

1 Calculate.

$$\sqrt{5.2^2 - 4.8 \times 6.3}$$

Give your answer correct to 3 significant figures.

7.5683... ✓

..... 7.57 ✓ [2]

2 The price of petrol decreases from £1.32 per litre to £1.02 per litre.

Calculate the percentage decrease in the price.

$$\frac{(1.32 - 1.02)}{1.32} \times 100 \quad \checkmark \quad \checkmark$$

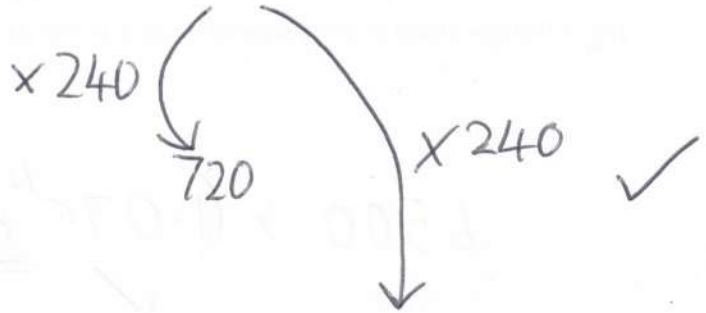
= 22.72

..... 22.7 ✓ [3]

3 E J L

- 3 (a) Eve, Jack and Ling share some money in the ratio 2 : 3 : 4.
Jack gets £720.

Work out how much Ling gets.



(a) £ [2]

- (b) Amir, Beth and Casey share some money in the ratio 3 : 5 : c.
Casey's share is $\frac{2}{3}$ of the total.

Find the value of c.

$$\frac{c}{8+c} = \frac{2}{3}$$

$$3c = 16 + 2c$$

$$c = 16$$

(b) c = [3]

4 Alex invests £4500 at a rate of 7.5% per year simple interest.

(a) Find the value of the investment at the end of 4 years.

$$4500 \times (1.075 \text{ or } 0.075)$$

$$(337.5 \times 4) + 4500 \quad \checkmark$$

5850

(a) £..... [3] ✓

(b) At the end of t years, the value of the investment is over £13500 for the first time.

Find the value of t .

$$\frac{(13500 - 4500)}{337.5} \quad \checkmark$$

$$= 26.6 \quad \checkmark$$

(b) $t =$ 27 ✓ [3]

- 5 (a) Write 0.00386 in standard form.

$$3.86 \times 10^{-3}$$

(a) [1]

- (b) The speed of sound is 3.43×10^{-1} km/s.
An object is travelling at the speed of sound.

Work out how far the object travels in one day.

$$3.43 \times 10^{-1} \times 60 \times 60 \times 24$$

$$= 29635.2$$

(b) 29635 km [2]

- (c) In a science fiction story, a spacecraft travelling faster than the speed of light is said to be travelling at 'warp n ' where n is an integer.

Warp n is defined as $n^3 \times$ the speed of light.

Sooooo... much waffle!

In the story, a spacecraft needs to travel from Earth to Neptune in less than 2 minutes. = T

- S • The speed of light is 3.00×10^5 km/s.
D • The distance from Earth to Neptune is 4.41×10^9 km.

$$= 120s$$

Find the smallest possible warp n at which the spacecraft can travel.
You must show your working.



$$n^3 \times 3 \times 10^5 = \frac{4.41 \times 10^9}{120}$$

so $n = \sqrt[3]{\frac{4.41 \times 10^9}{120 \times 3 \times 10^5}} = 4.96...$

(c) $n = 5$ [3]

- 6 A six-sided numbered spinner is thrown 50 times. The score for each throw is recorded. Some of the results are shown in the table.

An 8 was thrown f times.

An unknown number on the spinner is represented by n .

Score	Frequency
1	X 12
3	X 2
5	X 9
6	X 16
8	X f
n	X 4
Total	50

$$= 12$$

$$= 6$$

$$= 45$$

$$= 96$$

$$= 8f = 56$$

$$= 4n$$

$$f = 50 - 43$$

$$= 7$$

The mean score of the 50 throws is 5.5.

