OCR-H Nov '20 P4

Answer **all** the questions.

1 **(a)** Write these numbers in standard form.

(i) 6500

6.5×10^3 ✓

(a)(i) ..... **[1]**

(ii) 0.0584

5.84×10^{-2} ✓

(ii) ..... **[1]**

(b) Work out $(4.2 \times 10^5) \times (1.8 \times 10^{-2})$, giving your answer in standard form.

7560

7.56×10^3 ✓

(b) ..... **[1]**

2 James is taking three examination papers in Spanish.
Here are his first two results.

Paper 1: $\frac{43}{80}$ Paper 2: $\frac{38}{65}$

Paper 3 is out of 95.
The marks in each of the three papers are added together.

Find the lowest mark that James needs in Paper 3 to achieve 60% of the total marks.

Needs $(80 + 65 + 95) \times \frac{60}{100}$ = 144 total
✓ ✓

144 − 43 − 38
✓

63 ✓

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

3 Three people take $2\frac{1}{2}$ hours to deliver leaflets to 270 houses.

Assuming all people deliver leaflets at the same rate, how long will it take five people to deliver leaflets to 405 houses?
Give your answer in hours and minutes.

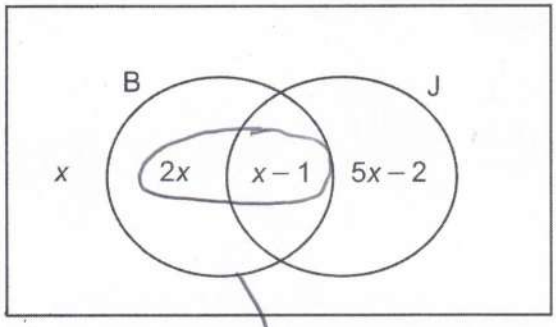
$3 \times 2.5 = 7.5\text{hrs} \Rightarrow 1\text{person} \Rightarrow 270\text{h}$

$\frac{7.5 \times 405}{270 \times 5} = 2.25\text{hrs}$

2 ..... hours 15 ..... minutes **[4]**

4 In a survey, 60 students were asked whether they have a bank account (B) and whether they have a part-time job (J).

The number of students who had neither a bank account nor a part-time job was x.
The Venn diagram shows the results in terms of x.



$9x - 3 = 60$

$9x = 63$

$x = 7$

One of the 60 students is chosen at random.

Find the probability that they have a bank account.
Show your working.

