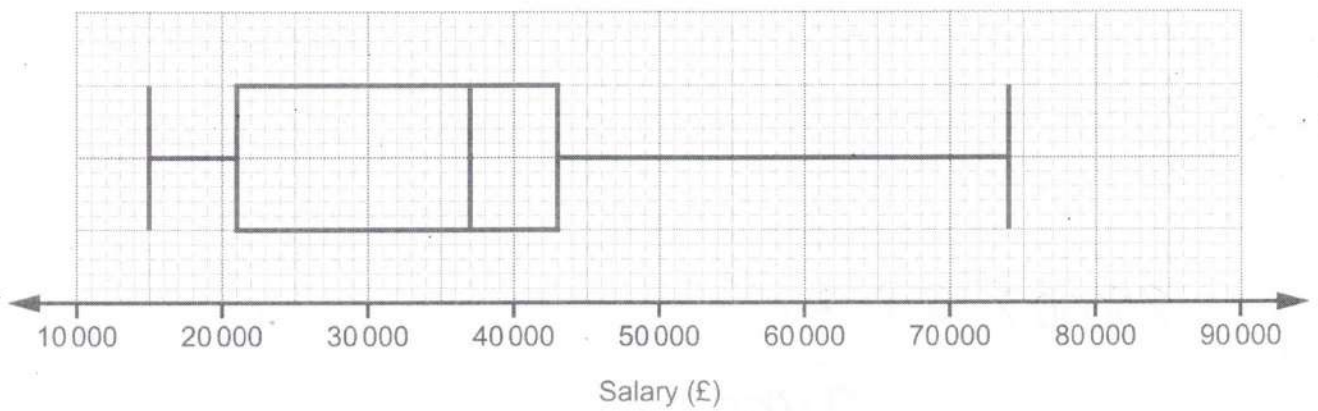
$$0.072 \times 100$$

$$7.2 \quad \checkmark$$

$$r = \dots\dots\dots [4]$$

$$[7.2 \text{ or } 7.199\dots]$$

16 The box plot shows the distribution of the salaries for the workers at Bexbridge Biscuits.



(a) State the median salary.

(a) £ 37000 ✓ [1]

(b) Find the interquartile range.

43 - 21 ✓

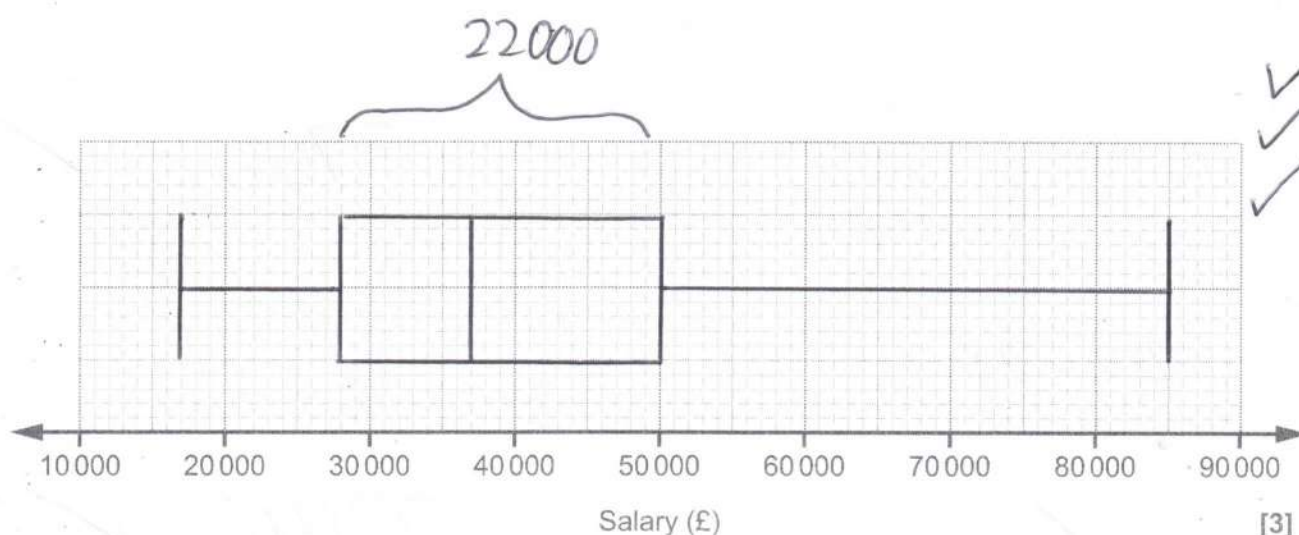
(b) £ 22000 ✓ [2]