Find the value of f and the value of n .

$$\frac{4n + 215}{50} = 5.5 \quad \checkmark$$

$$n = \frac{50 \times 5.5 - 215}{4} \quad \checkmark$$

7

$f = \dots$

$n = \dots$

[4]

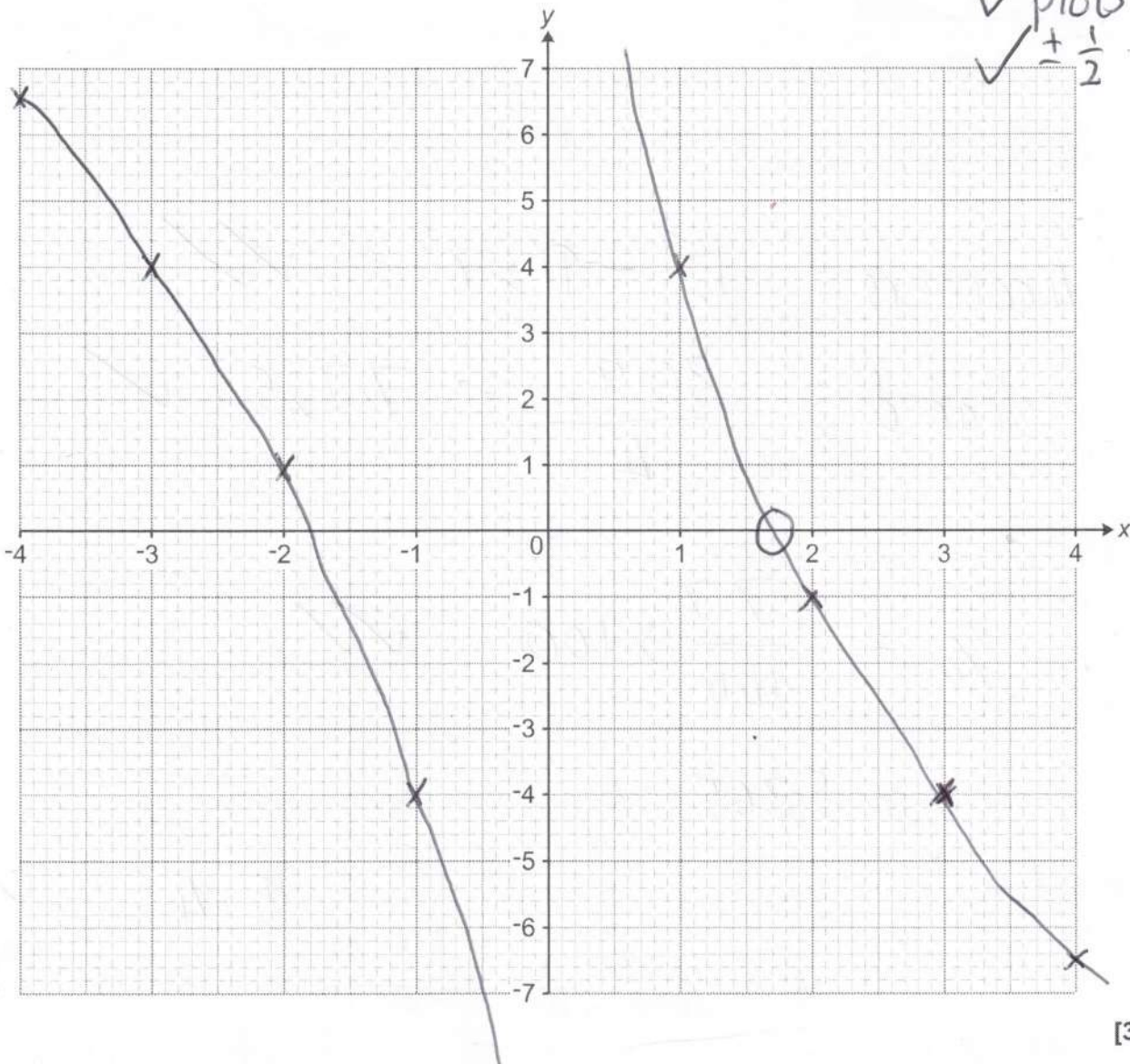
$x=0, y = \text{Undefined}$

7 Here is a table of values for $y = \frac{6}{x} - 2x$.

x	-4	-3	-2	-1	1	2	3	4
y	6.5	4	1	-4	4	-1	-4	-6.5

✓ plots 7/8
 ✓ plots 5/6
 ✓ ± 1/2

(a) Draw the graph of $y = \frac{6}{x} - 2x$ for $-4 \leq x \leq 4, x \neq 0$.