$3x - 1$

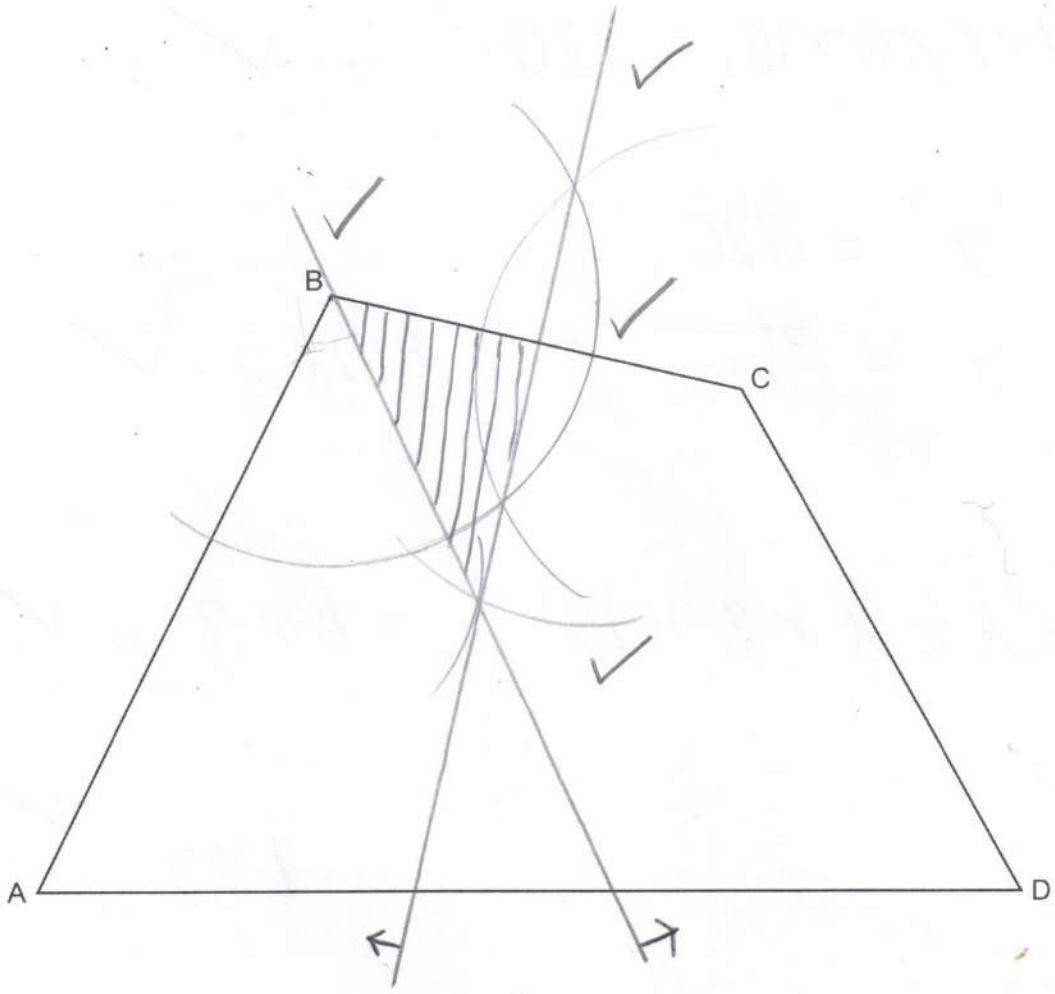
$= 3 \times 7 - 1$

$= 20$

$\frac{20}{60}$ OE

..... **[5]**

5 ABCD is a quadrilateral.



(a) Construct the bisector of angle ABC.
Show all your construction lines. **[2]**

(b) Construct the perpendicular bisector of BC.
Show all your construction lines. **[2]**

(c) Shade the region which is

- nearer to BC than to AB

and

- nearer to B than to C.

[1]

6 A cuboid measures 6 cm by 8 cm by 15 cm.
A cube has the same volume as the cuboid.

Find the surface area of the cube, giving your answer correct to 3 significant figures.

