OCR
Oxford Cambridge and RSA

H

Thursday 6 June 2019 – Morning

GCSE (9–1) Mathematics

J560/05 Paper 5 (Higher Tier)

Time allowed: 1 hour 30 minutes

You may use:
- geometrical instruments
- tracing paper

Do not use:
- a calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Answer **all** the questions.
- Read each question carefully before you start to write your answer.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided.
- If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

INFORMATION
- The total mark for this paper is **100**.
- The marks for each question are shown in brackets **[ ]**.
- This document consists of **20** pages.

No calculator can be used for this paper

Answer **all** the questions.

1 Work out $(2 \times 10^3) \times (4 \times 10^4)$, giving your answer in standard form.

$2 \times 4 = 8$

$10^3 \times 10^4 = 10^7$

.....8×10^7..... **[2]**

2 **(a)** Simplify fully.

$$\frac{3a^8 \times 2a^5}{a^2}$$

$3a^8 \times 2a^5 = 6a^{13}$

$\frac{6a^{13}}{1a^2} = 6a^{11}$

(a) .....$6a^{11}$..... **[3]**

(b) Solve.

$$\frac{6x - 10}{5} = 1$$

$\times 5 \quad \times 5$

$6x - 10 = 5$

$+10 \quad +10$

$6x = 15$

$\div 6 \quad \div 6$

$x = \frac{15}{6}$

$= \frac{5}{2}$

(b) $x =$ .....$\frac{5}{2}$..... **[3]**

3 Ed has a card shop.

(a) He buys a particular card for £1.20 and sells it for £1.68.

Calculate his percentage profit on this card.

120p → 168p

Profit = 168 − 120
= 48p

$\frac{48}{120} \begin{matrix}\div 12 \\ \div 12\end{matrix} = \frac{4}{10} = 0.4$

$0.4 \times 100 = 40$

(a) ..... 40 ..... % **[3]**

(b) Ed's profit on "Good Luck" cards in 2018 was £360.
This was a decrease of 20% on his profit in 2017.

Work out Ed's profit on "Good Luck" cards in 2017.

100% − 20% = 80%

80% = £360
÷4 ÷4
20% = £90
×5 ×5
100% = £450

(b) £ ..... 450 ..... **[3]**

4 **(a)** A sunflower grows at a rate of 4 cm each day.

How many days does it take to grow from a height of 80 cm to more than 1.06 m?

1m = 100cm (×100)

