

Write your name here

Surname

Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9-1)

Centre Number

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Candidate Number

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Mathematics

Paper 3 (Calculator)

Solutions from Dr. Belma ♥

Higher Tier

Tuesday 12 June 2018 – Morning

Time: 1 hour 30 minutes

Paper Reference

1MA1/3H

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.



Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Pearson

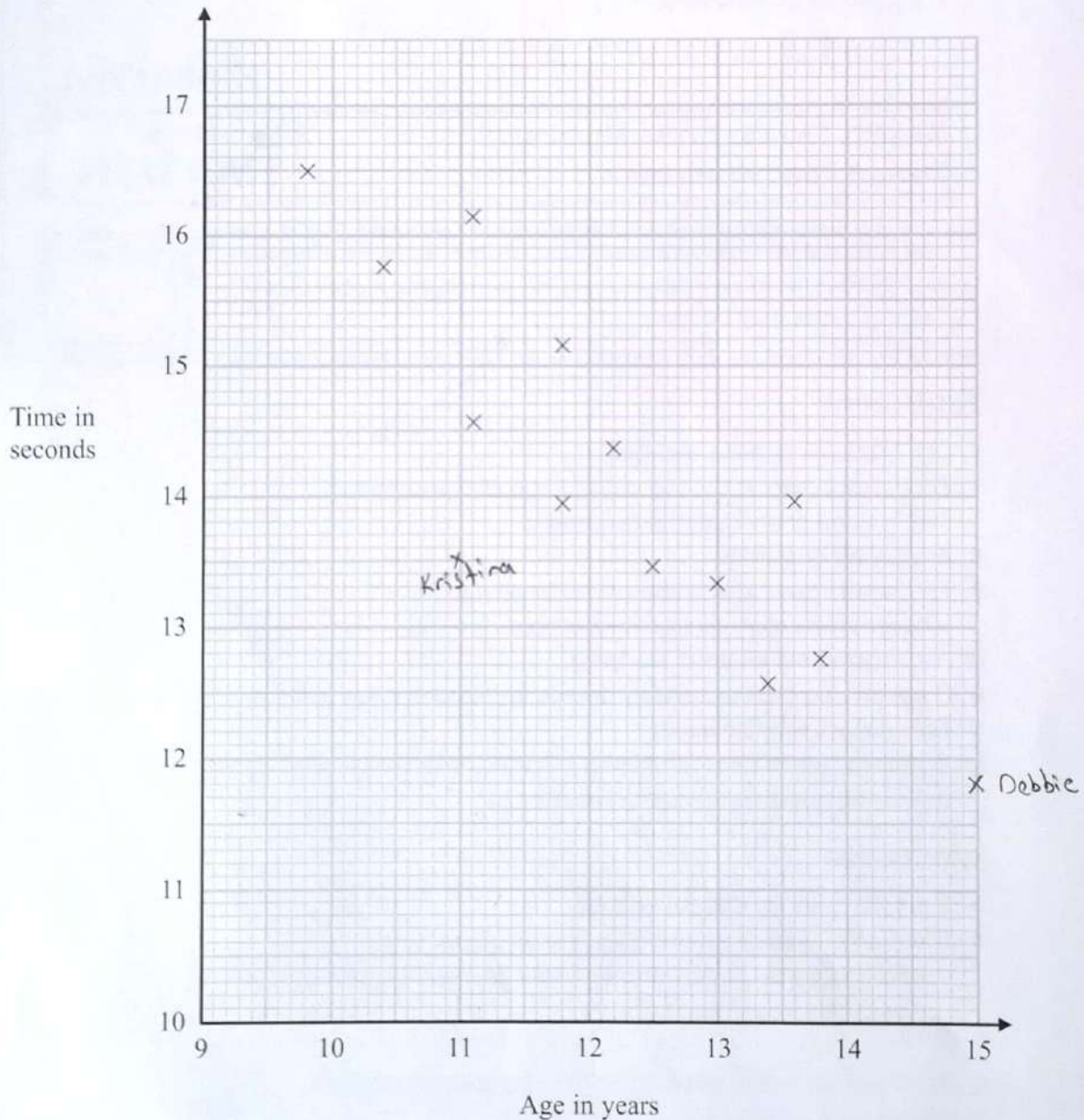
Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 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.

negatif

(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.

is far away from the other points 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.