$V = 6 \times 8 \times 15 = 720$ ✓

$x^3 = 720$

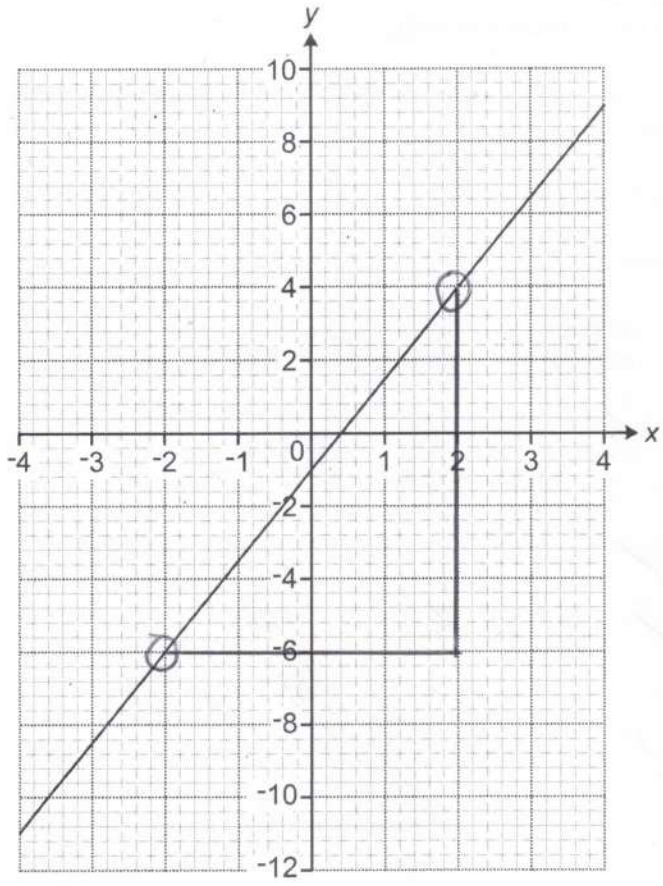
$x = \sqrt[3]{720} = 8.9628...$ ✓

$SA = 6 \times 8.9628^2 = 481.99...$ ✓

482 ✓

..... cm^2 **[4]**

7 This graph shows part of a straight line.



(a) Show that the gradient of the line is 2.5. **[1]**

$m = \frac{10}{4} = 2.5$ ✓

(b) Write down the equation of the line. $c = -1$

$y = 2.5x - 1$ ✓✓

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

8 Lily buys and sells microwaves.

She buys each one for £32 and sells it for £60.
She also pays £7 for the delivery of each microwave she sells.

If she sells a microwave that is faulty then Lily must pay for its repair and redelivery.
This costs her another £25 for each faulty microwave.

Last month, 6 out of the 80 microwaves Lily sold were faulty.

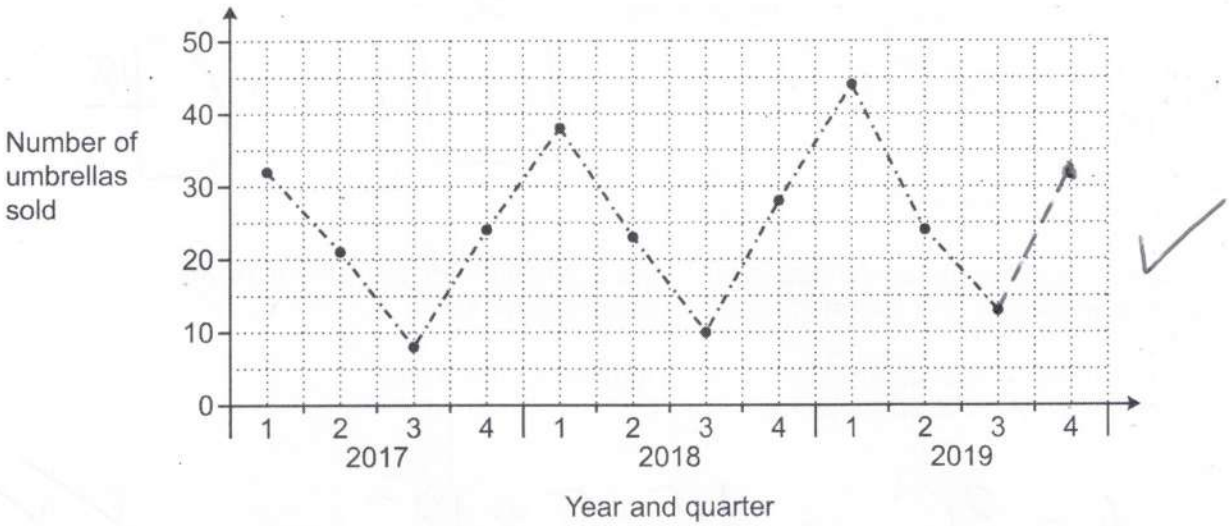
This month she has orders for 133 microwaves.

Calculate her expected percentage profit on this month's order.
Showing your working in the boxes below may help you present your work.

Expected number of faulty microwaves: $\frac{6}{80} \times 133 = 9.975$ ✓ $= 10$ ✓	Expected costs: 32, 7 $39 \times 133 + 10 \times 25$ $= £5437$ ✓
Income from sales: 60×133 $= £7980$ ✓	Expected percentage profit: $\frac{2543}{5437} \times 100$ $= 46.77$ ✓

47 ✓ ..... % **[6]**

9 The graph shows the number of umbrellas sold in Ling's shop for each quarter from quarter 1 of 2017 to quarter 3 of 2019.