$1.06 \times 100 = 106\text{cm}$

$106 - 80 = 26$

$4 \overline{)26.^{2}0}$ = 6.5

6.5 days → 7

(a) ..... 7 ..... **[3]**

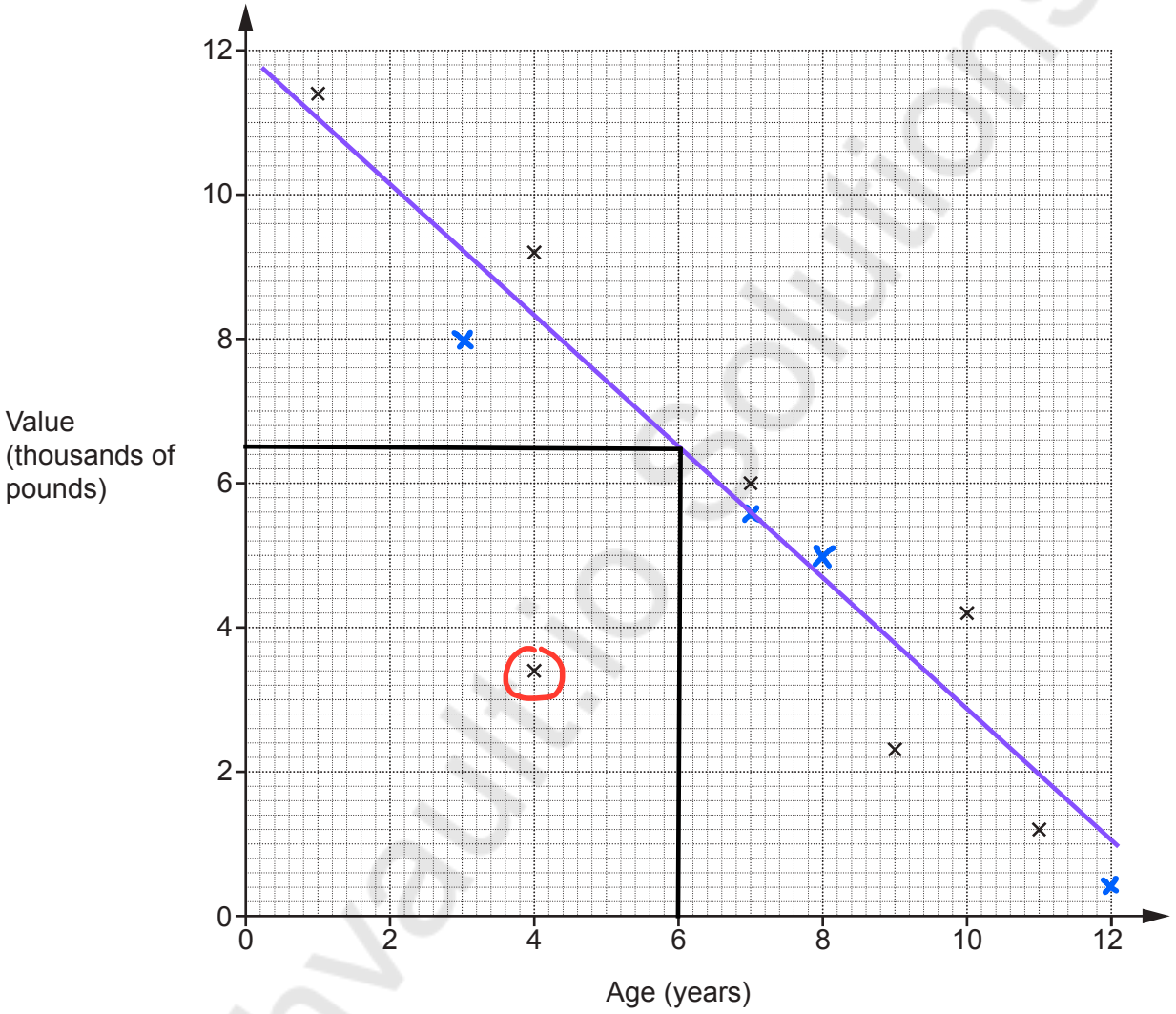
(b) If the sunflower grows at a faster rate, how would this affect your answer to part **(a)**?

..... Fewer days. ..... **[1]**

5 The table shows the ages and values of 11 cars of the same model.

Age (years)	4	7	11	1	9	10	4	3	7	8	12
Value (thousands of pounds)	9.2	6.0	1.2	11.4	2.3	4.2	3.4	8.0	5.6	5.0	0.4

The points for the first 7 cars are plotted on the scatter diagram.



(a) Plot the points for the remaining 4 cars. **[2]**

(b) Describe the type and strength of the correlation shown in the completed scatter diagram.

Strong negative correlation ..... **[2]**

(c) One car lost its value more quickly than the other cars.

On the scatter diagram, draw a circle around the point representing this car. **[1]**

(d) By drawing a line of best fit, estimate the value of a car that is 6 years old.

(d) £ 6500 **[2]**

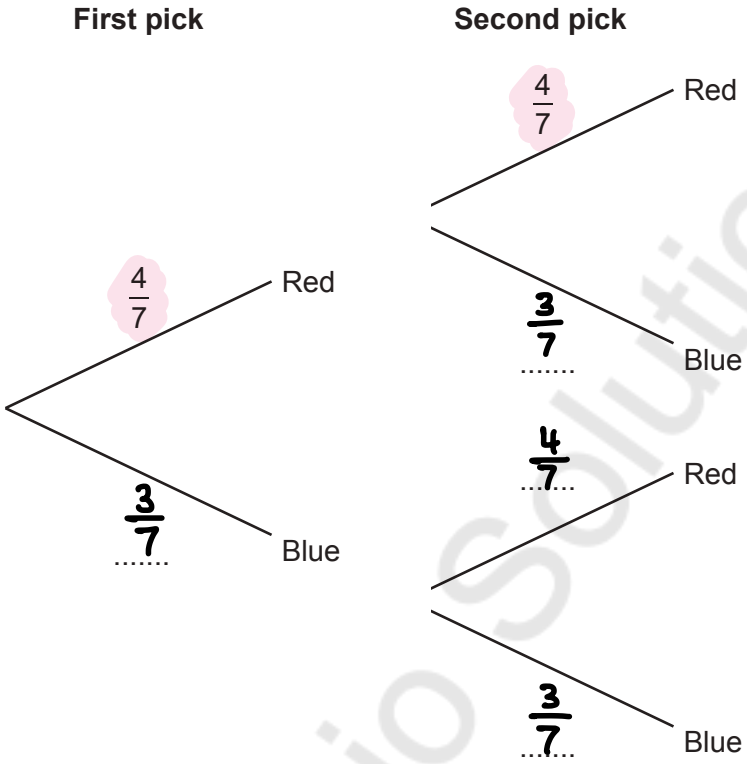
(e) Explain the limitations of using the equation of the line of best fit to estimate the value of a car that is 16 years old.

