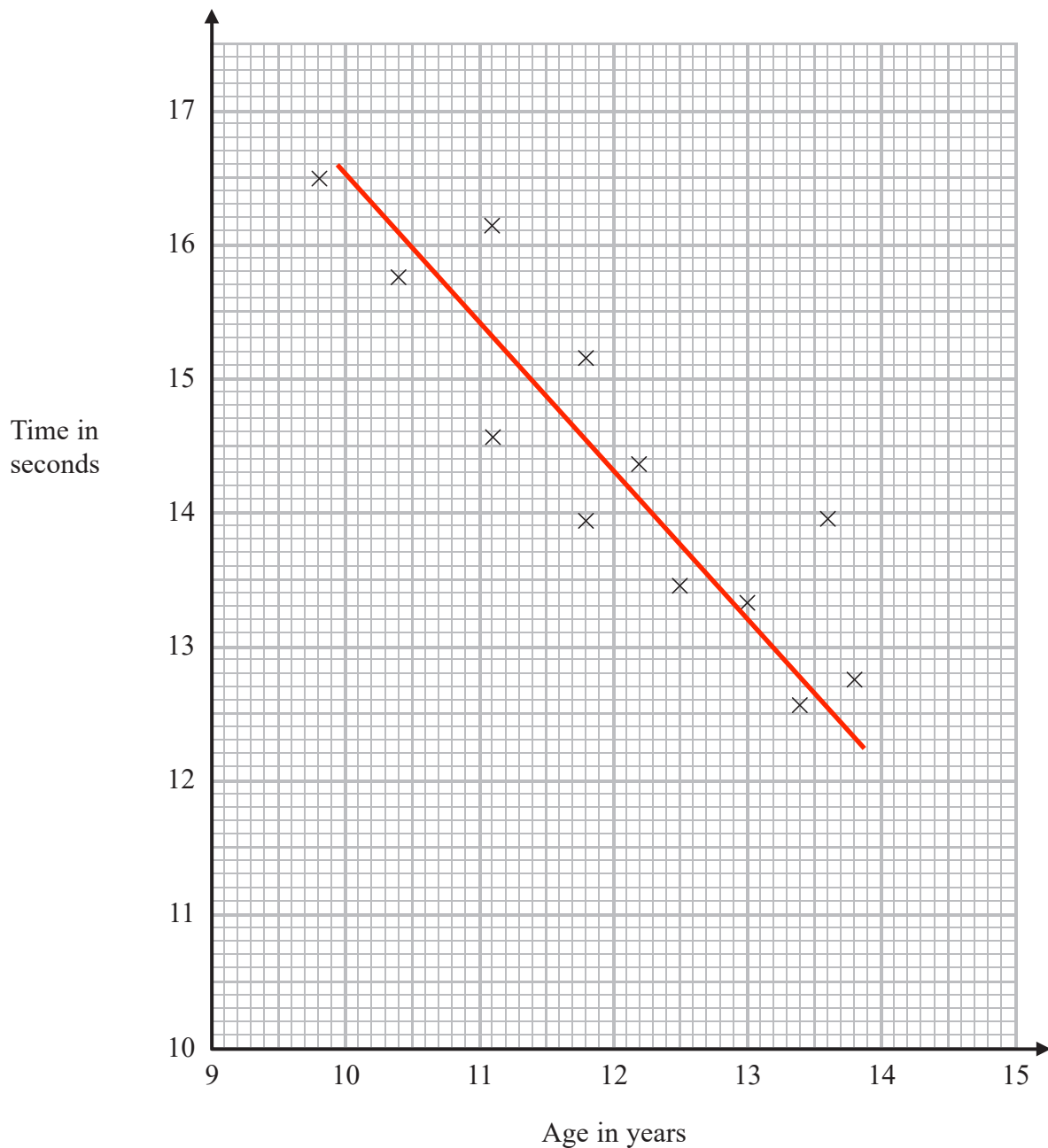




- 1 The scatter diagram shows information about 12 girls.

It shows the age of each girl and the best time she takes to run 100 metres.



- (a) Write down the type of correlation.

Negative

(1)

Kristina is 11 years old.
Her best time to run 100 metres is 12 seconds.

The point representing this information would be an outlier on the scatter diagram.

(b) Explain why.

it is not near the line of best fit

(1)

Debbie is 15 years old.

Debbie says,

“The scatter diagram shows I should take less than 12 seconds to run 100 metres.”