[3]

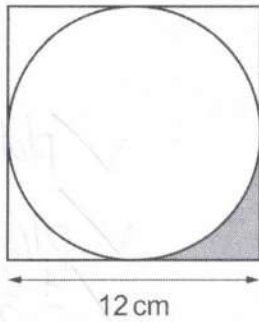
(b) Use your graph to find the positive solution of $\frac{6}{x} - 2x = 0$.

Give your answer to 1 decimal place.

1.7 ✓

(b) $x = \dots\dots\dots$ [1]

- 8 The diagram shows a circle inside a square of side 12 cm.



$$r = 6$$

Work out the percentage of the square that is shaded.
You must show your working.

$$4 \text{ corners} = 12^2 - \pi \times 6^2 \quad \checkmark \checkmark$$

$$\text{shaded} = \frac{30.9...}{4} = 7.725... \quad \checkmark$$

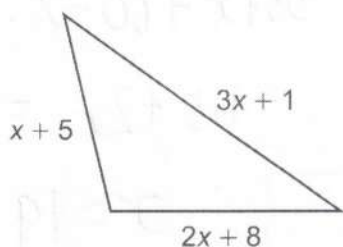
$$\% = \frac{7.7}{144} \times 100 \quad \checkmark \checkmark$$

$$= 5.365...$$

5.4

.....% [6] ✓

- 9 The sides of this triangle are given in centimetres.
The perimeter of the triangle is 80 cm.



Not to scale

- (a) Find the length of each side of the triangle.
You must show your working.

$$6x + 14 = 80$$

$$6x = 66$$

$$x = 11$$

$$11 + 5 = 16$$

$$2 \times 11 + 8$$

$$3 \times 11 + 1$$

(a) 16 cm, 30 cm and 34 cm [5]

- (b) Is the triangle above a right-angled triangle?
Use calculations to show how you decide.

$$\sqrt{16^2 + 30^2} = \sqrt{1156}$$

$$= 34$$

✓

✓

✓

Yes

..... because

.....

..... [3]

10 100 people were asked whether they had visited France (F) or Spain (S).

- 55 had visited France
- 60 had visited Spain
- 4 had not visited either country.

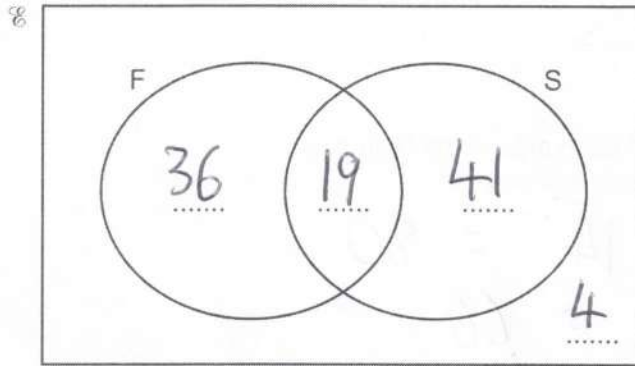
$$55 + x + 60 = 96$$

$$115 + x = 96$$

$$x = 19$$

✓
✓
✓

(a) Complete the Venn diagram. 55 x 60



[3]

(b) One of these 100 people is chosen at random.