Only have data on cars up to 12 years old.

[1]

6 A bag contains 4 red counters and 3 blue counters only.
Jack picks a counter at random and then replaces it.
Jack then picks a second counter at random.

(a) Complete the tree diagram.



[2]

(b) Work out the probability that Jack picks two red counters.

$P(RR) = \frac{4}{7} \times \frac{4}{7}$

$= \frac{16}{49}$

(b) $\frac{16}{49}$ **[2]**

7 Adam buys some theatre tickets in a sale.

The normal prices are:

£80 for each adult
£40 for each child.

In the sale, the prices are reduced by 15%.
Adam buys 2 adult tickets and 1 child ticket at the sale price.
A 2% booking fee is then added to the total cost of the tickets.

Calculate the total amount that Adam must pay.

Adult

100% = £80
10% = £8
5% = £4

15% = £12

Sale price = £80 − £12
= £68

Child

100% = £40
10% = £4
5% = £2

15% = £6

Sale price = £40 − £6
= £34

2 Adult tickets
= 2 × 68
= £136

Total cost = £136 + £34
= £170

Booking Fee

100% = £170 ÷100
1% = £1.70
1% = £1.70
2% = £3.40

£170 + £3.40 = £173.40

£ 173.40 **[6]**

8 Mrs Mills buys 4 packs of treats for her cats, Fluff and Tigger.

She gives Fluff $\frac{1}{6}$ of a pack each day.

She gives Tigger $\frac{1}{5}$ of a pack each day.

For how many complete days will the 4 packs of treats last?

$$\frac{1^{\times 5}}{6_{\times 5}} + \frac{1^{\times 6}}{5_{\times 6}}$$

$$= \frac{5}{30} + \frac{6}{30}$$

$$= \frac{11}{30}$$

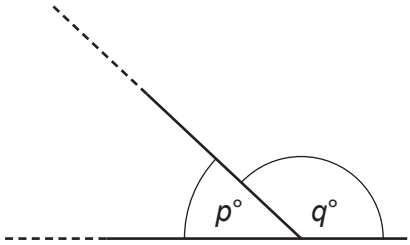
$$4 \div \frac{11}{30}$$

$$\frac{4}{1} \times \frac{30}{11} = \frac{120}{11}$$

$$11 \overline{)\,120.00\,} = 10.9$$

....10................. **[5]**

9 An interior angle of an isosceles triangle is $p°$ and an exterior angle is $q°$.



Not to scale

It is given that $q = 5p$.

(a) Write the ratio $p : q$ in its simplest form.

p : q

1 : 5

(a) ..... 1 ..... : ..... 5 ..... **[2]**

(b) Work out the two different possible sets of angles for the isosceles triangle.

Total parts = 6

180 ÷ 6 = 30°

p = 1 x 30
= 30° (if base angle)

30°, 30°, 120°

p = 30° (if not base angle)

30°, 75°, 75°

180 - 30 = 150
150 ÷ 2 = 75°

(b) Triangle 1: ..... 30 .....°, ... 30 .....°, ... 120 .....°

Triangle 2: ..... 30 .....°, ... 75 .....°, ... 75 .....°

[4]

10 **(a)** Write $\frac{1}{6}$ as a recurring decimal.

$1 \div 6$

$$6 \overline{)1.^{1}0^{4}0^{4}0} \quad 0.166$$

(a) $0.1\dot{6}$ **[2]**

(b) Elsa divides a two-digit number by another two-digit number.
She gets the answer $0.1\dot{5}$.

She says that there is only one possible pair of numbers that will give this answer.
Is she correct? Show how you decide.