(c) Comment on what Debbie says.

outside the range of the scatter diagram

(1)

(Total for Question 1 is 3 marks)

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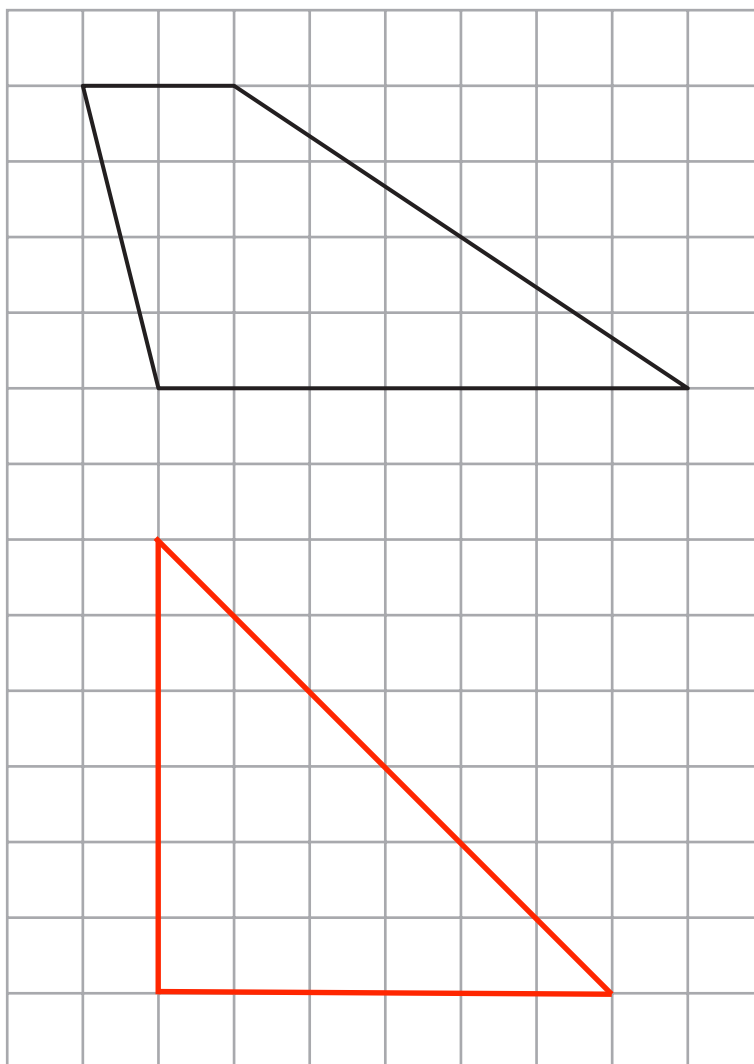
2 Expand and simplify $5(p + 3) - 2(1 - 2p)$

$$\begin{aligned} &5p + 15 - 2 + 4p \\ &= 9p + 13 \end{aligned}$$

$$9p + 13$$

(Total for Question 2 is 2 marks)

- 3 Here is a trapezium drawn on a centimetre grid.



$$\begin{aligned} & \frac{1}{2}(a+b)h \\ &= \frac{1}{2}(1+2) \times 4 \\ &= 18 \text{ cm}^2 \end{aligned}$$

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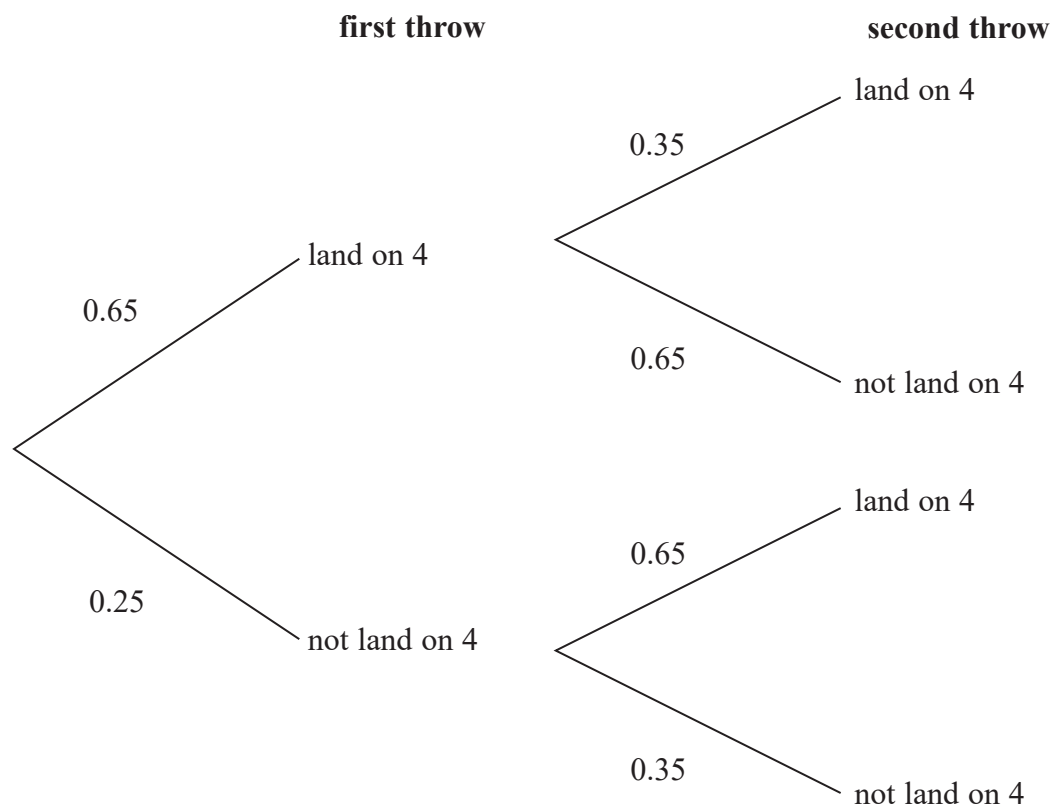
On the grid, draw a triangle equal in area to this trapezium.