(a) The shop sold 32 umbrellas in quarter 4 of 2019.

Complete the graph. **[1]**

(b) Make one comment about the **seasonal** variation shown in this graph.

Peaks in Q1, lowest in Q3 ✓OE

..... **[1]**

(c) Make one comment about the **annual** variation shown in this graph.

Small increase year to year ✓

..... **[1]**

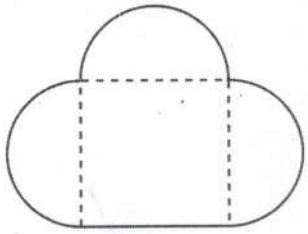
(d) Ling predicts that she will sell 50 umbrellas in quarter 1 of 2020.

What assumption has she made?

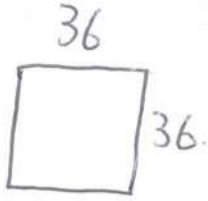
The trend in the sales will continue ✓

..... **[1]**

10 The diagram shows Jane's lawn.
It is in the shape of a square of side 36 m and three semi-circles.



Not to scale



She is going to spread fertiliser on the lawn at a rate of 30 g per square metre.
The fertiliser is only sold in 10 kg bags costing £15.80 each.

Calculate the cost of buying the bags of fertiliser for her lawn.
You must show all your working.

$A = 36^2 + 1{\cdot}5 \times \pi \times 18^2$ ✓✓

$= 2822{\cdot}8\ldots\ m^2$

$\times 30 \quad = 84684g$ ✓

$= 84{\cdot}684\ kg$

$\Rightarrow$ 9 bags needed ✓

✓

$9 \times 15{\cdot}80$

£ 142.20 ✓ **[6]**

11 **(a)** The length, d, of Jamal's car is 4.72 m, correct to 2 decimal places.

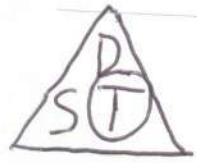
Complete the error interval for the length, d.

(a) 4·715 $\leqslant d <$ 4·725 **[2]**

(b) Jamal travels 430 km, correct to the nearest 10 km.
His average speed is 57.3 km/h, correct to 1 decimal place.

Calculate the shortest possible time for Jamal's journey.
Give your answer correct to the nearest minute.