$x = 0.1\dot{5}$

$10x = 1.\dot{5}$

$100x = 15.\dot{5}$

$100x - 10x = 90x$

$15.\dot{5} - 1.\dot{5} = 14$

$90x = 14$

$x = \frac{14}{90} = \frac{7}{45}$

She is correct. $14 \div 90 = 0.1\dot{5}$ **[4]**

11 **(a)** Simplify fully.

$\sqrt{200}$

$= \sqrt{2} \times \sqrt{100}$

$= \sqrt{2} \times 10$

(a) $10\sqrt{2}$ **[2]**

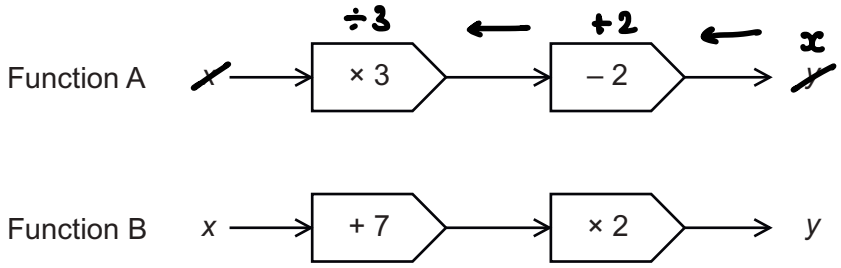
(b) Evaluate.

$8^{\frac{1}{3}}$

$\sqrt[3]{8}$

(b) 2 **[1]**

12 Here are two functions.



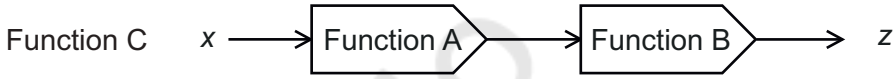
(a) Find an algebraic expression for the output of the **inverse** of function A when the input is x.

$\frac{x+2}{3}$

$\frac{x+2}{3}$

(a) ..... **[2]**

(b) Here is a composite function C.



Find the value x when $z = 4x$.

A: $x \times 3 = 3x$

$3x - 2$

B: $(3x-2) + 7 = 3x + 5$

$2(3x+5) = 6x + 10$

$6x + 10 = 4x$

$-4x \quad -4x$

$2x + 10 = 0$

$-10 \quad -10$

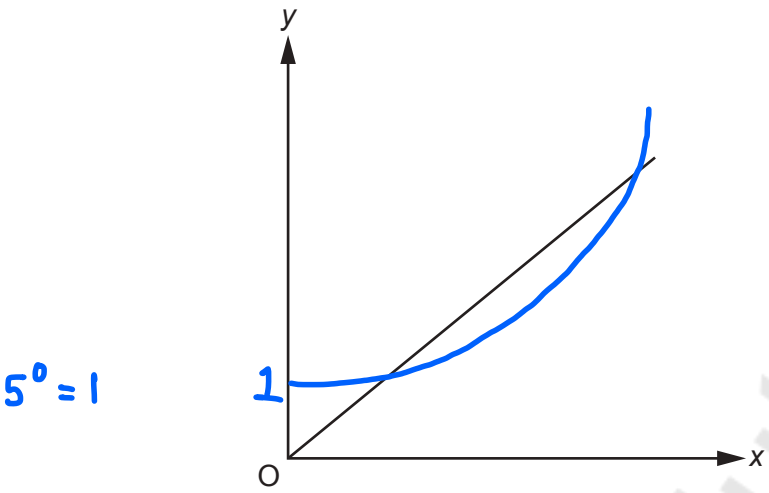
$2x = -10$

$\div 2 \quad \div 2$

$x = -5$

(b) $x =$ -5 ..... **[5]**

13 Shirley is asked to sketch a graph of $y = 5^x$ for $x \geqslant 0$.
She produces the following.



$5^0 = 1$

The graph has two errors.