(Total for Question 3 is 2 marks)



- 4 When a biased 6-sided dice is thrown once, the probability that it will land on 4 is 0.65
The biased dice is thrown twice.

Amir draws this probability tree diagram.
The diagram is **not** correct.



Write down **two** things that are wrong with the probability tree diagram.

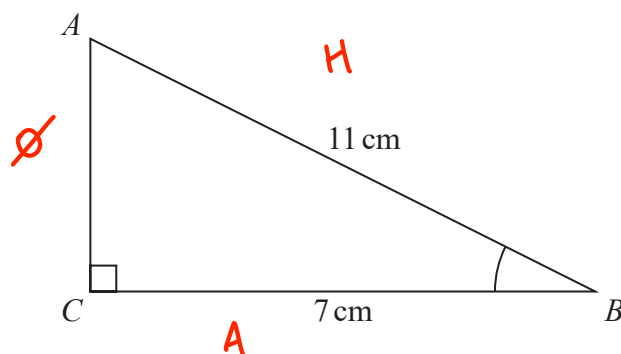
1 $0.65 + 0.25 \neq 1$

2 Second throw land on 4 should be 0.65.

(Total for Question 4 is 2 marks)



5 ABC is a right-angled triangle.



- (a) Work out the size of angle ABC .
Give your answer correct to 1 decimal place.

$S^{\circ}H \quad \cancel{A}^{\circ}H \quad T^{\circ}A$

$$\cos^{-1}\left(\frac{7}{11}\right) = 50.478\dots$$

50.5
(2)

The length of the side AB is reduced by 1 cm. $= 10\text{ cm}$

The length of the side BC is still 7 cm.
Angle ACB is still 90°

- (b) Will the value of $\cos ABC$ increase or decrease?
You must give a reason for your answer.

$$\frac{7}{10} > \frac{7}{11} \quad \text{it will increase}$$

(1)

(Total for Question 5 is 3 marks)



- 6 There are some counters in a bag.
The counters are red or white or blue or yellow.

Bob is going to take at random a counter from the bag.

The table shows each of the probabilities that the counter will be blue or will be yellow.

Colour	red	white	blue	yellow
Probability	0.2	0.1	0.45	0.25

$2x$ x

There are 18 blue counters in the bag.

The probability that the counter Bob takes will be red is twice the probability that the counter will be white.

- (a) Work out the number of red counters in the bag.

$$0.45 + 0.25 = 0.7$$

$$1 - 0.7 = 0.3$$

$$\begin{array}{r|l} 2x + x & = 0.3 \\ 3x & = 0.3 \\ \div 3 & \div 3 \\ x & = 0.1 \end{array}$$

$$\begin{array}{l} \div 45 \quad 45\% = 18 \\ \quad 1\% = 0.4 \\ \times 20 \quad 20\% = 8 \end{array}$$

8

(4)

A marble is going to be taken at random from a box of marbles.
The probability that the marble will be silver is 0.5

There must be an even number of marbles in the box.

- (b) Explain why.

0.5 x odd number will be a decimal.

Need a whole number of marbles

(1)

(Total for Question 6 is 5 marks)

7 Solve $\frac{5-x}{2} = 2x-7$

$$\begin{array}{rcl} & \times 2 & \times 2 \\ 5-x & = & 4x-14 \\ +x & & +x \\ 5 & = & 5x-14 \\ +14 & & +14 \\ 19 & = & 5x \\ \div 5 & & \div 5 \\ 3.8 & = & x \end{array}$$

$$x = 3.8$$

(Total for Question 7 is 3 marks)

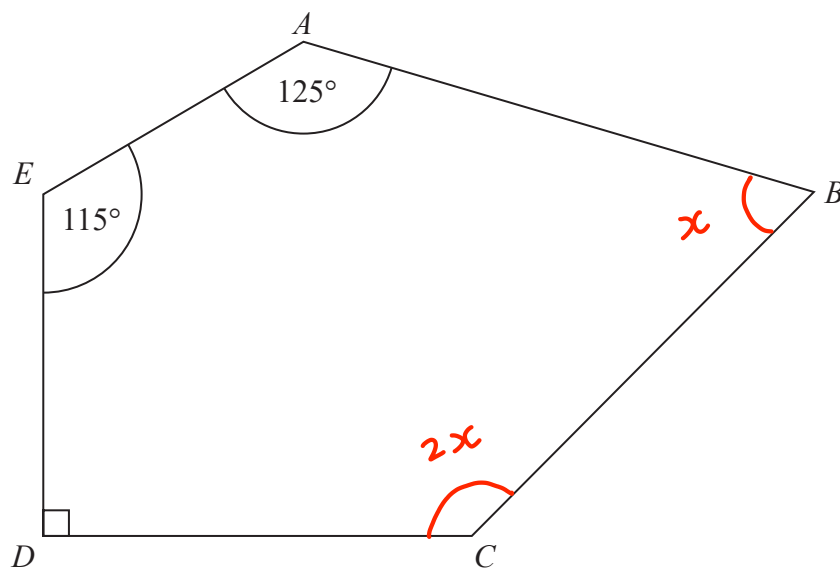
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8 $ABCDE$ is a pentagon.