(i) Write down the probability that this person had visited exactly **one** of the countries.

$$36 + 41$$

$$\frac{77}{100}$$

✓
✓

(b)(i) [2]

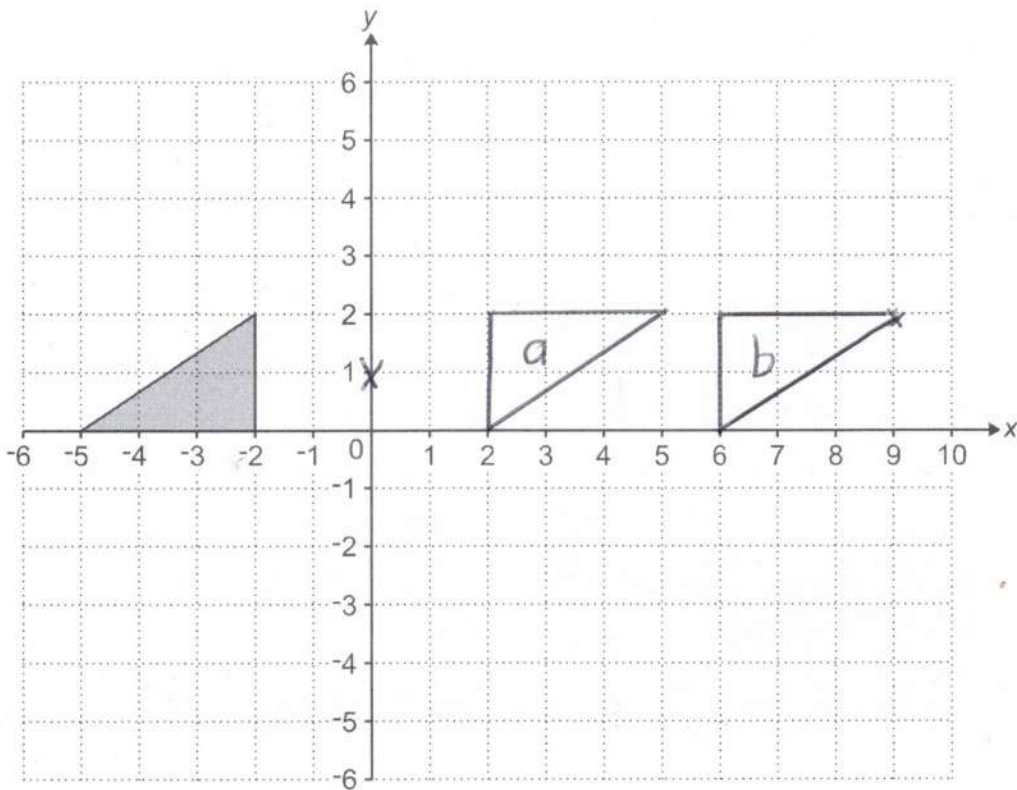
(ii) Write down the probability that this person had visited France given that they had also visited Spain.

$$\frac{19}{60}$$

✓
✓

(ii) [2]

11 You may use this coordinate grid to help you answer the following question.



Describe fully the **single** transformation that is equivalent to:

- a). a rotation of 180° with centre $(0, 1)$, followed by
 b). a translation of $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$.

Rotation, 180° , centre $(2, 1)$

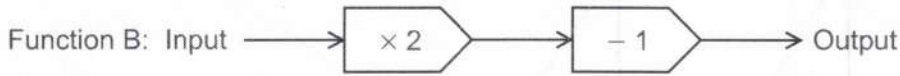
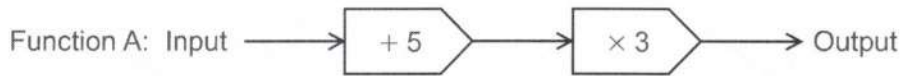
✓

✓

✓

[3]

12 Here are two functions.



(a) Write an algebraic expression for the output of function A when the input is x .

(a) $3(x+5)$ ✓ [1]

(b) Here is a composite function C.



The input to function C is x .

The output from function C is $2x + 1$.

Find the value of x .

You must show your working.

$$\begin{aligned} \checkmark\checkmark \quad 2(3x+15) - 1 &= 2x + 1 \quad \checkmark \\ 6x + 30 &= 2x + 1 \quad \checkmark \\ 4x &= -29 \end{aligned}$$

$$x = \frac{-29}{4}$$

(b) $x = -7$ ✓ [5]

13 Here are two pieces of work.

Each shows a question and the **first line** of an incorrect solution.

For each part, describe the error made in the first line of the solution.
You do **not** need to complete the solution.

(a)

Question:
Simplify. $\frac{2}{x-1} + \frac{3}{x+4}$

Solution:
 $\frac{2}{x-1} + \frac{3}{x+4} = \frac{2(x-1) + 3(x+4)}{(x-1)(x+4)}$

numerator should be $2(x+4) + 3(x-1)$ ✓

[1]

(b)

Question:
Solve. $x^2 + 7x + 5 = 0$

Solution:
 $x = -\frac{7 \pm \sqrt{7^2 - 4 \times 1 \times 5}}{2 \times 1}$

"discounted"

all candidates awarded 1 mark

[1]

- 14 A college offers 41 different subjects including 9 different languages. Students are asked to choose one subject from Option A, one subject from Option B and one subject from Option C.

Each of the 41 different subjects appears only once, either in Option A, or in Option B or in Option C.

Option A : 14 subjects including 2 languages

Option B : 12 subjects including 3 languages

Option C : 15 subjects including 4 languages

Work out the proportion of all the possible subject combinations that include **at least one** language.

You must show your working.

$$\text{All} = 14 \times 12 \times 15 = 2520 \quad \checkmark$$

$$\text{No languages} = 12 \times 9 \times 11 = 1118 \quad \checkmark \checkmark$$

$$\begin{aligned} \text{for more language} &= 2520 - 1118 \quad \checkmark \\ &= 1332 \end{aligned}$$

$$\frac{1332}{2520} \quad \checkmark$$

$$\dots\dots\dots \text{etc} \quad [5]$$

- 15 y is inversely proportional to the square root of x .
 $y = 7$ when $x = 144$.

Find the value of y when $x = 16$.

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

$$7 = \frac{K}{12} \quad \checkmark$$

$$K = 84$$

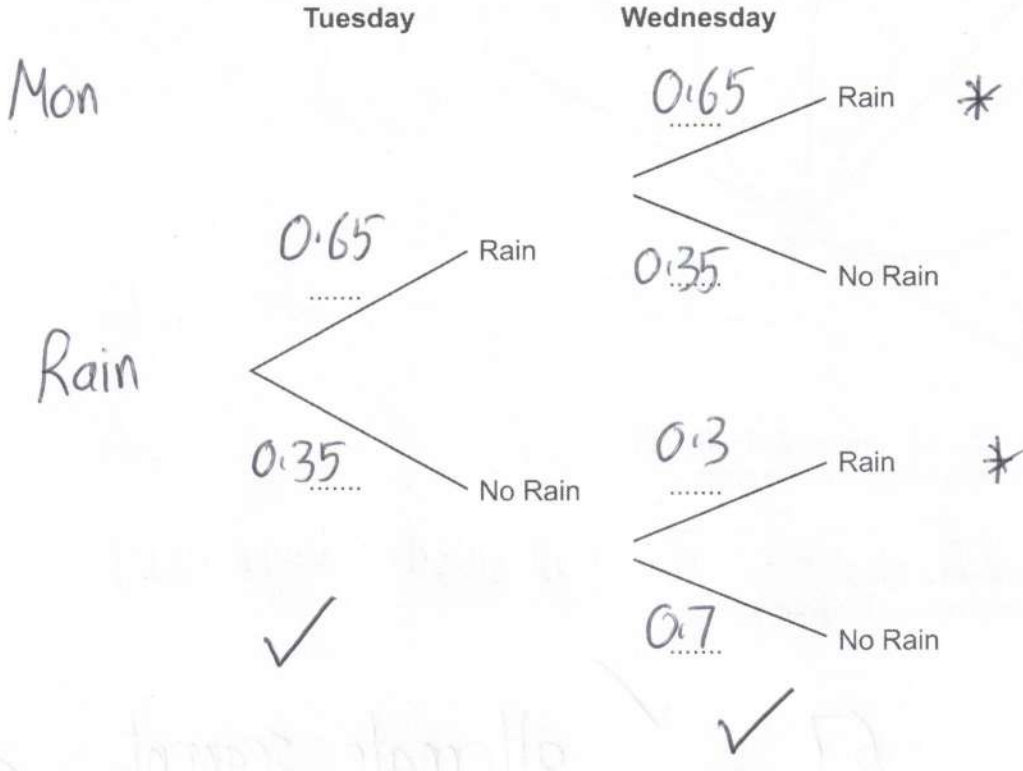
$$y = \frac{84}{\sqrt{16}} \quad \checkmark$$

$$= \frac{84}{4}$$

$$y = \dots\dots\dots 21 \quad \checkmark \quad [3]$$

- 16 If it rains on a given day the probability that it will rain the next day is 0.65.
 If it does **not** rain on a given day the probability that it will rain the next day is 0.3.
 It rained on Monday.

(a) Complete the tree diagram.



[2]

(b) Find the probability that it rains on Wednesday.

$$= RR + NR$$

$$= 0.65^2 + 0.35 \times 0.3$$

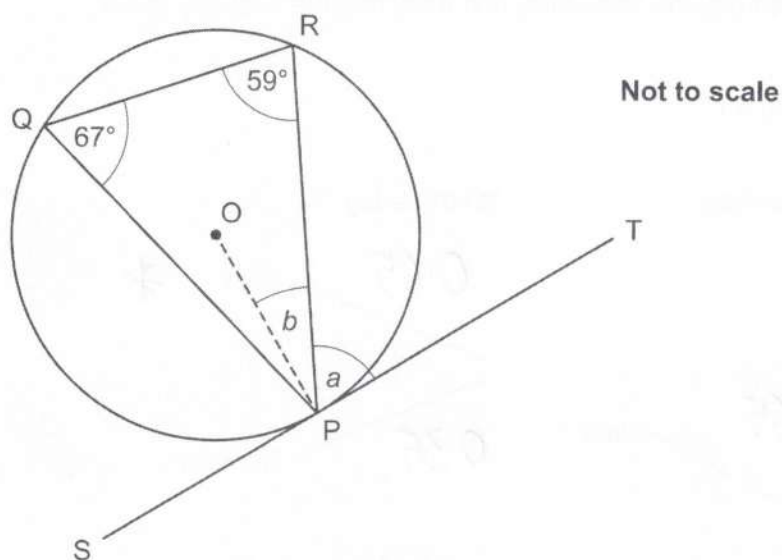
$$= \frac{211}{400}$$

or 0.5275

(b) [3]

etc

- 17 (a) P, Q and R are points on the circumference of a circle, centre O.



Angle $PRQ = 59^\circ$ and angle $PQR = 67^\circ$.
Line SPT is a tangent to the circle.

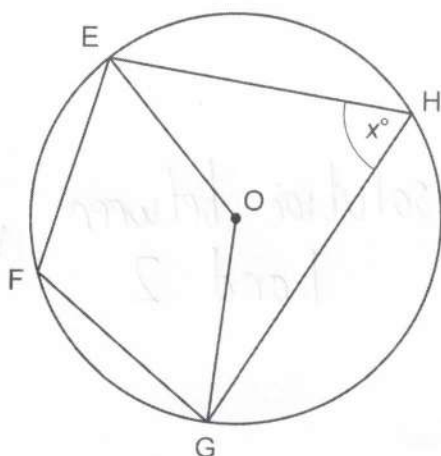
- (i) Work out angle a .
Give a reason for your answer.

Angle $a = 67^\circ$ because alternate segment theorem [2]

- (ii) Work out angle b .
Give a reason for your answer.

Angle $b = 23^\circ$ because radius and tangent are perpendicular [2]

- (b) E, F, G and H are points on the circumference of a circle, centre O.
Acute angle $\text{EHG} = x^\circ$.



Not to scale

- (i) Complete the following, giving the values of the angles in terms of x .

Obtuse angle $\text{EOG} = 2x$ ° because angle at the
centre is twice angle at
circumference ✓

Therefore, reflex angle $\text{EOG} = 360 - 2x$. ✓

Therefore, angle $\text{EFG} = 180 - x$. ✓

[3]

- (ii) Write down what your working in part (b)(i) has proved.

Opposite angles in a cyclic quadrilateral
sum to 180° [1]

- 18 (a) Show that the equation $x^3 + x^2 - 5 = 0$ has a solution between $x = 1$ and $x = 2$. [3]

$$f(1) = -3 \quad \checkmark$$

$$f(2) = 7 \quad \checkmark$$

change of sign hence solution between 1 and 2 \checkmark

- (b) Find this solution correct to 1 decimal place.
You must show calculations to support your answer.

$$f(1.5) = 0.625 \quad \text{too big} \quad \checkmark$$

$$f(1.3) = -1.113 \quad \text{too small} \quad \checkmark$$

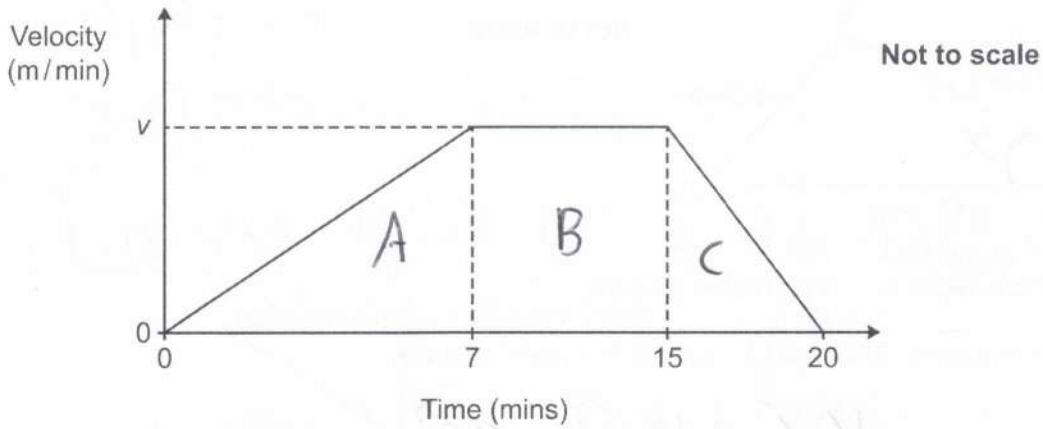
$$f(1.4) = -0.296 \quad \text{too small} \quad \checkmark$$

$$f(1.45) = 0.151125 \quad \text{too big} \quad \checkmark$$

hence $1.4 < x < 1.45$

(b) $x = 1.4$ (1dp) \checkmark [4]

- 19 The graph shows the velocity of a particle over the first 20 minutes of its motion.



Between 7 minutes and 15 minutes the velocity of the particle is v metres per minute.
The average velocity of the particle over the 20 minutes is 11.55 metres per minute.

Find the value of v .
You must show your working.

$$\text{Area} = \left(\frac{1}{2} \times 7 \times v\right) + (8 \times v) + \left(\frac{1}{2} \times 5 \times v\right) \checkmark \checkmark$$

A B C

$$= 14v = \text{distance} \checkmark$$



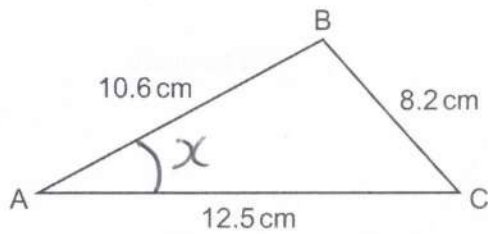
$$14v = 11.55 \times 20 \checkmark$$

$$v = \frac{231}{14}$$

$$v = 16.5 \checkmark \quad [5]$$

TURN OVER FOR QUESTION 20

20 The diagram shows triangle ABC.



Not to scale

AB = 10.6 cm, BC = 8.2 cm and AC = 12.5 cm.

(a) Show that angle BAC = 40.5° , correct to 1 decimal place.

[3]

$$\cos x = \frac{10.6^2 + 12.5^2 - 8.2^2}{2 \times 10.6 \times 12.5} = 0.7598... \checkmark \checkmark$$

$$x = \cos^{-1}(0.7598...) = 40.54... \checkmark$$

(b) Work out the area of triangle ABC.

$$\frac{1}{2} \times 10.6 \times 12.5 \times \sin 40.5 = 43.0259... \checkmark$$

$$(b) \quad 43.0 \quad \checkmark \quad \text{cm}^2 \quad [2]$$

END OF QUESTION PAPER

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