(c) The following salary information is true for workers at Camford Cookies.

- The highest paid worker earns £85 000.
- The lowest paid worker earns 20% of the salary of the highest paid worker.
- 25% of the workers earn more than £50 000.
- 25% of the workers earn less than £28 000.
- The median salary is £37 000.

Draw a box plot to show the salaries of the workers at Camford Cookies.

$$85000 \times 0.2 =$$



(d) Make two different comparisons between the distribution of the salaries at Bexbridge Biscuits and the salaries at Camford Cookies.

1. Same IQR so similar spread * ✓

2. Same median so on average similar ✓

[2]

* Or CC is more spread using range.

17 Here is a function.



(a) The **output** of function A is x .

Write an algebraic expression, in terms of x , for the input of function A.

$$\frac{x}{5} - 14$$

(a) [2]

(b) A number, k , is put into function A.
The output is also k .

Find the value of k .

$$5(k+14) = k$$

$$5k + 70 = k$$

$$4k = -70$$

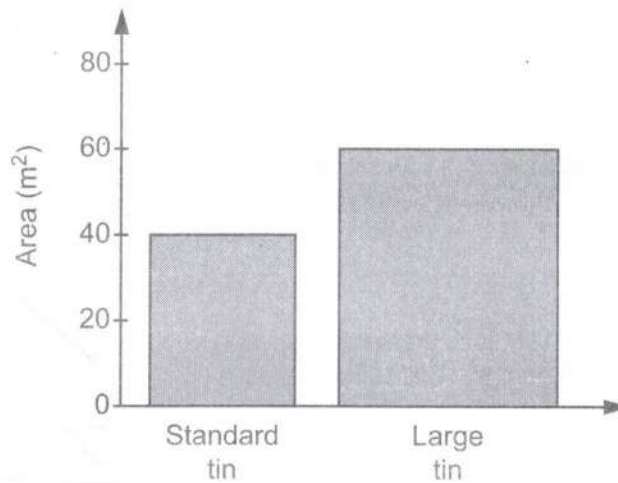
$$k = -\frac{70}{4}$$

$$-17.5$$

(b) $k =$ [3]

- 18 Percy sells paint in standard tins and large tins.
The standard tin covers 40 m^2 and the large tin covers 60 m^2 .

(a) Percy publishes this chart showing the area that can be covered with each tin of paint.



Explain why the chart is misleading.

Bars are different widths ✓

[1]

- (b) The standard tin and the large tin are mathematically similar.
The **volume** of the large tin is 50% more than the volume of the standard tin.
Both tins are cylinders.
The radius of the standard tin is 10 cm.

Calculate the radius of the large tin.

$$VSF = 1.5 \quad \checkmark$$

$$LSF = \sqrt[3]{1.5} \quad \checkmark$$

$$\checkmark \quad 10 \times \sqrt[3]{1.5} = 11.447... \quad \checkmark$$

11.4

(b) cm [4]

- 19 Show that $\frac{2x^2 + 13x + 20}{2x^2 + x - 10}$ simplifies to $\frac{x+a}{x-b}$ where a and b are integers. [4]

$$= \frac{(2x+5)(x+4)}{(2x+5)(x-2)}$$

✓✓✓

$$= \frac{x+4}{x-2}$$

✓

END OF QUESTION PAPER

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