Angle $BCD = 2 \times$ angle ABC

Work out the size of angle BCD .
You must show all your working.

$$(5 - 2) \times 180 = 540$$

$$\begin{array}{rcl}
 2x + x + 125 + 115 + 90 & = & 540 \\
 3x + 330 & = & 540 \\
 -330 & & -330 \\
 3x & = & 210 \\
 x & = & 70
 \end{array}$$

$$BCD = 2x = 2 \times 70 = 140^\circ$$

140

(Total for Question 8 is 5 marks)



9 $T = \sqrt{\frac{w}{d^3}}$

$$w = 5.6 \times 10^{-5}$$

$$d = 1.4 \times 10^{-4}$$

(a) Work out the value of T .

Give your answer in standard form correct to 3 significant figures.

$$= 4517.539515$$

$$T = \underline{4.52 \times 10^3} \quad (2)$$

w is increased by 10%

d is increased by 5%

Lottie says,

“The value of T will increase because both w and d are increased.”

(b) Lottie is wrong.

Explain why.

$$\begin{aligned} \sqrt{\frac{1.1w}{(1.05d)^3}} &= \sqrt{\frac{1.1w}{1.157625d^3}} \\ &= 0.97 \sqrt{\frac{w}{d^3}} \end{aligned}$$

It will decrease by 3%.

(2)

(Total for Question 9 is 4 marks)



10 Here are three lamps.

lamp A



lamp B



lamp C



Lamp A flashes every 20 seconds.

Lamp B flashes every 45 seconds.

Lamp C flashes every 120 seconds.

The three lamps start flashing at the same time.

How many times in one hour will the three lamps flash at the same time?

LCM of 20, 45 and 120

$$A \quad 20 = 2 \times 2 \times 5$$

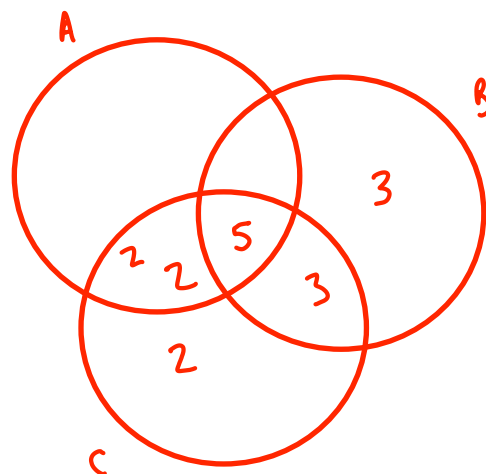
$$B \quad 45 = 3 \times 3 \times 5$$

$$C \quad 120 = 2 \times 2 \times 2 \times 3 \times 5$$

$$LCM = 2 \times 2 \times 2 \times 5 \times 3 \times 3 \\ = 360$$

$$1 \text{ hour} = 3600 \text{ seconds}$$

$$3600 \div 360 = 10$$



10

(Total for Question 10 is 3 marks)

11 In 2003, Jerry bought a house.

In 2007, Jerry sold the house to Mia.
He made a profit of 20%

In 2012, Mia sold the house for £162 000
She made a loss of 10%

Work out how much Jerry paid for the house in 2003

2012

$$\begin{array}{lcl} \div 90 & 90\% = 162\,000 & \div 90 \\ \downarrow & 1\% = 1800 & \downarrow \\ \times 100 & 100\% = 180,000 & \times 100 \end{array}$$

2007

$$\begin{array}{lcl} 120\% = 180\,000 \\ 1\% = 1500 \\ 100\% = 150,000 \end{array}$$

£ 150,000

(Total for Question 11 is 3 marks)