D: $430 < 435$, 425 — S: $57{\cdot}3 < 57{\cdot}35$, $57{\cdot}25$

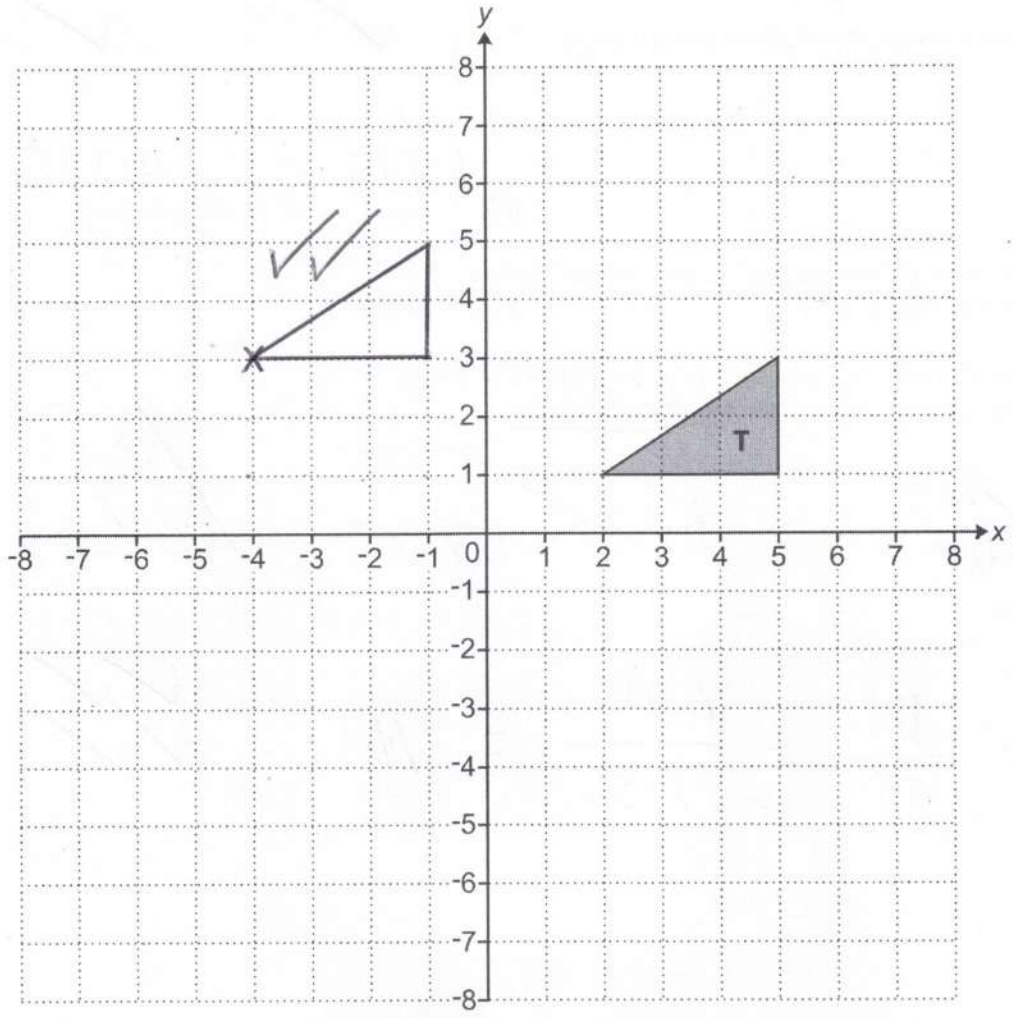


$$T\downarrow = \frac{D\downarrow}{S\uparrow} = \frac{425}{57{\cdot}35} = 7{\cdot}41\ldots$$

$0{\cdot}41\ldots \times 60 = 24{\cdot}6\ldots$ m

(b) 7 hours 25 minutes **[5]**

12 Triangle **T** is drawn on a coordinate grid.



(a) Translate triangle **T** by vector $\begin{pmatrix} -6 \\ 2 \end{pmatrix}$. **[2]**

(b) Describe fully the **single** transformation that is equivalent to:

- a reflection in the line $y = x$, followed by
- a reflection in the x-axis.

You may use the grid above to help you.

Rotation, centre (0,0), 90 clockwise

..... **[3]**

13 Ali and Beth take it in turns to play a computer game.
On each turn, the player achieves a score out of 50.
Ali and Beth play the computer game many times and record their scores.

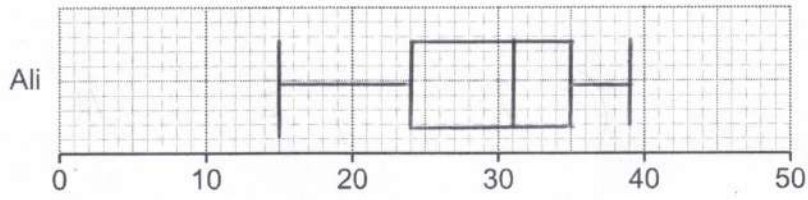
(a) Ali's scores are summarised below.

- median = 31
- highest score = 38
- range = 23
- lower quartile = 24
- interquartile range = 11

38 - 23 = 15

24 + 11 = 35

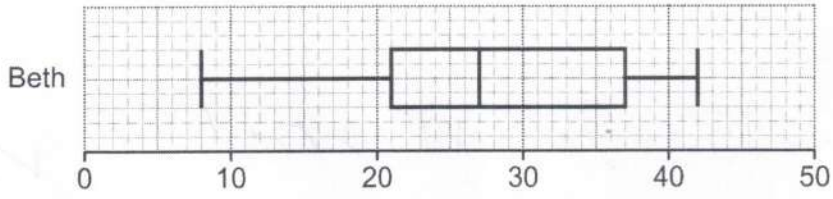
Draw a box plot to show the distribution of Ali's scores.



Q ✓
R ✓

[3]

(b) This box plot shows the distribution of Beth's scores.



Find the interquartile range of Beth's scores.

37 - 21 ✓

(b) 16 ✓ **[2]**

(c) Kareem says

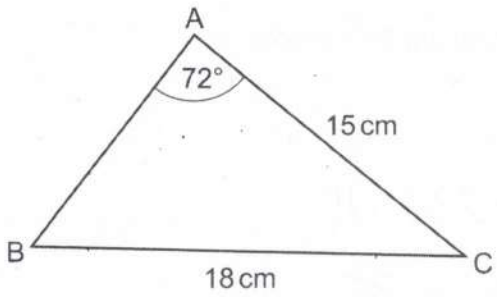
Beth was more consistent than Ali because Beth had a lower median score.

Is his statement correct? NO
Explain your reasoning.

Median is an average, IQR/range measure consistency ✓

[2]

14 The diagram shows triangle ABC.



Not to scale

AC = 15 cm, BC = 18 cm and angle BAC = 72°.

Calculate length AB, giving your answer correct to 3 significant figures.
Show your working.

$\frac{\sin B}{15} = \frac{\sin 72}{18}$ ✓✓

$B = \sin^{-1}(0.7925\ldots) = 52.4°$ ✓

$C = 180 - 72 - 52.4 = 55.6°$ ✓

$AB^2 = 18^2 + 15^2 - 2 \times 18 \times 15 \times \cos 55.6$ ✓

$AB = \sqrt{243.7\ldots}$

$= 15.611\ldots$

15.6 ✓

..... cm **[6]**

15 Here are two pieces of work.

For each one, describe the error made and give the complete correct solution.

(a)

Question:

Solve by factorisation.

$3x^2 - 2x - 5 = 0$

Solution:

$(3x + 5)(x - 1) = 0$

Therefore $x = -5/3$ or $x = 1$

Error: Signs are wrong way round ✓

Correct solution:

$(3x - 5)(x + 1) = 0$ ✓

$x = \frac{5}{3}$ $x = -1$ ✓

[3]

(b)

Question:

Solve, giving your answers correct to 3 significant figures.

$$2x^2 - 8x + 3 = 0$$

Solution:

$$x = -(-8) \pm \frac{\sqrt{(-8)^2 - 4 \times 2 \times 3}}{2 \times 2}$$

Therefore $x = 6.42$ or $x = 9.58$

Error: $-(-8)$ should be part of the numerator. ✓

Correct solution:

$$x = \frac{8 \pm \sqrt{40}}{4}$$ ✓

$x = 3.5811...$, $0.4188...$

$x = 3.58$ and 0.419 ✓

[3]

16 y is inversely proportional to the square of x.
$y = 2$ when $x = 5$.

Find a formula linking x and y.

$y = \frac{K}{x^2}$ ✓

$2 = \frac{K}{25}$

$K = 50$ ✓

$y = \frac{50}{x^2}$ ✓

..... **[3]**

17 Expand and simplify.

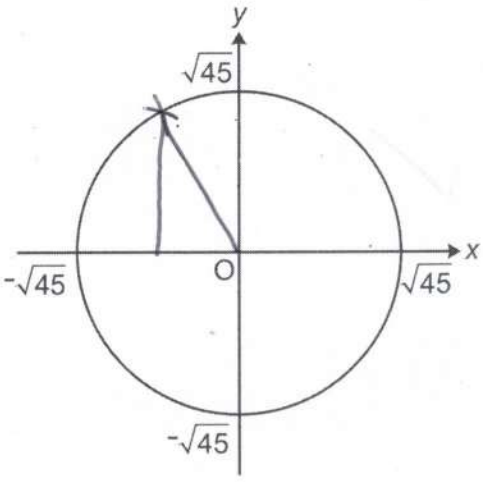
$(x+1)(x-1)(x+2)$

$x^2 - x + x - 1 = x^2 - 1$ ✓

$(x^2-1)(x+2) = x^3 + 2x^2 - x - 2$ ✓✓

..... **[3]**

18 Here is a sketch of the circle $x^2 + y^2 = 45$.



(a) Show that the tangent to this circle at the point $(-3, 6)$ has a gradient of $\frac{1}{2}$. **[2]**

$m_{radius} = \frac{-6}{3} = -2$ ✓

$m_{tangent} = \frac{-1}{-2} = \frac{1}{2}$ ✓

(b) Find the equation of the tangent at the point $(-3, 6)$.

$y = mx + c$

$m = \frac{1}{2} \quad x = -3 \quad y = 6$

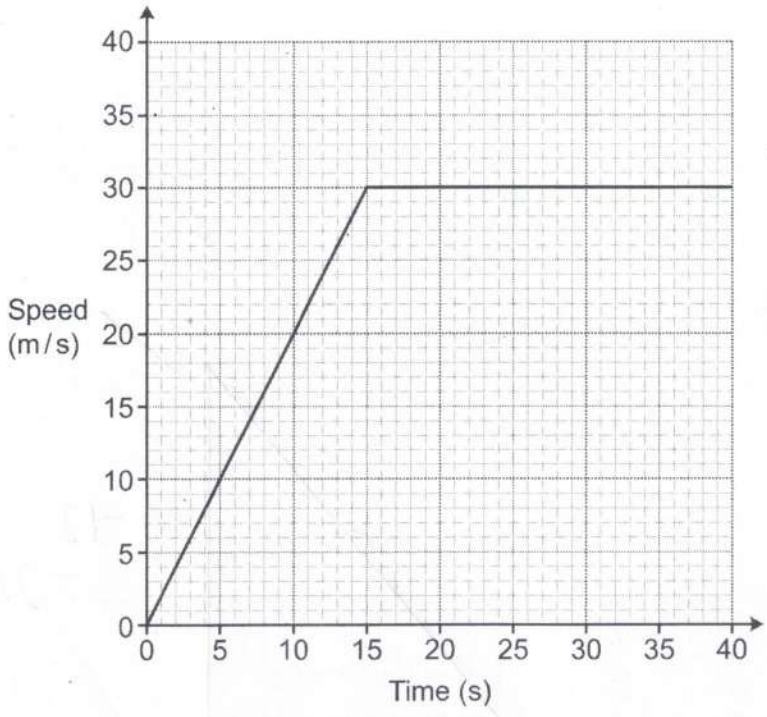
$6 = \frac{1}{2}x - 3 + c$

$c = 6 + \frac{3}{2} = 7\frac{1}{2}$ ✓

$y = \frac{1}{2}x + 7\frac{1}{2}$ ✓OE

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

19 (a) The graph shows the speed of a vehicle during the first 40 seconds of motion.



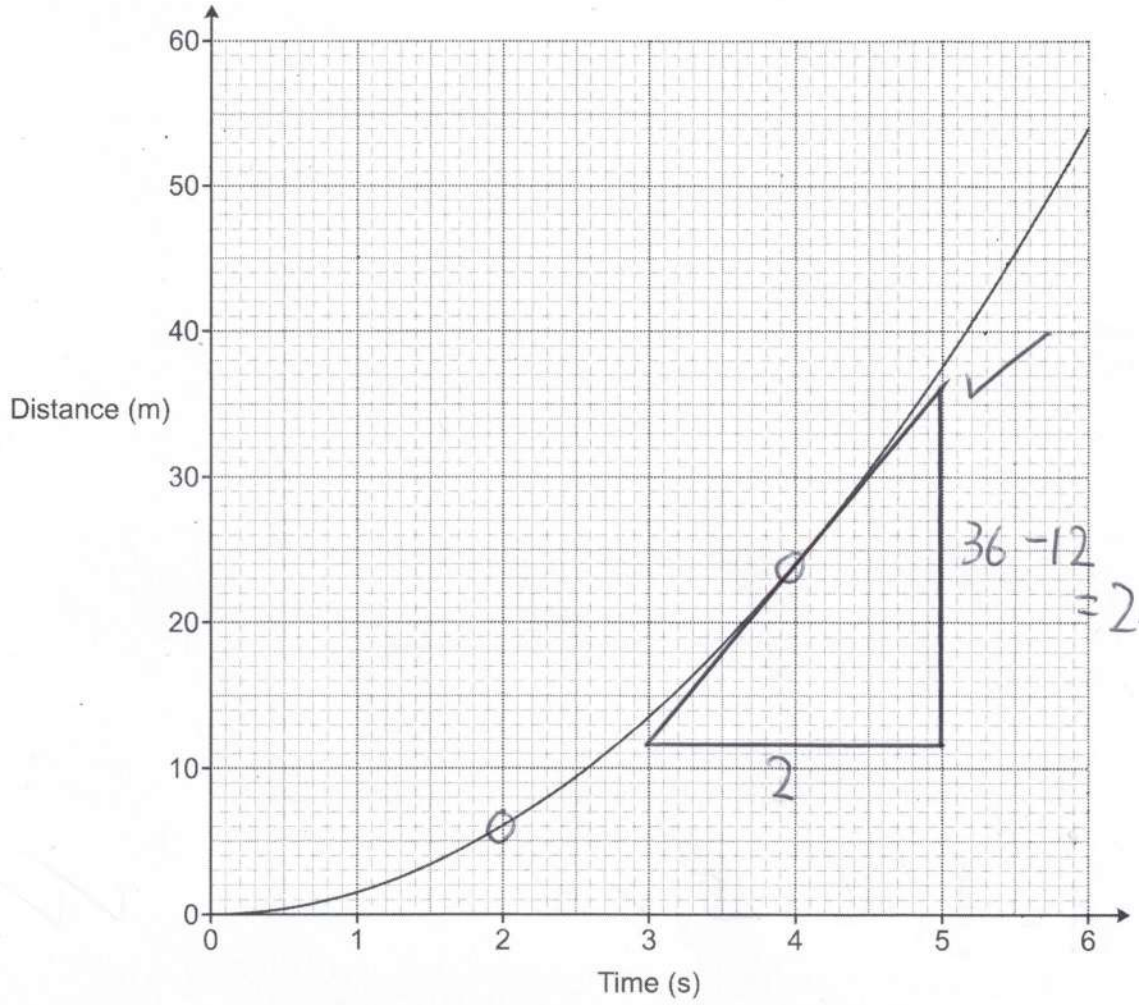
Calculate the distance travelled by the vehicle during the 40 seconds.

$A = \frac{1}{2}(40+25) \times 30$ ✓✓

975 ✓

(a) ..... m **[3]**

(b) The graph shows the distance travelled by a particle over 6 seconds.



(i) Work out the average speed of the particle between 2 and 4 seconds.

D = 24 - 6 = 18

T = 2

$S = \frac{18}{2}$

9

(b)(i) ..... m/s **[2]**

(ii) Estimate the speed of the particle at 4 seconds.

$\frac{24}{2}$

12

(ii) ..... m/s **[4]**

Turn over for Question 20

20 Solve.

$$x^2 + y^2 = 34$$
$$y = x + 2$$

Show your working.

$x^2 + (x+2)^2 = 34$ ✓

$x^2 + x^2 + 2x + 2x + 4 = 0$ ✓

$2x^2 + 4x - 30 = 0$ ✓ or better

$x^2 + 2x - 15 = 0$

$(x+5)(x-3) = 0$ ✓

$x = -5$ $\quad$ $x = 3$ ✓

$y = -5 + 2$ $\quad$ $y = 2 + 3$

$= -3$ $\quad$ $= 5$ ✓

$x =$ 3 $\quad y =$ 5

$x =$ −5 $\quad y =$ −3 **[6]**

END OF QUESTION PAPER