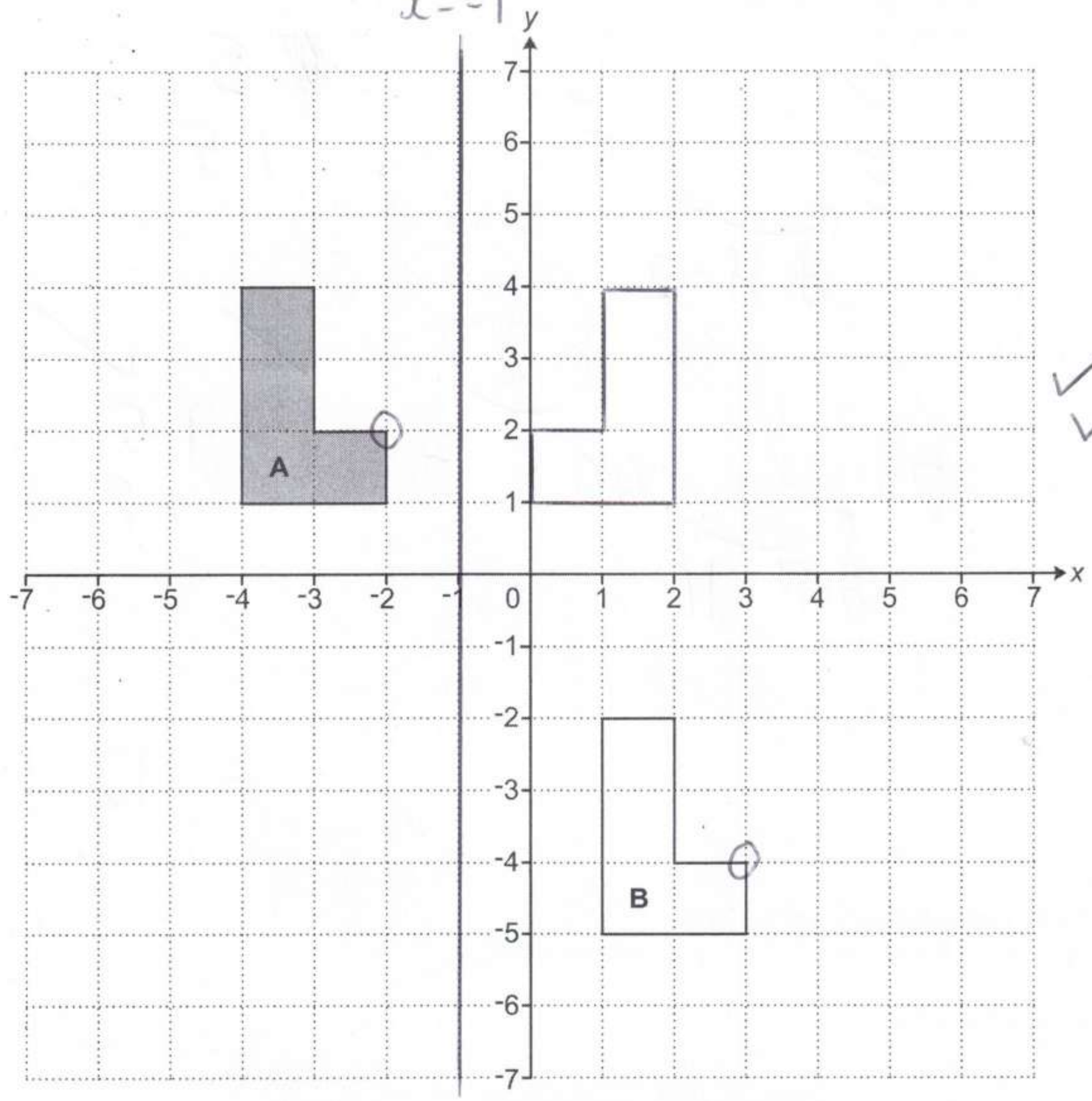
OCR-H Nov'22 P6

Answer **all** the questions.

1 Shape **A** and shape **B** are drawn on the coordinate grid.



(a) Describe fully the single transformation that maps shape **A** onto shape **B**.

Translation $\begin{bmatrix} 5 \\ -6 \end{bmatrix}$ **[2]**

(b) Reflect shape **A** in the line $x = -1$. **[2]**

2 A recipe for a batch of jam needs 3 oranges, 5 lemons and 1.5 kg of sugar.
A cook uses the recipe to make lots of batches of jam.
They use 16 **more** lemons than oranges in total.

Find how much sugar the cook should use.

O L S

3 5 1.5

diff = 2

×8

1.5
×8

24 40

diff = 16

= 12 kg **[3]**

3 In 1980, Ling's flat was worth £23 000.
Today, Ling's flat is worth 1200% of its value in 1980.

Calculate the value of Ling's flat today.

$\frac{1200}{100} \times 23000$

£ 276,000 **[2]**

4 Sam and Taylor are playing a game against a computer.
They can win, draw or lose the game.

Sam says

I think the probability of us winning the game is 0.3.

Taylor says

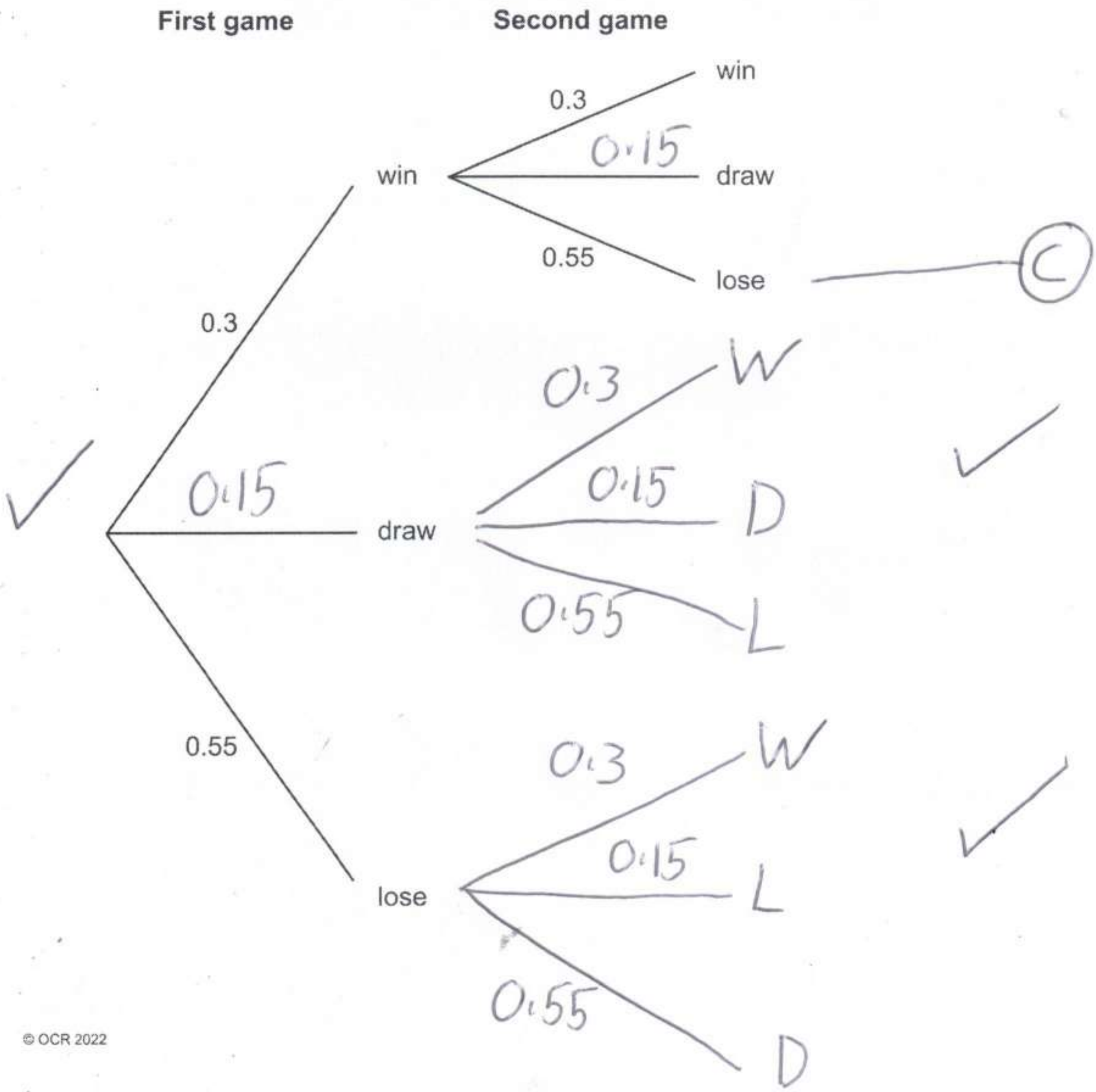
I think the probability of us losing the game is 0.75.

(a) Explain why Sam and Taylor cannot both be correct.

$0.3 + 0.75 > 1$ **[1]**

(b) Sam is correct. The probability of them winning the game is 0.3.
Taylor is not correct. The probability of them losing the game is actually 0.55.

Complete this **partly drawn** tree diagram to show **all** the possible outcomes of playing the game twice.



[3]

(c) Find the probability of them winning the first game and losing the second game.

0.3×0.55 ✓

(c) 0.165 ✓ .... **[2]**

5 In space, distances can be measured in Astronomical Units.
In this question, use the conversion 1 Astronomical Unit $= 1.5 \times 10^8$ km.

(a) On a particular day the distance from Earth to Neptune is 29.09 Astronomical Units.

Calculate the distance from Earth to Neptune in kilometres on that day.
Give your answer in standard form.

$29.09 \times 1.5 \times 10^8$

4,363,500,000

(a) 4.3635×10^9 km **[3]**

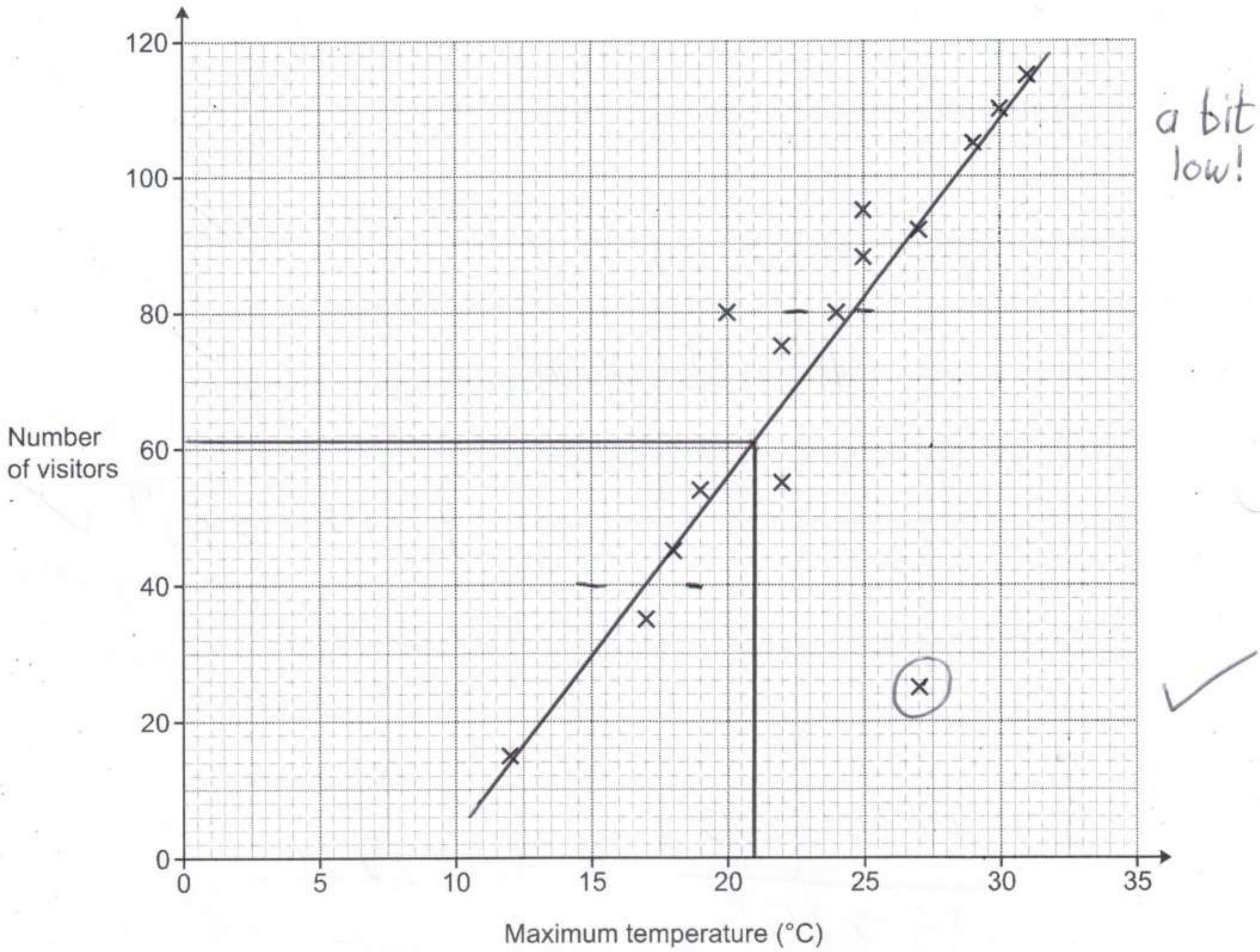
(b) On a particular day the distance from Earth to Mars is 78 340 000 km.

Calculate the distance from Earth to Mars in Astronomical Units on that day.

$\frac{7,8340,000}{1.5 \times 10^8} = 0.52226...$

(b) 0.52 Astronomical Units **[2]**

6 The scatter diagram shows the number of visitors to a children's playground and the maximum temperature on fifteen Saturdays in summer.



(a) Describe the type of correlation shown in the scatter diagram.

(a) positive [1]

(b) One Saturday was a hot but stormy day.

(i) Circle the most likely point on the scatter diagram for this Saturday. [1]

(ii) Explain why you chose this point.

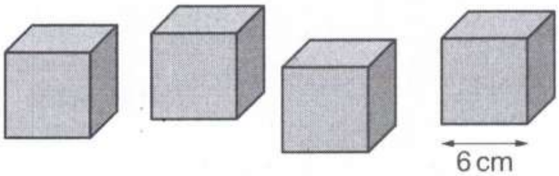
Hot day with fewer visitors (outlier) [1]

(c) Use a line of best fit to predict the number of visitors on a Saturday that has a maximum temperature of 21 °C.

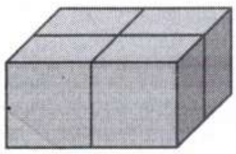
(c) 61 visitors [2]

[ms 52 → 78]

7 A child has four identical wooden cubes of side length 6 cm.



(a) They arrange the cubes in a 2 by 2 by 1 arrangement to form a cuboid.



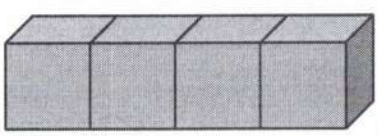
Show that the surface area of the cuboid is 576 cm^2. $\square = 36$ **[2]**

$(4+4+2+2+2+2) \times 36$

$= 16 \times 36$

$= 576$

(b) The child rearranges the cubes in a 4 by 1 by 1 arrangement to form a different cuboid.



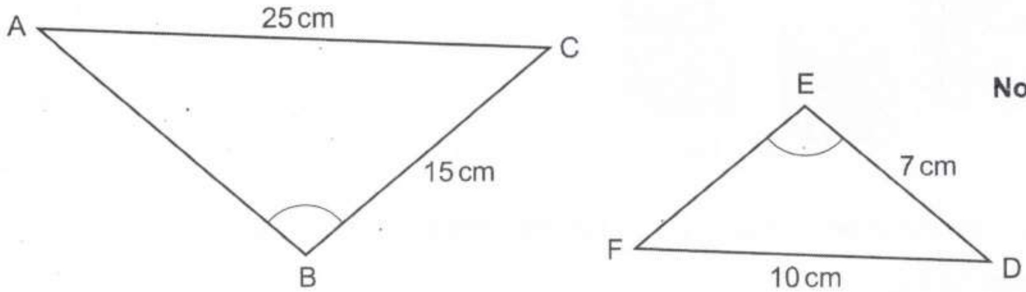
$SA = 36 \times 18 = 648$

Calculate the percentage increase in surface area for this cuboid compared with the 2 by 2 by 1 cuboid.

$\frac{72}{576} \times 100$

(b) 12.5 % .... % **[4]**

8 Triangles ABC and DEF are mathematically similar.
Angle ABC = Angle DEF.



Not to scale

Calculate the perimeter of triangle ABC.

$$\frac{25}{10} = 2.5$$

$$AB = 7 \times 2.5 = 17.5$$

$$Per = 25 + 15 + 17.5$$

$$= 57.5$$

.... cm **[4]**

9 Given that $(2^k)^6 \times 8 = 2^{45}$, find the value of k.

$$2^{6K} \times 2^3 = 2^{45}$$

$$6K + 3 = 45$$

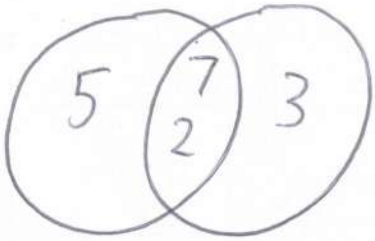
$$6K = 42$$

$k =$ ....7........ **[3]**

10 The highest common factor (HCF) of two numbers is 14.
The lowest common multiple (LCM) of the same two numbers is 210.
The two numbers are **not** 14 and 210.

Find the two numbers.

$210 \div 14 = 15 = 5 \times 3$



$5 \times 7 \times 2 = 70$

$2 \times 7 \times 3 = 42$

70 and 42 **[3]**

11 Factorise fully $30x^2 + 2x - 4$.

$ac = -120$

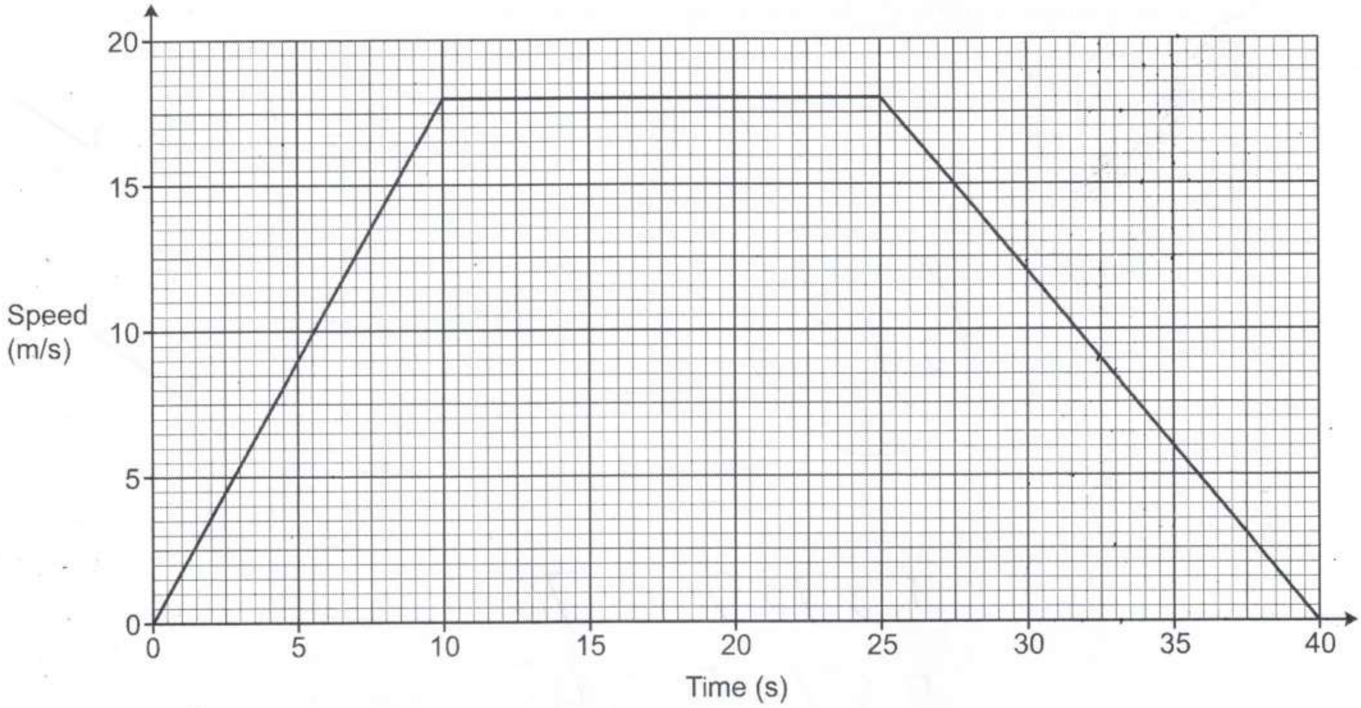
$30x^2 - 10x \mid +12x - 4$

$10x(3x-1) \mid +4(3x-1)$

$(10x+4)(3x-1)$

$2(5x+2)(3x-1)$ **[3]**

12 The graph shows the speed of a car during the first 40 seconds of a journey.



(a) Write down the acceleration of the car between 10 seconds and 25 seconds.

0

(a) .... m/s^2 **[1]**

(b) Work out the average speed of the car, in m/s, during the 40 seconds.
You must show your working.

$$\text{Area} = \frac{(15+40)}{2} \times 18$$

$$d = 495\text{m}$$

$$S = \frac{D}{T} = \frac{495}{40}$$

$$= 12.375$$

(b) .... m/s **[5]**

13 (a) Here is a function.

$$\text{Input} \longrightarrow \boxed{\times\, t} \longrightarrow \boxed{-\,2} \longrightarrow \text{Output}$$

When the input is 6, the output is 18.

Find the value of *t*.

$$6t - 2 = 18$$
$$6t = 20$$

$$t = \frac{20}{6} \text{ or } \frac{10}{3}$$ OE

(a) $t =$ .... **[3]**

(b) Here is another function.
When the input is *x*, the output is *y*.

$$x \longrightarrow \boxed{\div\, 4} \longrightarrow \boxed{+\,3} \longrightarrow y$$

Write an algebraic expression for ***x* in terms of *y***.

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

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

$$x = 4(y+3)$$ OE

(b) .... **[2]**

14 (a) The time taken to paint a wall is inversely proportional to the number of people painting.
It takes 40 minutes for 3 people to paint the wall if nobody stops painting.

Layla, Mia and Nina start painting the wall.
After 10 minutes Layla stops painting.
She leaves Mia and Nina to finish painting the wall.

Assume that Layla, Mia and Nina paint at the same rate.

Work out the **total** time taken to paint the wall.

$40 \times 3 = 120$ total ✓

$120 - (3 \times 10) = 90$ left

$\frac{90}{2} = 45$ each ✓

$10 + 45 = 55$ ✓

(a) .... 55 .... minutes **[3]**

(b) y is inversely proportional to x^3.
$y = 16$ when $x = 2$.

Find the value of y when $x = 8$.

$y = \frac{K}{x^3}$ ✓

$16 = \frac{K}{2^3}$

$128 = K$ ✓

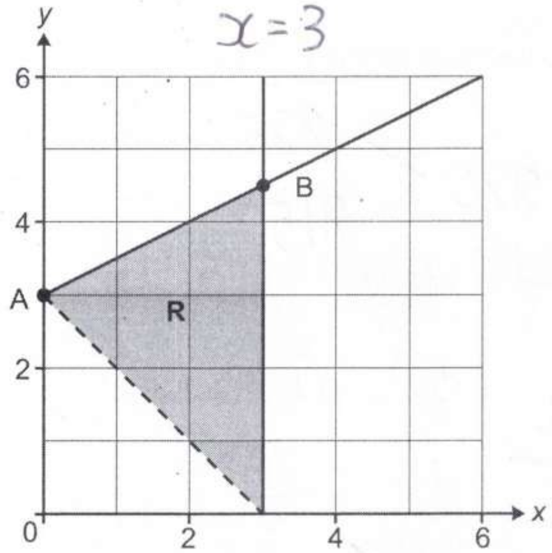
$y = \frac{128}{x^3}$

$y = \frac{128}{8^3} = \frac{128}{512}$

0.25 ✓OE

(b) .... 0.25 .... **[3]**

15 The region **R** is shown on this grid.
A is the point (0, 3) and B is the point (3, 4.5).



(a) Show that an equation of the straight line through A and B is $2y = x + 6$. **[3]**

$$m = \frac{1.5}{3} = \frac{1}{2} \quad c = 3$$

$$y = \frac{1}{2}x + 3$$

$$2y = x + 6$$

(b) Write down the three inequalities that define region **R**.

(b) $x + y > 3$

$x \leqslant 3$

$2y \leqslant x + 6$ **[5]**

16 A plane flies from London to Tokyo.
The distance is 9600 km, correct to the nearest 100 km.
The plane travels at an average speed of 820 km/h, correct to the nearest 10 km/h.

Calculate the shortest possible flight time of the plane.
Give your answer in hours and minutes, correct to the nearest minute.
You must show your working.

$9600 < \begin{matrix} 9650 \\ 9550 \end{matrix}$

$820 < \begin{matrix} 825 \\ 815 \end{matrix}$

$T\downarrow = \dfrac{D\downarrow}{\uparrow S}$

$= \dfrac{9550}{825} = 11.\dot{5}\dot{7}$

$0.\dot{5}\dot{7} \times 60$
$= 35$ mins

11 hours 35 minutes **[5]**

17 Charlie weighs many apples.

The weights of the apples are summarised below.

- heaviest apple = 75 g
- range = 50 g
- median = 60 g
- lower quartile = 45 g
- 50% of the apples weigh between 45 g and 65 g   so UQ = 65
- mean = 63 g

(a) **(i)** Write down the interquartile range for the weights of the apples.

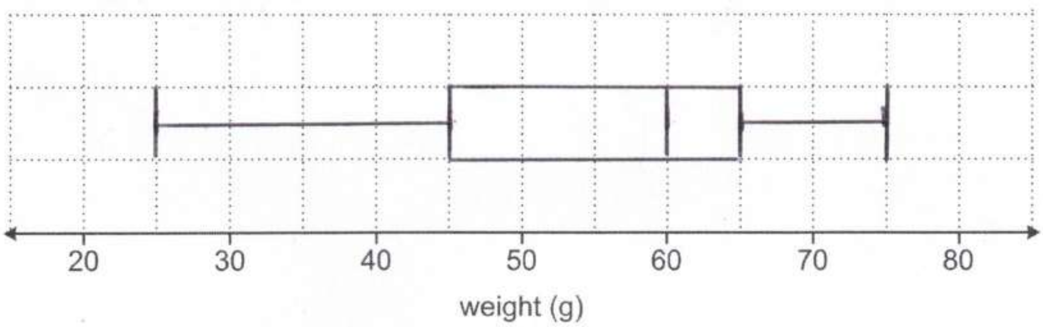
65 − 45

(a)(i) ....20........ g **[1]** ✓

(ii) Write down the percentage of the apples that weigh between 45 g and 60 g.

(ii) ....25........ % **[1]** ✓

(b) Draw a box plot to show the distribution of the weights of the apples.



✓3
✓4
✓All

[3]

(c) Charlie eats two of the apples.
The apples that they eat weigh 58 g and 66 g.

Charlie says

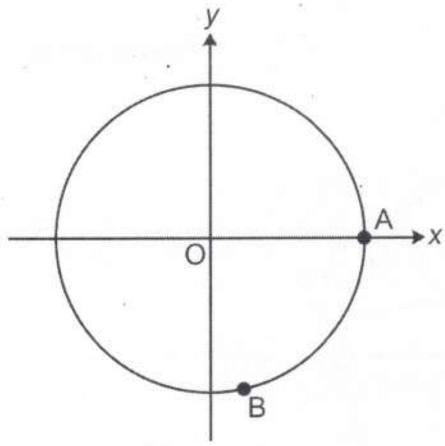
The mean weight of all the apples was 63 g.
I ate one apple that weighed less than the mean and another apple that weighed more than the mean.
Therefore, the mean of the remaining apples will still be 63 g.

Is Charlie correct?
Explain your reasoning.

$-5g + 3g$ = overall $-2g$ so mean would reduce

[2]

18 A circle has equation $x^2 + y^2 = 100$.
The sketch shows the circle and two points, A and B, which lie on the circumference of the circle.



(a) Write down the coordinates of point A.

(a) (10 , 0) **[1]**

(b) Point B has x-coordinate 3.

Find the exact value of the y-coordinate of point B.

$3^2 + y^2 = 100$ ✓

$y^2 = 91$ ✓

(b) $y = -\sqrt{91}$ ✓ **[3]**

(c) Another point, C, lies on the circle and has a y-coordinate that is seven times its x-coordinate.

Find the two possible pairs of coordinates for point C.
Give your answers in exact form.
You must show your working.

✓✓ $x^2 + (7x)^2 = 100$

$50x^2 = 100$

$x^2 = 2$

✓ $x = \pm\sqrt{2}$

$+2 + y^2 = 100$

$y^2 = 98$

$y = \sqrt{98}$

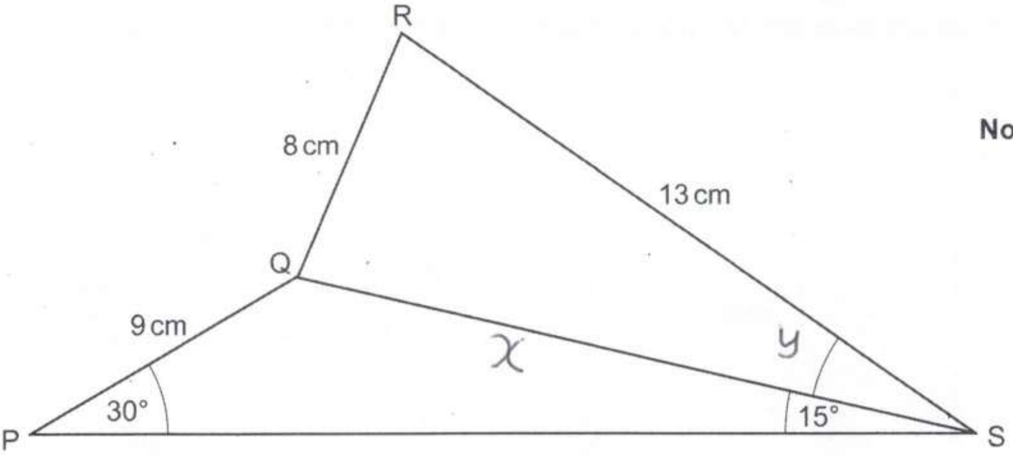
$+2 + y^2 = 100$

$y^2 = 98$

(c) ($\sqrt{2}$, $7\sqrt{2}$) and ($-\sqrt{2}$, $-7\sqrt{2}$) **[5]**

✓ ✓

19 PQS and QRS are triangles.



Not to scale

PQ = 9 cm, QR = 8 cm and RS = 13 cm.
Angle QPS = 30° and angle PSQ = 15°.

Calculate angle QSR.
Give your answer correct to **1** decimal place.
You must show your working.

$\Delta PQS \quad \frac{x}{\sin 30} = \frac{9}{\sin 15}$ ✓

$x = 4.5 \div \sin 15 = 17.38...$ ✓

$\cos y = \frac{17.38^2 + 13^2 - 8^2}{2 \times 17.38 \times 13} = 0.90099...$

✓✓✓

$y = \cos^{-1}(0.90099...) = 25.711...$

$= 25.7$ ✓ .... ° **[6]**

Turn over for Question 20

20 Write as a single fraction in its simplest form.

$$10 - \frac{6x+45}{3x+5}$$

$$= \frac{10(3x+5)}{3x+5} - \frac{(6x+45)}{3x+5}$$

$$= \frac{30x+50-6x-45}{3x+5}$$

$$= \frac{24x+5}{3x+5}$$

$\frac{24x+5}{3x+5}$ .... **[4]**

END OF QUESTION PAPER

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