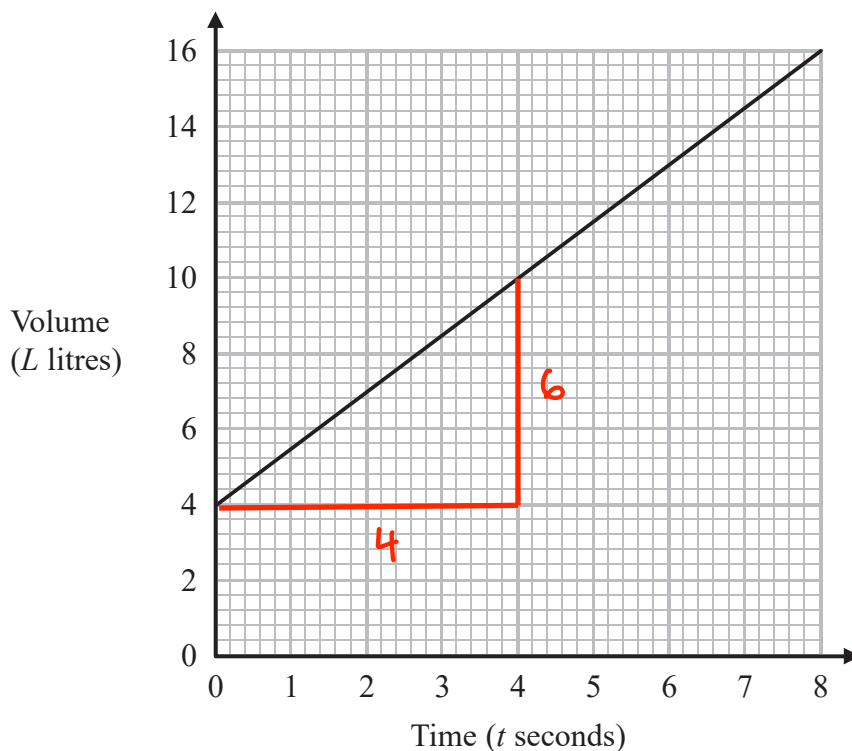
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12 The graph shows the volume of liquid (L litres) in a container at time t seconds.



(a) Find the gradient of the graph.

$$6 \div 4 = 1.5$$

1.5

(2)

(b) Explain what this gradient represents.

The increase in volume of liquid per second

(1)

The graph intersects the volume axis at $L = 4$

(c) Explain what this intercept represents.

The volume of liquid in the container at the start

(1)

(Total for Question 12 is 4 marks)



13 Here are two similar solid shapes.

A



B



surface area of shape A : surface area of shape B = 3 : 4

The volume of shape B is 10 cm^3

Work out the volume of shape A.

Give your answer correct to 3 significant figures.

$$\begin{aligned} A : B \\ \text{ASF} = 3 : 4 \\ \text{LSF} = \sqrt{3} : 2 \\ \text{VSF} = 3\sqrt{3} : 8 \end{aligned}$$

$$\begin{aligned} & A : B \\ & \times 1.25 \left(\begin{array}{l} 3\sqrt{3} : 8 \\ \downarrow 6.495 : 10 \end{array} \right) \times 1.25 \end{aligned}$$

6.50

..... cm^3

(Total for Question 13 is 3 marks)

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- 14 There are 16 hockey teams in a league.
Each team played two matches against each of the other teams.

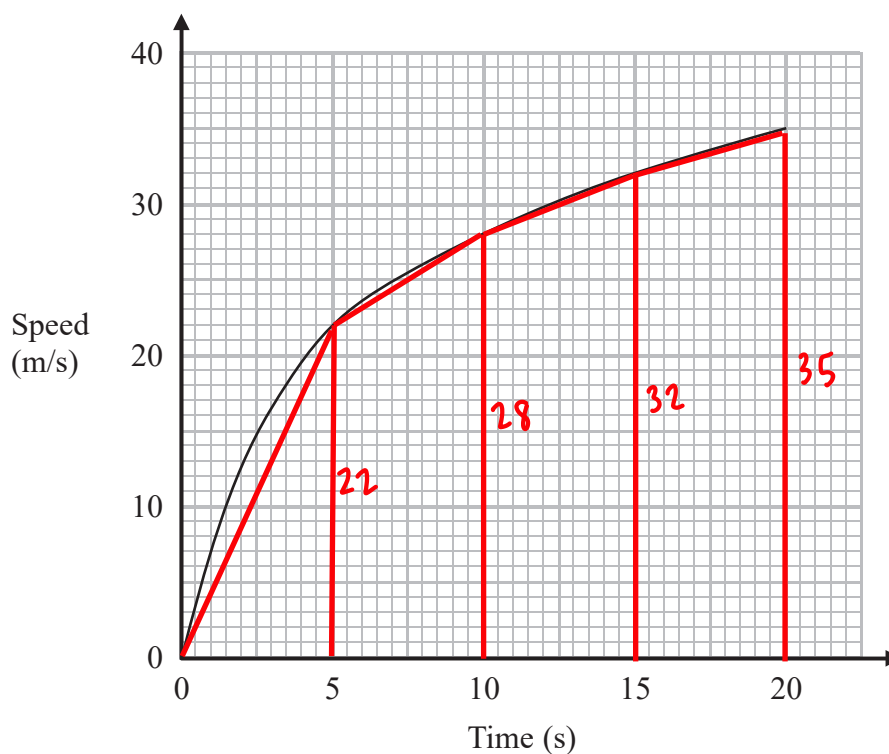
Work out the total number of matches played.

$$\begin{array}{ccccc} \text{Team 1} & & \text{Team 2} & & \\ 16 & \times & 15 & = & 240 \\ \text{options} & & \text{options} & & \end{array}$$

(Total for Question 14 is 2 marks)



- 15 The graph shows the speed of a car, in metres per second, during the first 20 seconds of a journey.