point would be outside of the range of the scatter diagram

(1)

(Total for Question 1 is 3 marks)

2 Expand and simplify

$$5(p+3) - 2(1-2p)$$

$$\begin{aligned} 5 \times p + 5 \times 3 \\ = 5p + 15 \end{aligned}$$

$$\begin{aligned} 2 \times 1 - 2 \times (2p) \\ = 2 - 4p \end{aligned}$$

$$5p + 15 - (2 - 4p)$$

$$5p + 15 - 2 + 4p$$

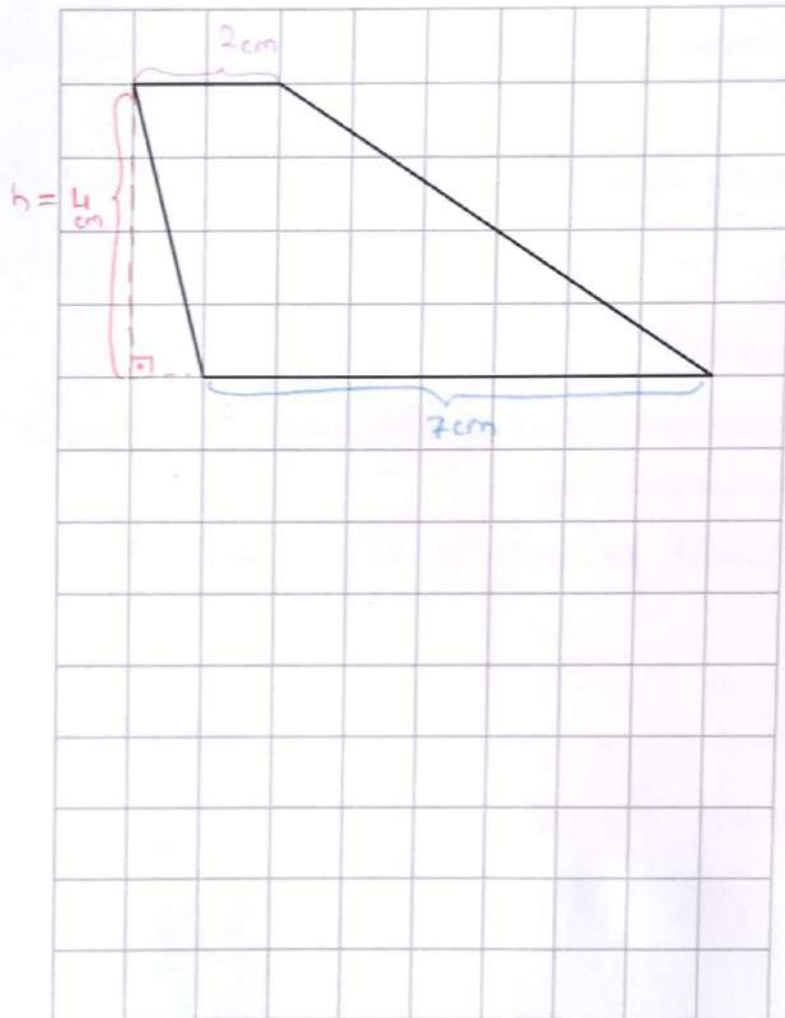
$$7p + 13$$

$$7p + 13$$

(Total for Question 2 is 2 marks)



3 Here is a trapezium drawn on a centimetre grid.



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

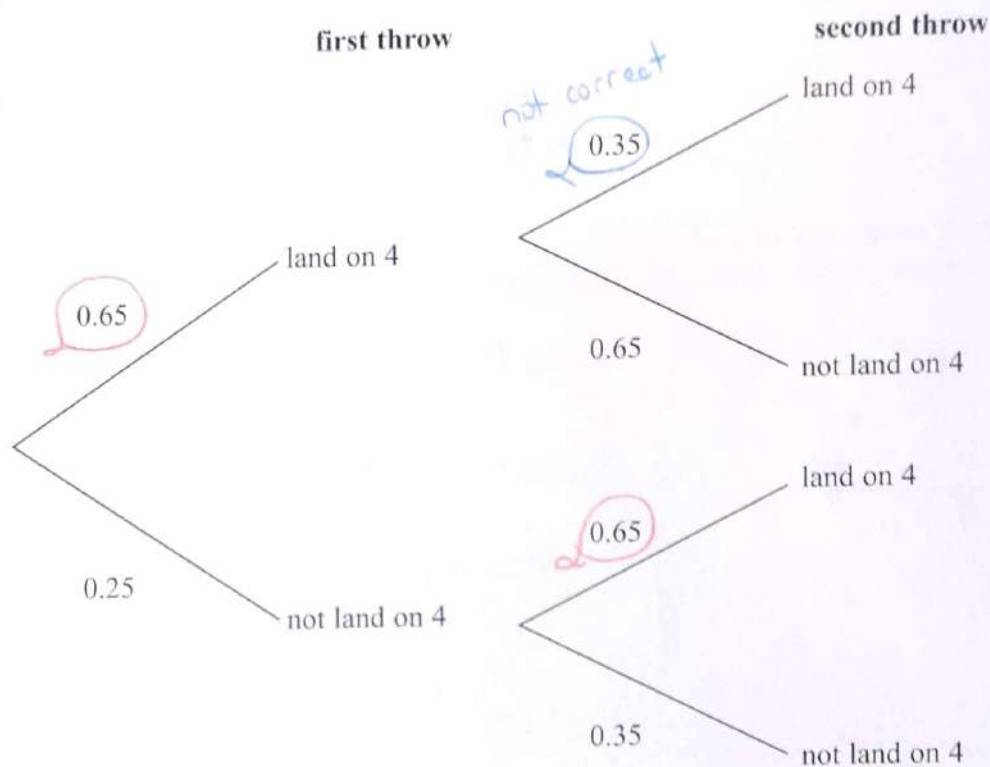
$$\begin{aligned}
 \text{Area of trapezium} &= \frac{7+2}{2} \times 4 \\
 &= \frac{9}{2} \times \frac{4}{1} \\
 &= 9 \times 2 \\
 &= 18 \text{ cm}^2
 \end{aligned}$$

(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.



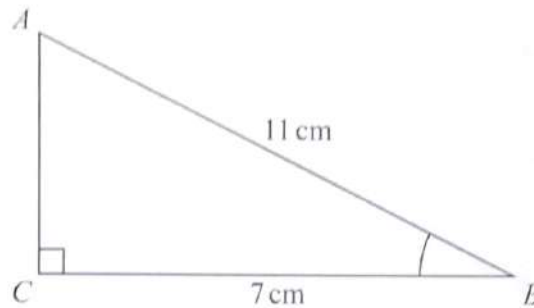
Write down **two** things that are wrong with the probability tree diagram.

- 1 probabilities should total 1 but first line $0.65 + 0.25 \neq 1$
- 2 for second throw, the probability it lands on 4 should be 0.65

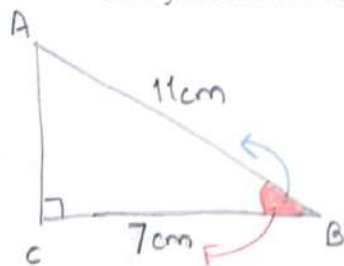
(Total for Question 4 is 2 marks)



5 ABC is a right-angled triangle.



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



$$\cos ABC = \frac{7}{11} = 0.636363\dots$$

(which angle's cos is equal to 0.6363...?)

$$50.4788 \longrightarrow 50.5$$

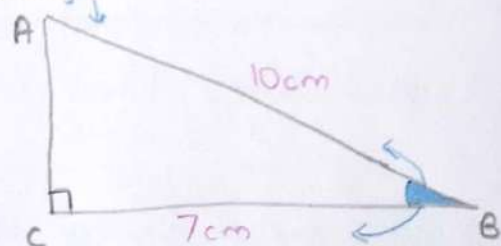
1 decimal place

The length of the side AB is reduced by 1 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.

new triangle



50.5

(2)

$$\cos ABC = \frac{7}{10} \text{ increase, } \frac{7}{10} \text{ is greater than } \frac{7}{11}$$

(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			0.45	0.25

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. 2x

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

colour	red	white	blue	yellow
probability	$2 \times P = 0.2$	$P = 0.1$	0.45	0.25
number of counters			18	

40 =

total number of counters
 $\Downarrow$
 $x \times 0.45 = 18$
 $x \times \frac{45}{100} = 18$
 $x = \frac{18 \times 100}{45}$
 $x = 40$

$2 \times p + p + 0.45 + 0.25 = 1$ (probabilities should total 1)
 $3p + 0.70 = 1$
 $3p = 0.30$
 $p = 0.10$

red counters probability = 0.2
 number of red counters = $40 \times 0.2 = \frac{40 \times 2}{10} = 8$

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 multiplied by an odd number will never be a whole number,
for half of a number to be an integer that number must be even, you can't have half a marble

(1)

(Total for Question 6 is 5 marks)



7 Solve $\frac{5-x}{2} = \frac{2x-7}{1}$

$$1 \times (5-x) = 2 \times (2x-7)$$

$$1 \times 5 - 1 \times x = 2 \times 2x - 2 \times 7$$

$$5 - x = 4x - 14$$

$$5 + 14 = 4x + x$$

$$\frac{19}{5} = \frac{5x}{5}$$

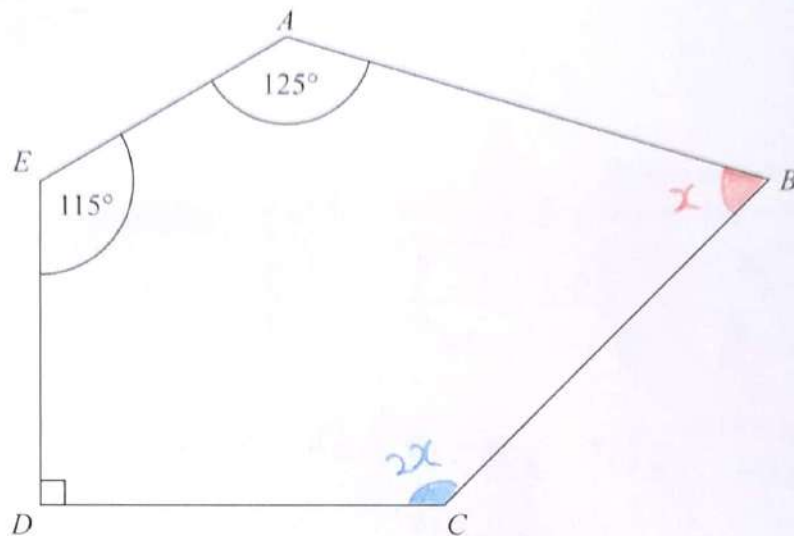
$$\frac{19}{5} = x \Rightarrow x = 3.8$$

$$x = 3.8$$

(Total for Question 7 is 3 marks)



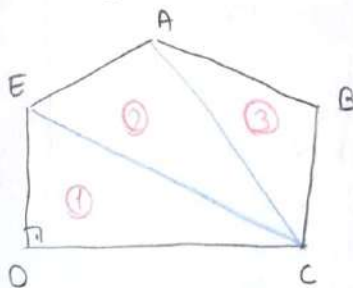
8 $ABCDE$ is a pentagon.



Angle $BCD = 2 \times \text{angle } ABC$

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

explanation



sum of the interior
angles of a pentagon

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

$$= 3 \times 180$$

$$= 540$$

$$540 = 90 + 2x + x + 125 + 115$$

$$540 = 3x + 330$$

$$540 - 330 = 3x$$

$$\frac{210}{3} = \frac{3x}{3}$$

$$70 = x$$

$$\text{angle } BCD = 2 \times x = 2 \times 70 = 140$$

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.

$$T = \sqrt{\frac{5.6 \times 10^{-5}}{(1.4 \times 10^{-4})^3}} = \sqrt{\frac{5.6 \times 10^{-5}}{1.4^3 \times 10^{-12}}} = \sqrt{\frac{5.6}{1.4^3} \times 10^{-5+12}} = \sqrt{\frac{5.6}{1.4^3} \times 10^7}$$

$$= \sqrt{2.040816... \times 10^7} = 4517.539515, \text{ not written in standard form}$$

$$= 4.51 \times 10^3 \text{ to } 4.52 \times 10^3$$

$T = 4.52 \times 10^3$
(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.

explanation
— > — > —

w is increased by 10% = $\frac{110}{100} = 1.1$

d is increased by 5% = $\frac{105}{100} = 1.05$

$$T = \sqrt{\frac{5.6 \times 10^{-5} \times 1.1}{(1.4 \times 10^{-4} \times 1.05)^3}}$$

$$= \sqrt{\frac{5.6 \times 1.1 \times 10^{-5+12}}{1.4^3 \times 1.05^3}} = 4.40... \times 10^3$$

new value of T (4.40×10^3) less than previous T value (4.52×10^3)

(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?

$$\text{LCM}(20, 45, 120) = 2 \times 2 \times 2 \times 3 \times 5 \times 3 = 360$$

$$20 = 2 \times 2 \times 5$$

$$45 = 3 \times 3 \times 5$$

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

$$\text{one hour} = 60 \text{ minutes} = 3600 \text{ seconds}$$

$$3600 \div 360 = 10 \text{ times}$$

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%

$$\Rightarrow \text{profit } 20\% = \frac{120}{100} = 1.20$$

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

$$\Rightarrow \text{loss } 10\% = \frac{90}{100} = 0.9$$

Work out how much Jerry paid for the house in 2003

$$162\,000 \div 0.9 = 180\,000$$

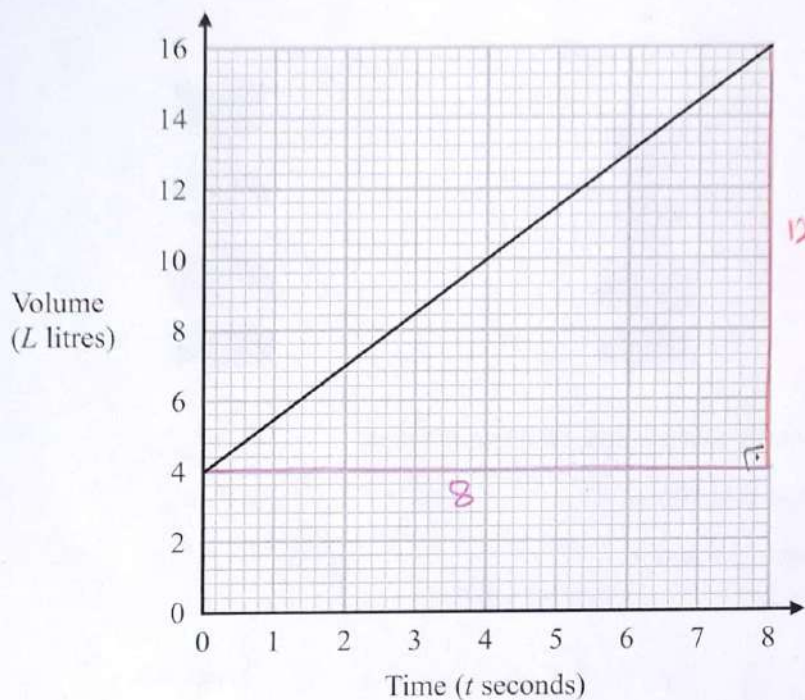
$$180\,000 \div 1.20 = 150\,000$$

£ 150 000

(Total for Question 11 is 3 marks)



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



(a) Find the gradient of the graph.

$$\text{gradient} = \frac{12}{8} = 1.5$$

1.5

(2)

(b) Explain what this gradient represents.

rate at which the container fills or change in number of litres per second

(1)

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

(c) Explain what this intercept represents.

Volume (amount) of liquid in the container at the start

(1)

(Total for Question 12 is 4 marks)



13 Here are two similar solid shapes.



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.

$$\frac{\text{area of A}}{\text{area of B}} = \frac{3}{4} \Rightarrow \frac{\sqrt{3}}{2} \Rightarrow \text{scale of lengths}$$

$$\frac{\text{volume of A}}{\text{volume of B}} = \left(\frac{\sqrt{3}}{2}\right)^3 \Rightarrow \frac{\text{volume of A}}{10} = \frac{5.19615...}{8}$$

$$= \frac{\text{volume of A}}{10} \Rightarrow \underline{0.6495...}$$

$$\text{volume of A} = 6.495...$$

6.50 cm^3

(Total for Question 13 is 3 marks)



- 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.

explanation

1st team play other 15 teams
2nd team play other 14 teams
3rd 13 "
..... 12 "
..... 11 "
..... 10 "
..... 9 "
..... 8 "
..... 7 "
..... 6 "
..... 5 "
..... 4 "
..... 3 "
..... 2 "
15th " " + 1

$$15 + 14 + 13 + 12 + \dots + 1 = \frac{15 \times 16}{2} = 120$$

$$\frac{15 \times 16}{2} = 120 \text{ matches}$$

each team played two matches

↓

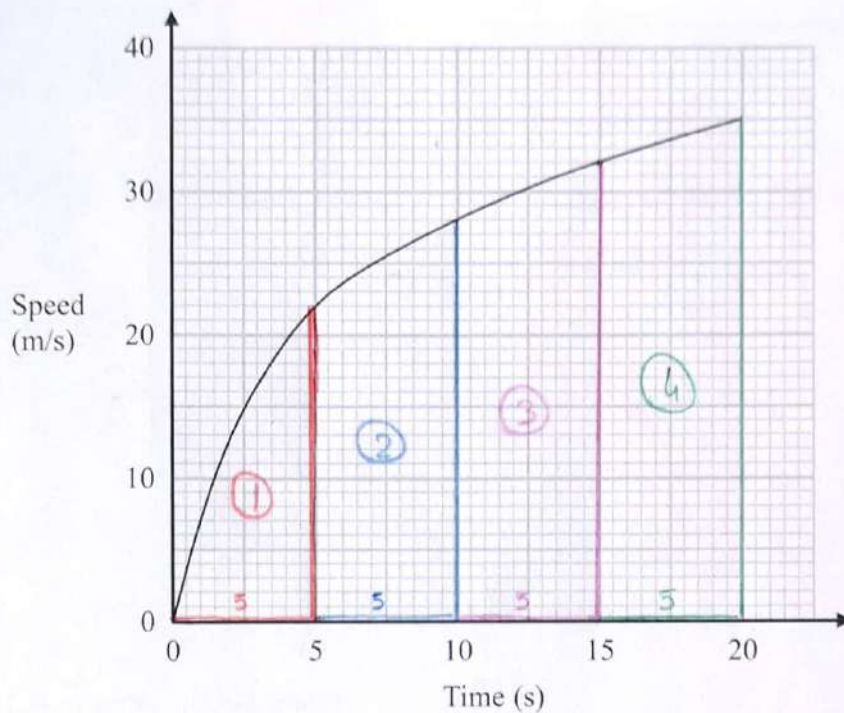
$$120 \times 2 = 240$$

240

(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.

$$\textcircled{1} \Rightarrow \frac{22 \times 5}{2} = 55$$

$$\textcircled{2} \Rightarrow \frac{22 + 28}{2} \times 5 = 25 \times 5 = 125$$

$$\textcircled{3} \Rightarrow \frac{28 + 32}{2} \times 5 = 30 \times 5 = 150$$

$$\textcircled{4} \Rightarrow \frac{32 + 35}{2} \times 5 = 33.5 \times 5 = 167.5$$

$$\begin{aligned} \text{approximately total of area} &= 55 + 125 + 150 + 167.5 \\ &= 497.5 \end{aligned}$$

497.5

metres

(3)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

- (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 parts not included below the graph

(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 $-2 \rightarrow (-2)$

The 4th term of the sequence is 12

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

$$\begin{aligned} n=2 &\Rightarrow a \times 2^2 + b \times 2 = -2 \Rightarrow 4a + 2b = -2 \quad \times 4 \Rightarrow 16a + 8b = -8 \\ n=4 &\Rightarrow a \times 4^2 + b \times 4 = 12 \Rightarrow 16a + 4b = 12 \end{aligned}$$

$$\begin{array}{r} 16a + 8b = -8 \\ -16a + 4b = 12 \\ \hline 4b = -20 \\ b = -5 \end{array}$$

$$\begin{array}{l} 16a + 8 \times (-5) = -8 \\ 16a - 40 = -8 \\ 16a = -8 + 40 \\ 16a = 32 \\ a = 2 \end{array}$$

$$2n^2 - 5n$$

$$\begin{aligned} n=6 &\Rightarrow 2 \times 6^2 - 5 \times 6 \\ &= 2 \times 36 - 30 \\ &= 72 - 30 = 42 \end{aligned}$$

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.

$$\begin{array}{ccccccc} 0 & & 2 & & 6 & & 12 & & 20 \\ & \swarrow & & \swarrow & & \swarrow & & \swarrow & \\ & +2 & & +4 & & +6 & & +8 & \\ & \swarrow & & \swarrow & & \swarrow & & \swarrow & \\ & +2 & & +2 & & +2 & & & \end{array}$$

expression $\Rightarrow an^2 + bn + c$

$$a = \frac{\text{second difference}}{2} = \frac{2}{2} = 1$$

$$an^2 + bn + c$$

$$1n^2 + bn + c$$

$$n=1 \Rightarrow 1^2 + b \times 1 + c = 0$$

$$1 + b + c = 0 \rightarrow b + c = -1$$

$$n=2 \Rightarrow 2^2 + b \times 2 + c = 0$$

$$4 + 2b + c = 0$$

$$2b + c = -4$$

$$b = -1$$

$$c = 0$$

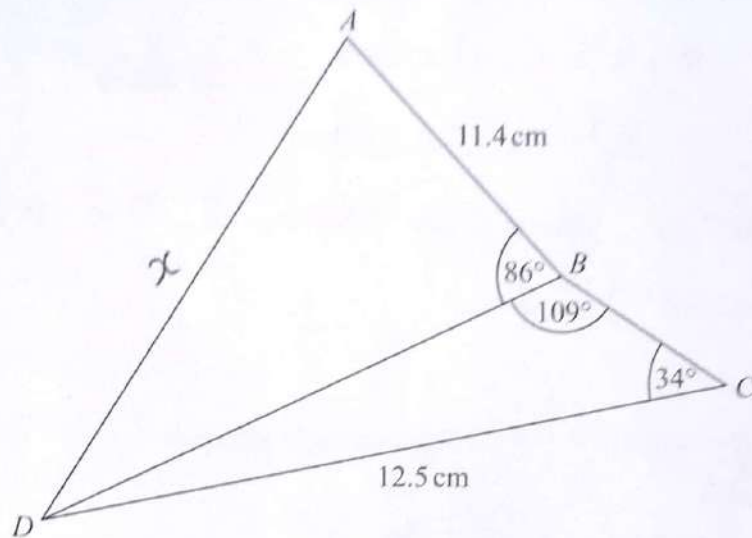
$$n^2 - n$$

(2)

(Total for Question 16 is 6 marks)



17



Work out the length of AD .

Give your answer correct to 3 significant figures.

$$\text{sin theorem} \Rightarrow \frac{DC}{\sin 109^\circ} = \frac{BD}{\sin 34^\circ}$$

$$\Rightarrow BD = \frac{\sin 34^\circ \times DC}{\sin 109^\circ}$$

$$\Rightarrow BD = \frac{\sin 34^\circ \times 12.5}{\sin 109^\circ}$$

$$BD = 7.392674 \dots$$

$$BD = 7.39$$

cos theorem $\Rightarrow$

$$AD^2 = AB^2 + BD^2 - 2 \cdot AB \cdot BD \cdot \cos 86^\circ$$

$$x^2 = 11.4^2 + 7.39^2 - 2 \times 11.4 \times 7.39 \times \cos 86^\circ$$

$$x^2 = 172.82$$

$$x = 13.1$$

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

$$\left. \begin{array}{l} \text{for } x=1 \Rightarrow x^3 + x = 1^3 + 1 = 2 \\ \text{for } x=2 \Rightarrow x^3 + x = 2^3 + 2 = 10 \end{array} \right\} \Rightarrow$$

2 and 10 are above and below 7. Thus implying a solution lies between 1 and 2

(2)

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

$$x^3 + x = 7$$

$$\sqrt[3]{x^3} = \sqrt[3]{7-x} \Rightarrow x = \sqrt[3]{7-x}$$

(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 $x^3 + x = 7$

$$x_{n+1} = \sqrt[3]{7-x_n}$$

$$x_0 = 2 \Rightarrow x_{0+1} = \sqrt[3]{7-x_0} \Rightarrow x_1 = \sqrt[3]{7-2} = \sqrt[3]{5} = 1.7099759\dots$$

$$x_1 = 1.7099\dots \Rightarrow x_{1+1} = \sqrt[3]{7-x_1} \Rightarrow x_2 = \sqrt[3]{7-1.7099\dots} = 1.742427\dots$$

$$x_2 = 1.7424\dots \Rightarrow x_{2+1} = \sqrt[3]{7-x_2} \Rightarrow x_3 = \sqrt[3]{7-1.7424\dots} = 1.73885\dots$$

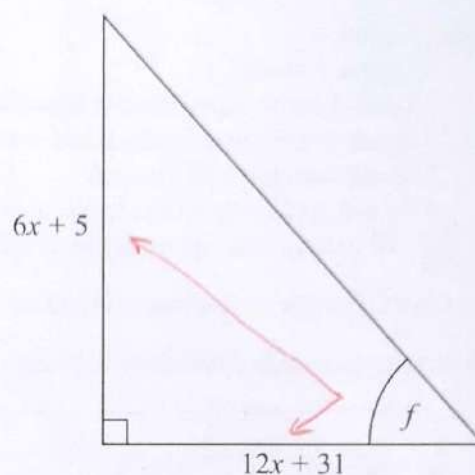
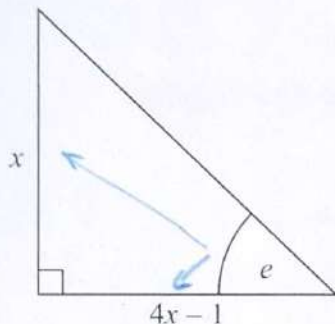
1.74

(3)

(Total for Question 18 is 6 marks)



19 Here are two right-angled triangles.



Given that

$$\tan e = \tan f$$

find the value of x .

You must show all your working.

$$\tan e = \frac{x}{4x-1}$$

$$\tan f = \frac{6x+5}{12x+31}$$

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

$$x \times (12x+31) = (4x-1) \times (6x+5)$$

$$x \times 12x + x \times 31 = 4x \times 6x + 4x \times 5 - 6x - 5$$

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

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

$$0 = 24x^2 + 14x - 5 - 12x^2 - 31x$$

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

$$\begin{array}{rcl} 4x & \xrightarrow{\quad} & +1 \\ 3x & \xrightarrow{\quad} & -5 \end{array}$$

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

$$4x+1=0 \quad 3x-5=0$$

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

!!

$\frac{5}{3}$

(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

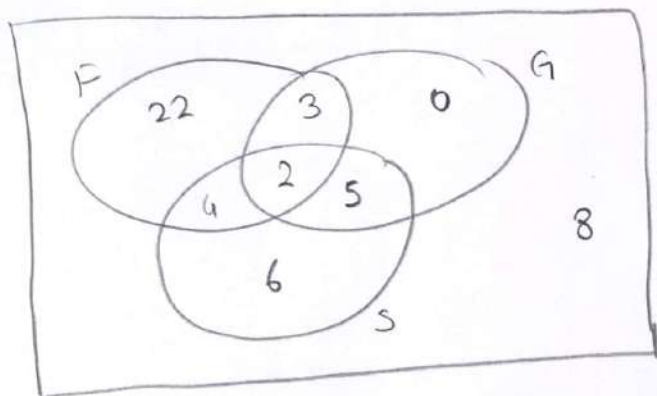
7 speak German and Spanish

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.



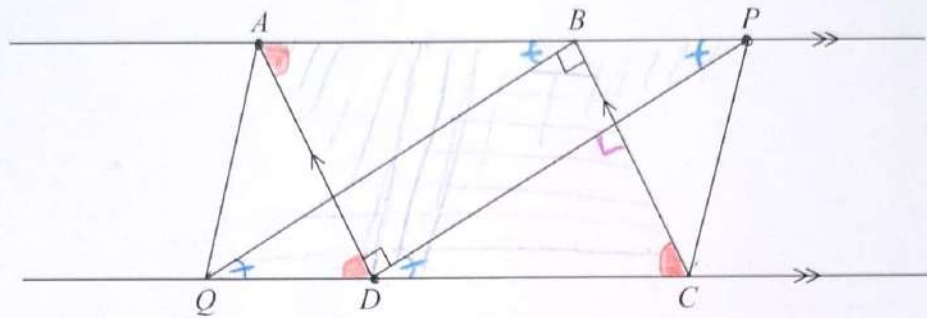
$$\frac{6}{50} \times \frac{5}{49} = \frac{6}{490}$$

$$\frac{6}{490}$$

(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 .

$AD = BC$ (opposite sides of a parallelogram are equal)
 angle $BAQ = \text{angle } BCD$ (opposite angles of a parallelogram are equal)
 angle $ADP = \text{angle } CBQ = 90^\circ$

(3)

(b) Explain why AQ is parallel to PC .

$AP = QC$ (triangle ADP is congruent to triangle CBQ)

(2)

(Total for Question 21 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS



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