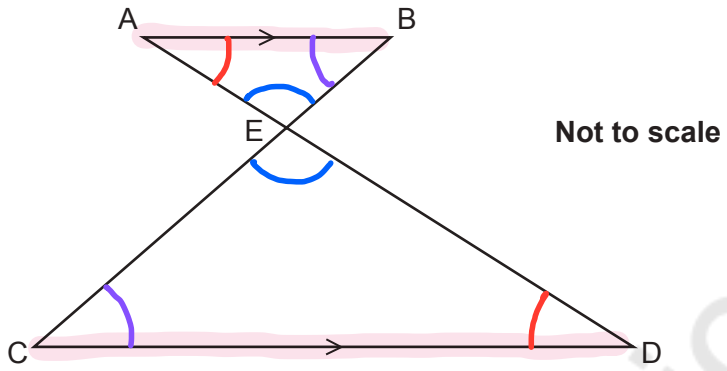
How should they be corrected?

1 It should be curved with an increasing gradient

2 It should go through (0, 1)

[2]

14 In the diagram AB is parallel to CD.
AED and BEC are straight lines.



Not to scale

Prove that triangle ABE is similar to triangle CDE.

Angle AEB = Angle CED - vertically opposite

Angle DAB = Angle ADC - alternate

Angle ABC = Angle DCB - alternate

Angles are equal, therefore similar

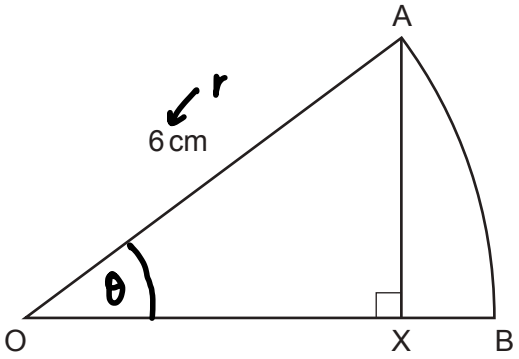
.....

.....

.....

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

15 OAB is a sector of a circle, centre O.
OA = 6 cm and AX is perpendicular to OB.



Not to scale

The area of sector OAB is $6\pi\,\text{cm}^2$.

Show that $AX = 3\sqrt{3}\,\text{cm}$. **[6]**

Area of sector $= \frac{\theta}{360} \times \pi r^2$

$6\pi = \frac{\theta}{360} \times \pi \times 6^2$

$\div \pi$ $\div \pi$

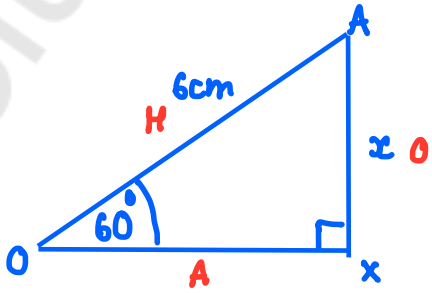
$6 = \frac{\theta}{360} \times 36$

$6 = \frac{36\theta}{360}$

$6 = \frac{\theta}{10}$ $\times 10$

$\times 10$

$60 = \theta$



SOH CAH TOA

$\sin\theta = \frac{O}{H}$

$\sin 60 = \frac{AX}{6}$

$\frac{\sqrt{3}}{2} = \frac{AX}{6}$ $\times 6$

$\times 6$

$\frac{6\sqrt{3}}{2} = AX$

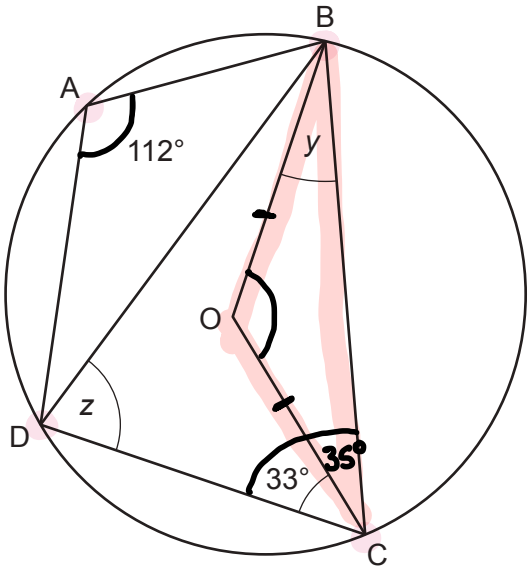
$3\sqrt{3} = AX$

	0°	30°	45°	60°	90°
sin	0	1	2	3	4
cos	4	3	2	1	0

2

16 A, B, C and D are points on the circumference of a circle, centre O.

Angle BAD = 112° and angle DCO = 33°.



Not to scale

(a) Show that angle $y = 35°$.
Give reasons for each stage of your working. **[4]**

Angle DCB = 180 − 112
= 68° Opposite angles of a cyclic quadrilateral sum to 180

68° − 33° = 35° angle OCB

y = 35° base angles of an isosceles are equal

(b) Work out angle z.
Give reasons for your answer.

Angle BOC = 180 − 35 − 35
= 180 − 70
= 110°

z = 110° ÷ 2
= 55°

Angle z = ..55.. ° because ..angle at the circumperance is half the angle at the centre..

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

17 **(a)** Write $x^2 + 8x + 3$ in the form $(x+a)^2 - b$.

$(x+4)^2 - 4^2 + 3$

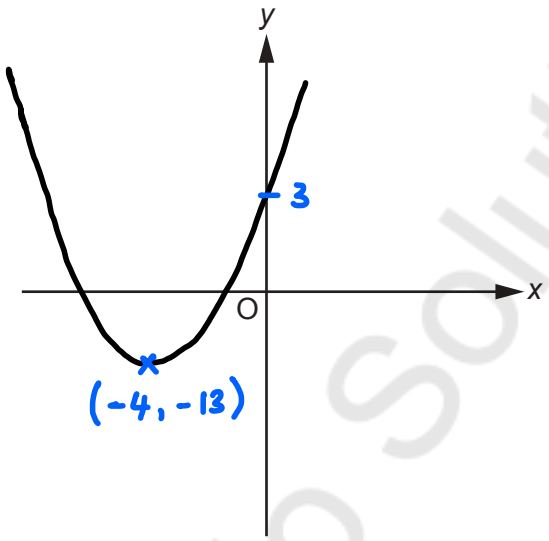
$(x+4)^2 - 16 + 3$

(a) $(x+4)^2 - 13$ **[3]**

(b) Sketch the graph of $y = x^2 + 8x + 3$.
Show clearly the coordinates of any turning points and the y-intercept.

Turning point
$(-4, -13)$

y-intercept
$0^2 + 8(0) + 3 = 3$
$(0, 3)$



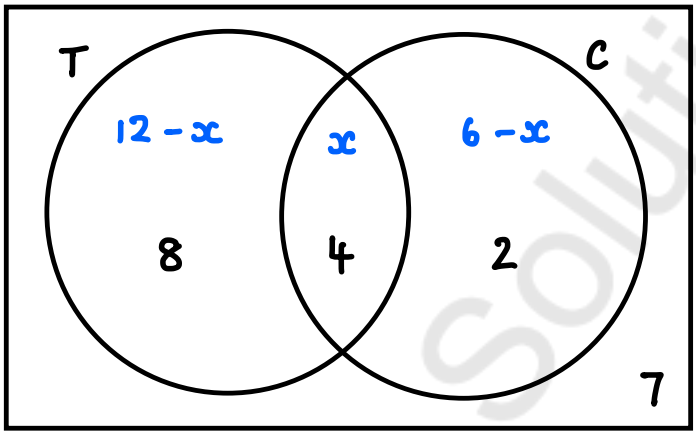
[4]

18 21 people travelled to a meeting.

- 12 used a train.
- 6 used a car.
- 7 did not use a train or a car. ✓
- Some used a train and a car.

Two people are chosen at random from those who used a train.

Find the probability that both these people also used a car.



$12 - x + x + 6 - x = 14$

$18 - x = 14$

$-18 \quad -18$

$-x = -4$

$x = 4$

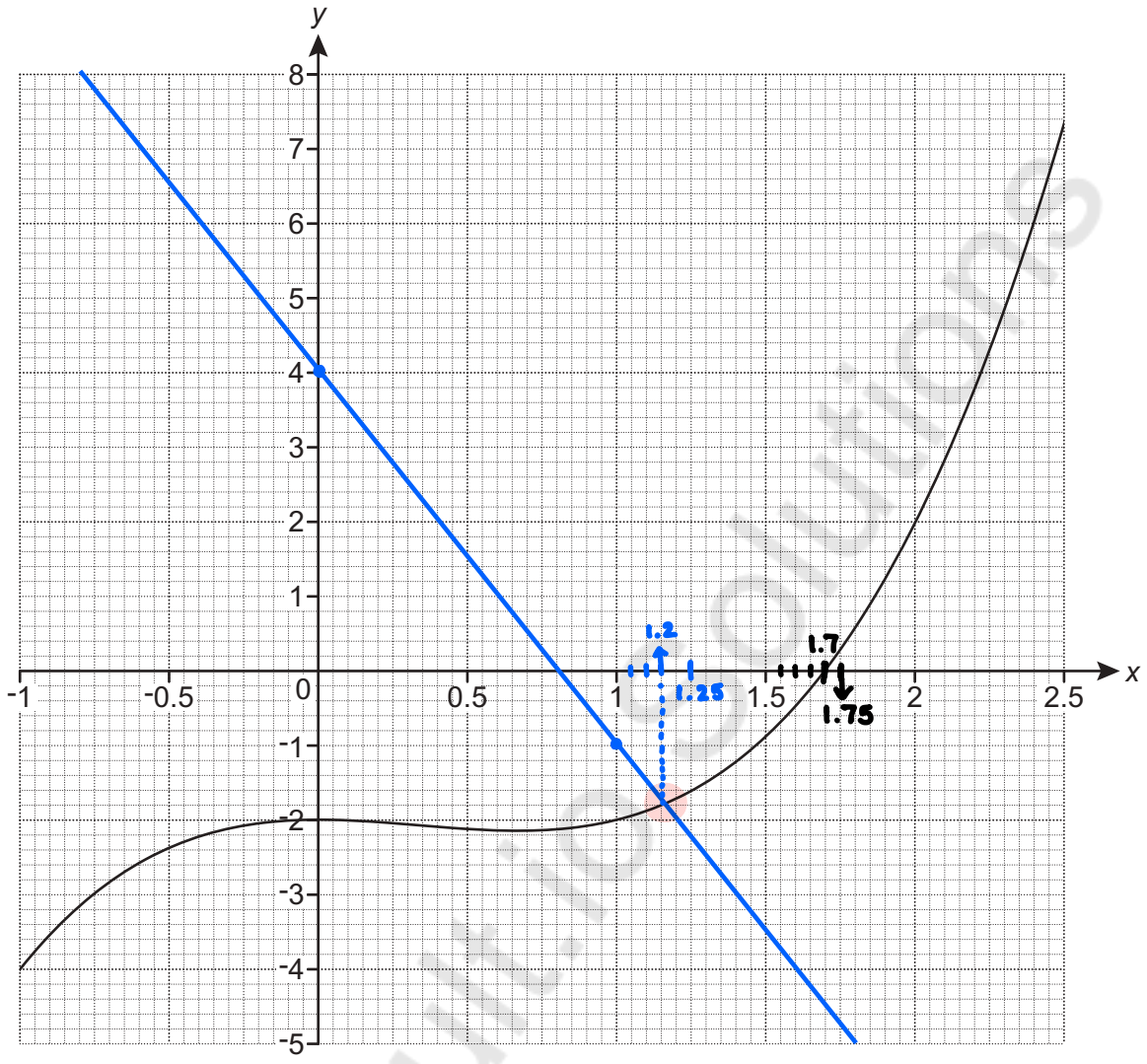
Train = 12

Car = 4

$\frac{4}{12} \times \frac{3}{11} = \frac{12}{132}$

$\frac{12}{132}$ ..... **[6]**

19 The graph of $y = x^3 - x^2 - 2$ is drawn on the grid.



(a) Use the graph to solve $x^3 - x^2 - 2 = 0$.
Give your answer correct to 1 decimal place.

$x =$ 1.7 ..... **[1]**

(b) The equation $x^3 - x^2 + 5x - 6 = 0$ can be solved by finding the intersection of the graph of $y = x^3 - x^2 - 2$ and the line $y = ax + b$.

(i) Find the value of a and the value of b.

$x^3 - x^2 - 2 = ax + b$

$-ax - b \qquad -ax - b$

$x^3 - x^2 - ax - b - 2 = 0$

$-ax = 5x$

$a = -5$

$-b - 2 = -6$

$+2 \quad +2$

$-b = -4$

$b = 4$

(b)(i) $a =$ -5 .....

$b =$ 4 ..... **[2]**

(ii) Hence, **use the graph** to solve the equation $x^3 - x^2 + 5x - 6 = 0$.
Give your answer correct to 1 decimal place.

$y = -5x + 4$

x	0	1	2
y	4	−1	−6

(ii) $x =$ 1.2 ..... **[3]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).