- (a) Work out an estimate for the distance the car travelled in the first 20 seconds.
Use 4 strips of equal width.

$$\frac{1}{2} (5 \times 22) + \frac{1}{2} (22 + 28) 5 + \frac{1}{2} (28 + 32) 5$$

$$+ \frac{1}{2} (32 + 35) 5 = 497.5$$

497.5 metres
(488 to 507)⁽³⁾

- (b) Is your answer to part (a) an underestimate or an overestimate of the actual distance the car travelled in the first 20 seconds?
Give a reason for your answer.

Underestimate, all of the areas found are under the curve

(1)

(Total for Question 15 is 4 marks)



16 The n th term of a sequence is given by $an^2 + bn$ where a and b are integers.

The 2nd term of the sequence is -2

The 4th term of the sequence is 12

(a) Find the 6th term of the sequence.

2nd term:

$$\begin{aligned} a(2)^2 + b(2) &= -2 \\ 4a + 2b &= -2 \end{aligned}$$

4th term:

$$\begin{aligned} a(4)^2 + b(4) &= 12 \\ 16a + 4b &= 12 \end{aligned}$$

$$\begin{array}{r} \times 4 \quad \times 4 \quad \times 4 \\ 4a + 2b = -2 \\ 16a - 4b = 12 \end{array}$$

$$\begin{array}{r} 16a + 4b = 12 \\ - 16a + 8b = -8 \\ \hline \end{array}$$

$$\begin{aligned} -4b &= 20 \\ b &= -5 \end{aligned}$$

$$\begin{array}{r} 4a + 2b = -2 \\ 4a - 10b = -2 \\ \hline 4a = 8 \\ a = 2 \end{array}$$

$\therefore$ Sequence is $2n^2 - 5n$

$$6^{\text{th}} \text{ term: } 2(6)^2 - 5(6) = 42$$

$$\frac{42}{(4)}$$

Here are the first five terms of a different quadratic sequence.

0 2 6 12 20

(b) Find an expression, in terms of n , for the n th term of this sequence.

$$\begin{array}{cccccc} 0 & 2 & 6 & 12 & 20 \\ \curvearrowright & \curvearrowright & \curvearrowright & & \\ 2 & 4 & 6 & & \\ \curvearrowright & \curvearrowright & & & \\ 2 & 2 & & & \end{array}$$

$$\rightarrow n^2$$

$$\begin{array}{r} \text{terms} \quad 0 \quad 2 \quad 6 \\ - \quad n^2 \quad 1 \quad 4 \quad 9 \\ \hline \quad \quad -1 \quad -2 \quad -3 \\ \quad \quad \curvearrowright \quad \curvearrowright \\ \quad \quad -1 \quad -1 \end{array}$$

$$\begin{aligned} n^{\text{th}} \text{ term:} \\ -n \end{aligned}$$

$$\frac{n^2 - n}{(2)}$$

(Total for Question 16 is 6 marks)

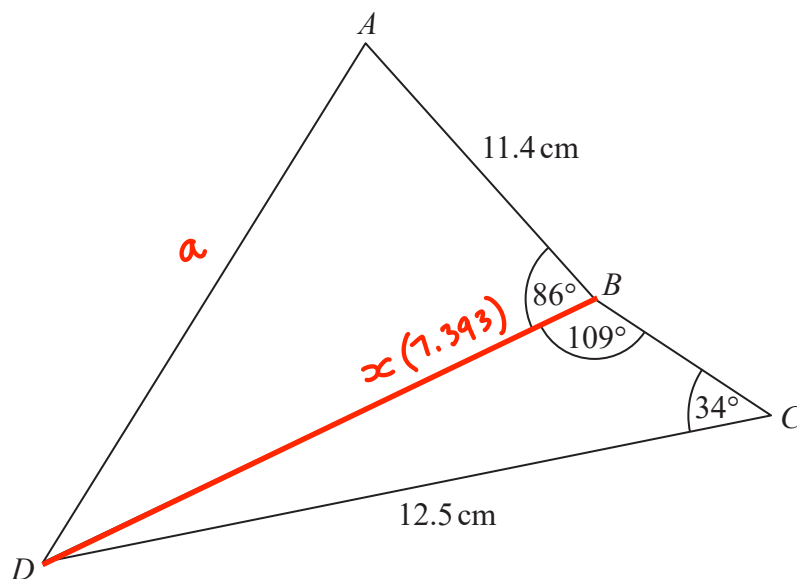
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17



Work out the length of AD .

Give your answer correct to 3 significant figures.

$$\frac{x}{\sin(34)} = \frac{12.5}{\sin(109)}$$

$$x = \frac{12.5}{\sin(109)} \times \sin(34) = 7.3926..$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$a^2 = (11.4)^2 + (7.393)^2 - 2(11.4)(7.393)^2 \times \cos(86)$$

$$= 172.853..$$



$$a = 13.147..$$

13.1

cm

(Total for Question 17 is 5 marks)



- 18 (a) Show that the equation $x^3 + x = 7$ has a solution between 1 and 2

$$x^3 + x - 7 = 0$$

When $x = 1$

$$(1)^3 + (1) - 7 = -5$$

Change in Sign $\therefore$
there is a Solution

When $x = 2$

$$(2)^3 + (2) - 7 = 3$$

(2)

- (b) Show that the equation $x^3 + x = 7$ can be rearranged to give $x = \sqrt[3]{7 - x}$

$$\begin{array}{r|l} -x & -x \\ x^3 & = 7 - x \\ \sqrt[3]{} & \sqrt[3]{} \\ x & = \sqrt[3]{7 - x} \end{array}$$

(1)

- (c) Starting with $x_0 = 2$,
use the iteration formula $x_{n+1} = \sqrt[3]{7 - x_n}$ three times to find an estimate for a solution of $x^3 + x = 7$

$$x_1 = \sqrt[3]{7 - (2)} = 1.709975 \dots$$

$$x_2 = 1.742418 \dots$$

$$x_3 = 1.738849 \dots$$

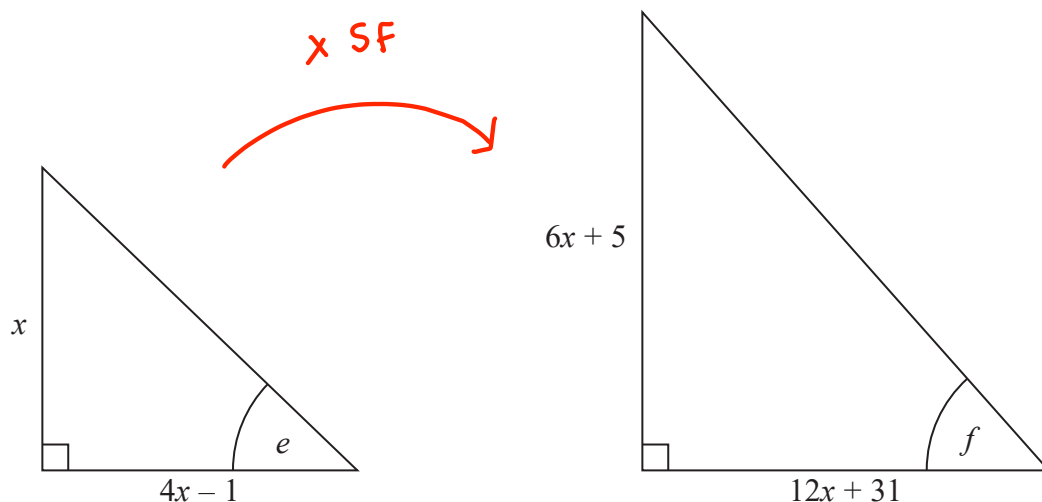
$$\underline{1.7388}$$

(3)

(Total for Question 18 is 6 marks)



19 Here are two right-angled triangles.



Given that

$$\tan e = \tan f$$

Similar Shapes!

find the value of x .

You must show all your working.

$$\frac{12x + 31}{4x - 1} = \frac{6x + 5}{x}$$

$$12x^2 + 31x = (6x + 5)(4x - 1)$$

$$12x^2 + 31x = 24x^2 - 6x + 20x - 5$$

$$12x^2 + 31x = 24x^2 + 14x - 5$$

$$-12x^2$$

$$-12x^2$$

$$31x = 12x^2 + 14x - 5$$

$$-31x = 12x^2 - 17x - 5$$

$$0 = 12x^2 - 17x - 5$$

$$0 = 12x^2 - 20x + 3x - 5$$

$$4x(3x - 5) + 1(3x - 5)$$

$$0 = (4x + 1)(3x - 5)$$

$$x = -\frac{1}{4} \text{ or } x = \frac{5}{3}$$

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

(Total for Question 19 is 5 marks)

20 50 people were asked if they speak French or German or Spanish.

Of these people,

31 speak French

2 speak French, German and Spanish

4 speak French and Spanish but not German

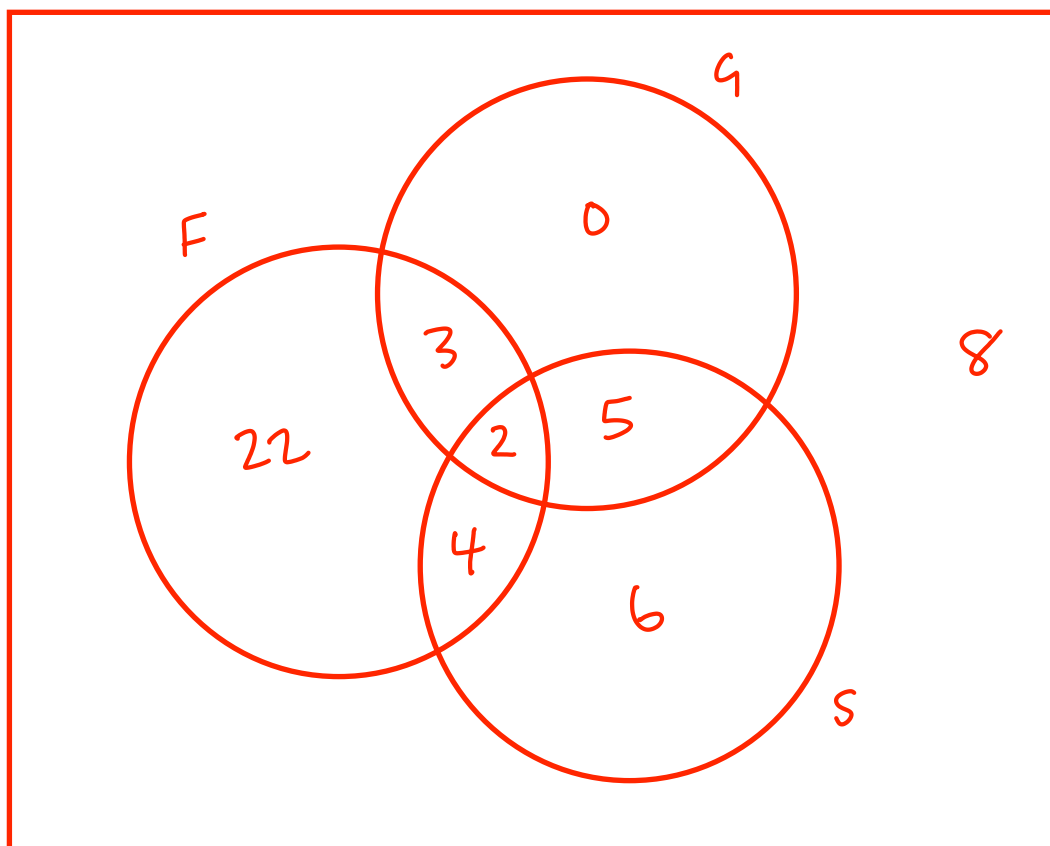
7 speak German and Spanish

8 do not speak any of the languages

all 10 people who speak German speak at least one other language

Two of the 50 people are chosen at random.

Work out the probability that they both only speak Spanish.



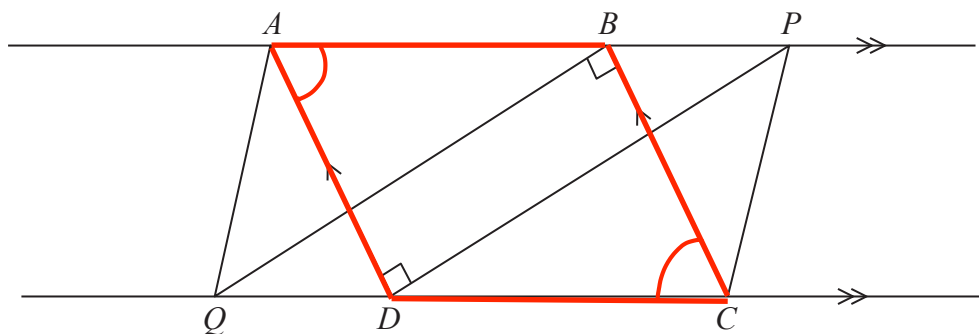
$$P(S, S) = \frac{6}{50} \times \frac{5}{49} = \frac{3}{245}$$

$$\frac{3}{245}$$

(Total for Question 20 is 5 marks)



21

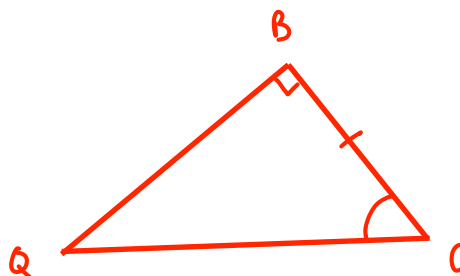
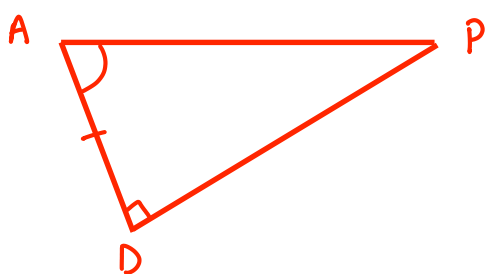


$ABCD$ is a parallelogram.

ABP and QDC are straight lines.

Angle $ADP = \text{angle } CBQ = 90^\circ$

(a) Prove that triangle ADP is congruent to triangle CBQ .



$$\angle ADP = \angle CBQ$$

$$BC = AD \text{ (opposite sides of parallelogram)}$$

$$\angle DAP = \angle BCQ \text{ (opposite angles in a parallelogram are equal)} \therefore \text{congruent as ASA (3)}$$

(b) Explain why AQ is parallel to PC .

Because ADP and CBQ are congruent,

$AP = QC$. So $APQC$ is a parallelogram

$\therefore AQ$ is parallel to PC .

(opposite sides of a parallelogram are equal)

(2)

(Total for Question 21 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS