Write your name here

Surname	Other names

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

Centre Number | Candidate Number

Mathematics

Paper 3 (Calculator)

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 ▶

6/7/7/7/8/7/1/

Pearson

Please note that these worked solutions have neither been provided nor approved by Pearson Education and may not necessarily constitute the only possible solutions. Please refer to the original mark schemes for full guidance.

Any writing in blue indicates what must be written in order to answer the questions and get the marks. The worked solutions have been designed to show the smallest amount of work which needs to be done to answer the question.

Anything written in green in a cloud doesn't have to be written in the exam.

Anything written in orange in a rectangle doesn't have to be written in the exam and is there to show what should be put into a calculator or measured using a ruler or protractor.

If you find any mistakes or have any requests or suggestions, please send an email to curtis@cgmaths.co.uk

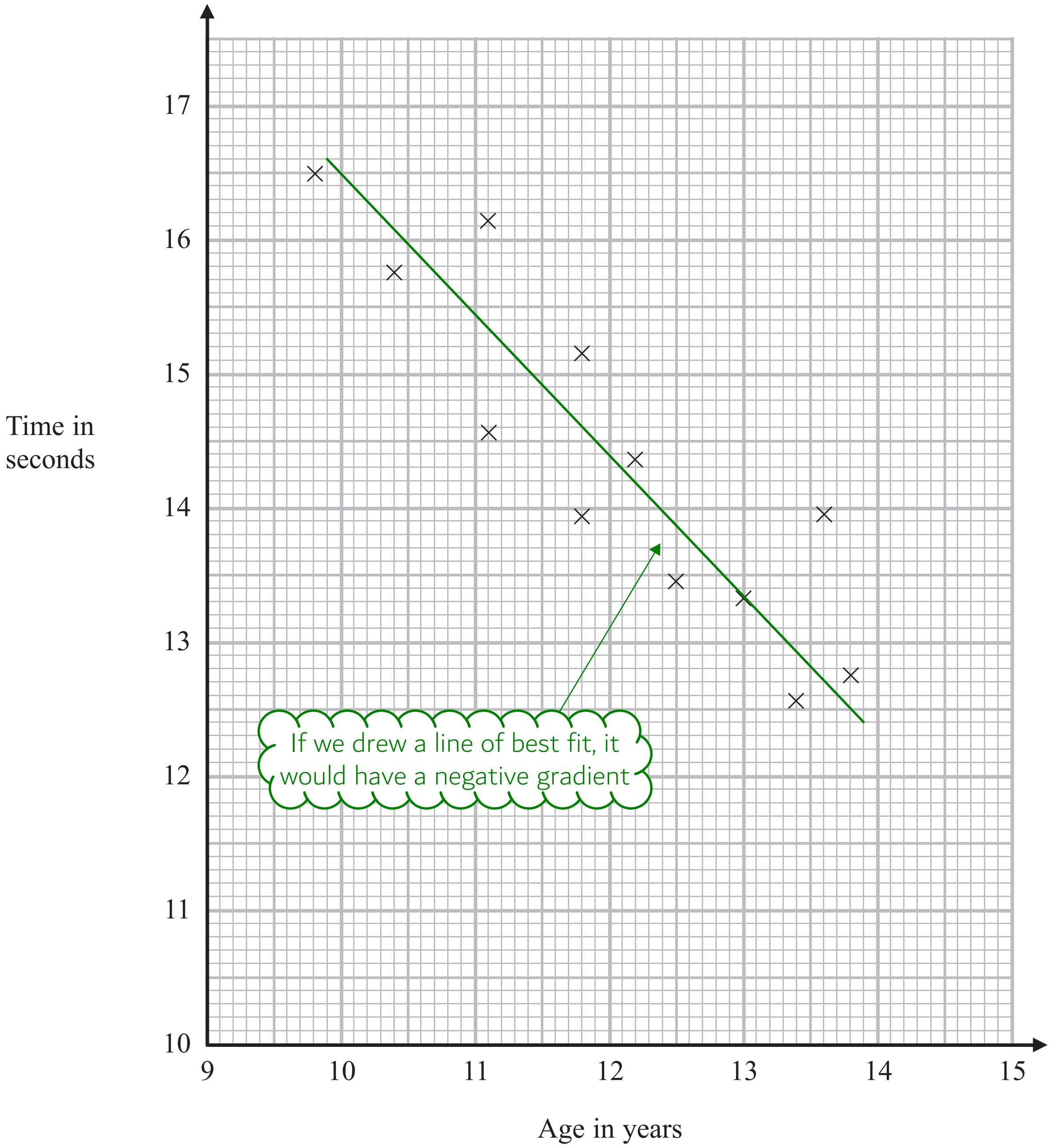
Answer ALL questions.

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.

Positive, negative or none

....

(1)

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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.

Plot the point on the graph and look where it is relative to the other points

(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.

The downward trend might not continue

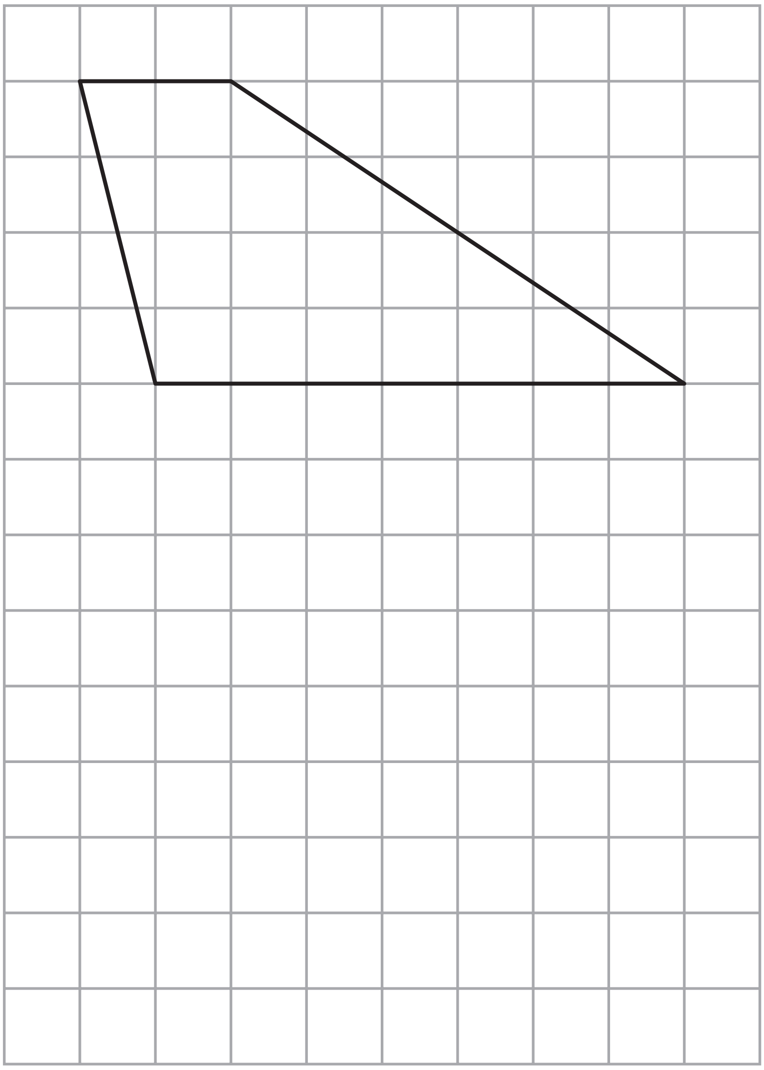
(1)

(Total for Question 1 is 3 marks)

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

(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.

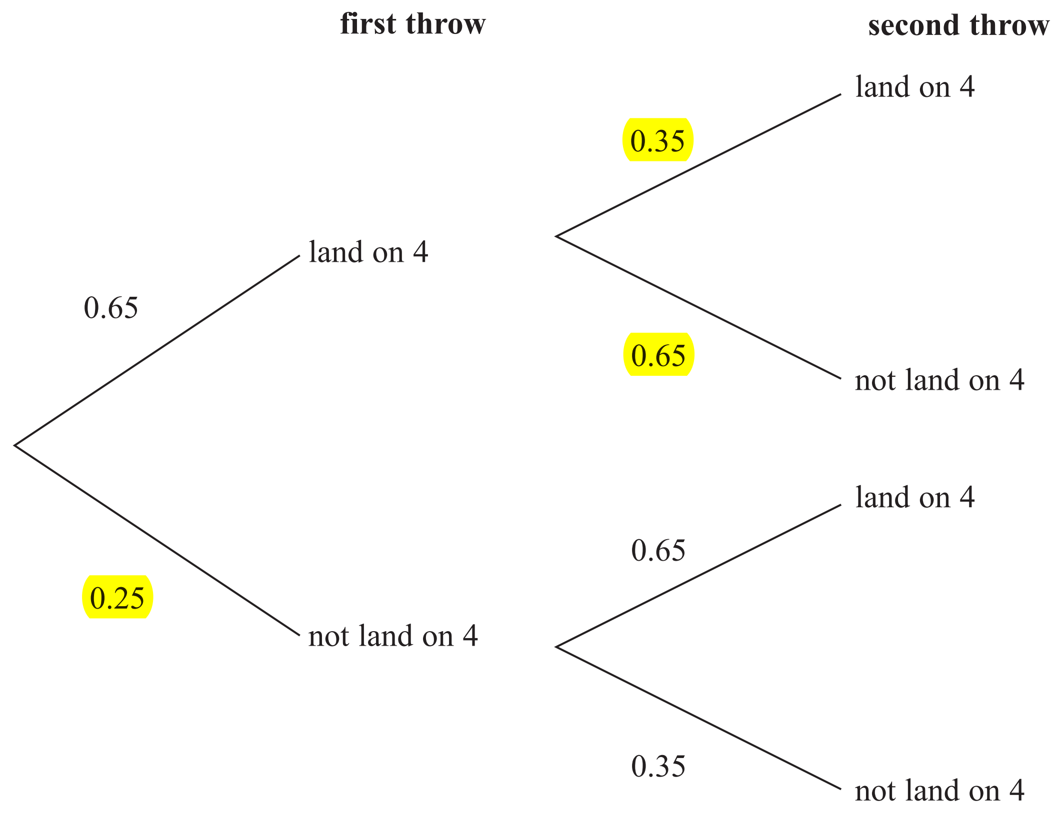
Area of trapezium = 1/2 x (a + b) x h, where a and b are the parallel sides and h is the distance between a and b.

Area of triangle = 1/2 x base x height

(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 ....

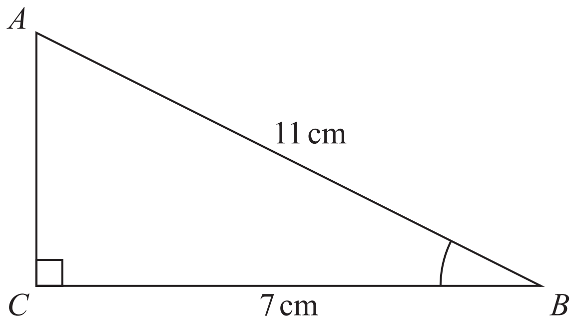
....

2 ....

....

(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.

SOH CAH TOA

Tick what sides we have (hypotenuse is the longest side, adjacent is the one next to the angle, opposite is opposite the angle). If there are two ticks, we can use that formula triangle. Write out the formula triangle and cover over what we are trying to find to get a formula involving the angle. Rearrange to find the angle

.... °

(2)

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.

Cos ABC = adjacent/hypotenuse

....

(1)

(Total for Question 5 is 3 marks)

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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.

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

2 : 1 ← This is the ratio of red to white

It is certain to get one of the colours so all the probabilities must add to 1. Therefore subtracting the probabilities of blue and yellow away from 1 leaves the probability of red or white.

There are 3 parts in total in the ratio. These represent red or white and the total probability of these. Divide the total probability of red or white into the ratio to find the probability of getting red.

Let x be the total number of counters. The probability is equal to the relative frequency so therefore 0.45 of the total is 18. Set up an equation in terms of x using this and then rearrange it to find x.

Multiply the probability of getting red by the total number of counters to find how many red counters there are

....

(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.

If the probability is 0.5, half of the marbles must be silver. Consider what this would mean if there was an odd number of marbles

(1)

(Total for Question 6 is 5 marks)

.CG Maths.

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

First eliminate the fraction by multiplying both sides by the denominator.

Bring all the x terms to the same side and move all the non-x terms to the other side. Then make x the subject

$x =$ ....

(Total for Question 7 is 3 marks)

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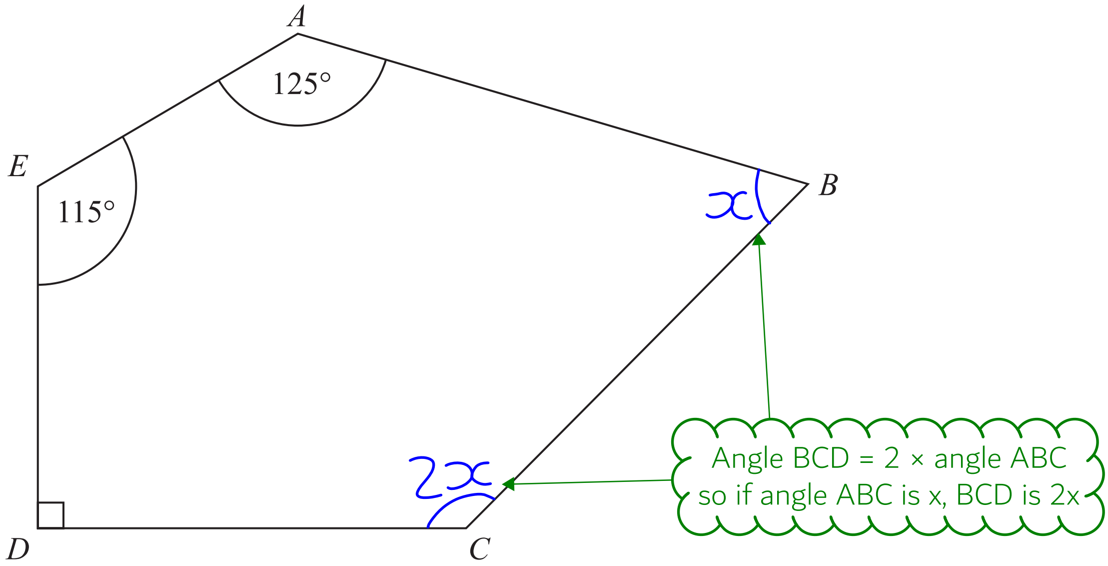
8 *ABCDE* is a pentagon.



Angle $BCD = 2 \times$ angle ABC

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

(n - 2) x 180 is the formula for the total number of degrees in a polygon, where n is the number of sides.

Adding all the angles in the shape gives the total number of degrees. Using this, create an equation in terms of x which can be rearranged and solved

.... °

(Total for Question 8 is 5 marks)

.CG Maths.

Turn over

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

$w = 5.6 \times 10^{-5}$
$d = 1.4 \times 10^{-4}$

(a) Work out the value of T.
Give your answer in standard form correct to 3 significant figures.

a x 10^n where $1 \le a < 10$ and n is a whole number

The first 3 digits are written and the rest of the digits are ignored or written as 0. The 4th digit rounds the 3rd digit

Substitute w and d for the values they are equal to and write the whole expression into the calculator to get the value in ordinary form

$T =$ ....

(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.

Increase w by 10% and d by 5% and put the values back into the formula for T to show that T actually decreases

....

....

(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?

Find the lowest common multiple of 20, 45 and 120. To find this, list out each number as a product of prime factors and multiply together the highest power of each prime. This is the number of seconds it takes for them to all flash at the same time. Then calculate how many times this would happen in an hour

....

(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

x is the original price in 2003. Increase x by 20% then decrease it by 10% and set it equal to £162000. Then rearrange the equation to make x the subject to find the price in 2003

£...

(Total for Question 11 is 3 marks)

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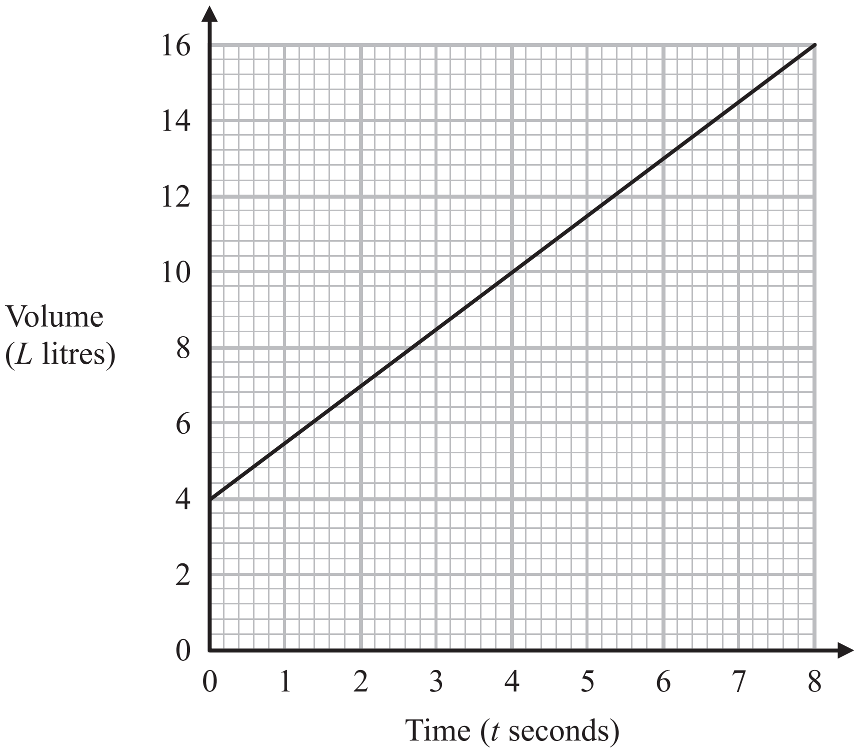
12 The graph shows the volume of liquid (L litres) in a container at time t seconds.



(a) Find the gradient of the graph.

Gradient = change in y/change in x

....

(2)

(b) Explain what this gradient represents.

On a distance-time graph the gradient is speed. This is a volume-time graph

....

....

(1)

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

(c) Explain what this intercept represents.

The time is 0 at this point

....

....

(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.

Square rooting both sides of the ratio gives the ratio of the lengths. Cubing both sides gives the ratio of the volumes

.... 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.

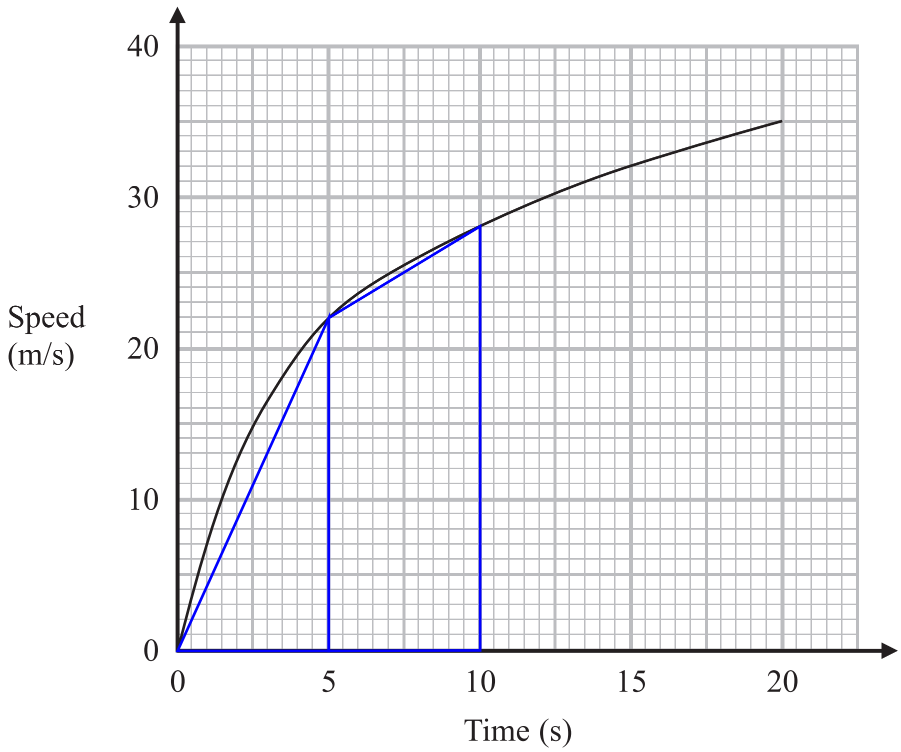
Work out the total number of matches played.

Using the product rule of counting, 16 x 15 gives the total number of matches played if each team plays each other once but it needs to be halved as each match is counted twice (1 match is counted as 2 games as it is a match for 2 of the teams)

....

(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.

The distance is the area under the curve. Two of the strips have been drawn on. Draw the other two strips then find the total area of all of the shapes.

Area of triangle = 1/2 x base x height

Area of trapezium = 1/2 x (a + b) x h, where a and b are the parallel sides and h is the distance between them

.... metres

(3)

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(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.

The distance was the area under the curve. The area of the shapes wasn't exactly the same as this

(1)

(Total for Question 15 is 4 marks)

16 The nth 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.

On the 6th term n = 6. The 6th term can be found by substituting n for 6 and by finding a and b in $an^2 + bn$

a and b can be found by forming and solving simultaneous equations using the terms given

....

(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 nth term of this sequence.

Work out the differences between the first 3 terms of the sequence. Then work out the second difference (the difference of the differences). Halving the second difference gives the number of n^2. Then work out what linear sequence needs to be added to this to get the quadratic sequence

....

(2)

(Total for Question 16 is 6 marks)

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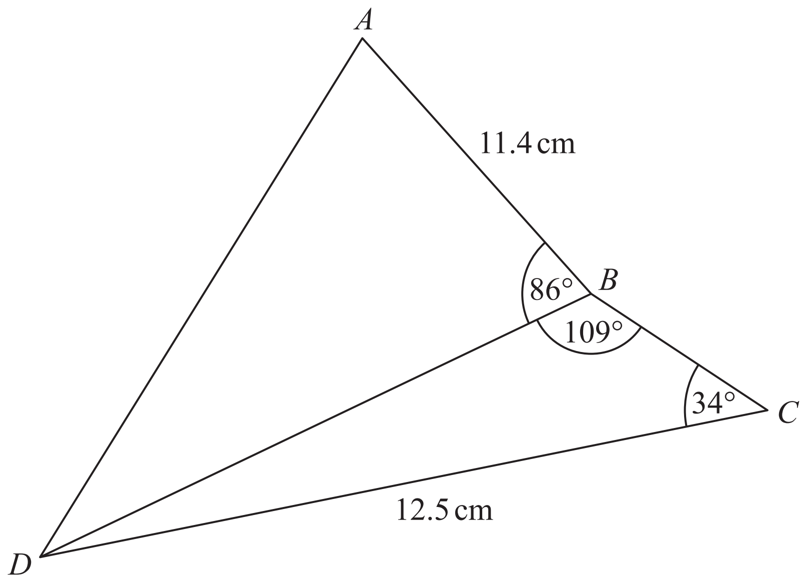
17



Work out the length of *AD*.
Give your answer correct to 3 significant figures.

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

There are opposite pairs of sides and angles in triangle DBC so we can use the sine rule to work out DB

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

There are two sides and the angle between them in triangle DAB so the cosine rule can be used to find AD

.... cm

(Total for Question 17 is 5 marks)

.CG Maths.

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

Start by substituting 1 and 2 into the left side of the equation. One of the solutions should be below 7 and the other solution should be above 7. The function is continuous so the solution to the equation must be between 1 and 2

(2)

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

$x^3 = 7 - x$

(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 $x^3 + x = 7$

$x_1 = \sqrt[3]{7 - x_0}$

$x_2 =$

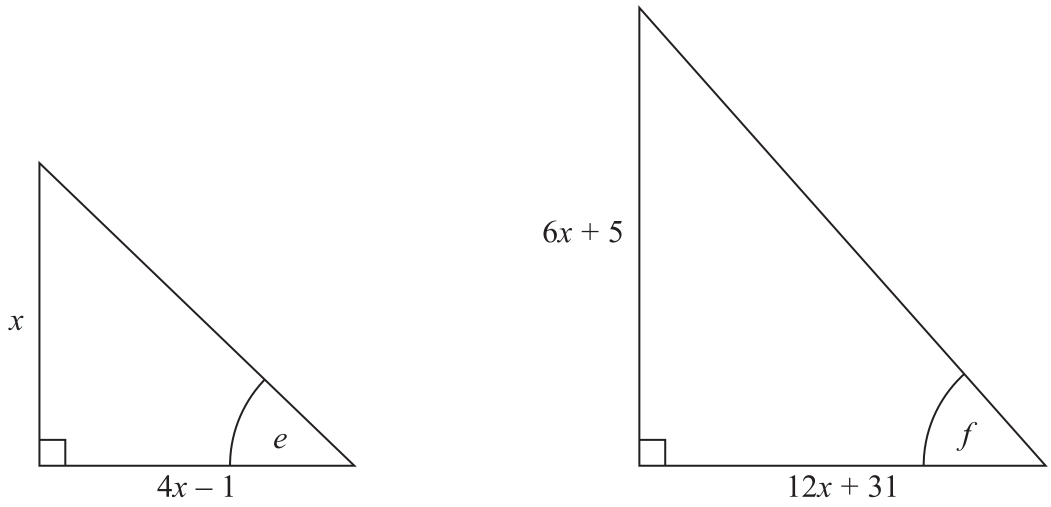
$x_3 =$

....

(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.

$$\frac{O}{T \mid A}$$

From the formula triangle, tan of the angle = opposite/adjacent

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

As the tan of the angles are equal, the opposite/adjacent are equal

Eliminate the denominators by multiplying both sides by them. Then rearrange the equation into the quadratic form $ax^2 + bx + c = 0$ so it can be solved with factorisation. Remember that length can't be negative

....

(Total for Question 19 is 5 marks)

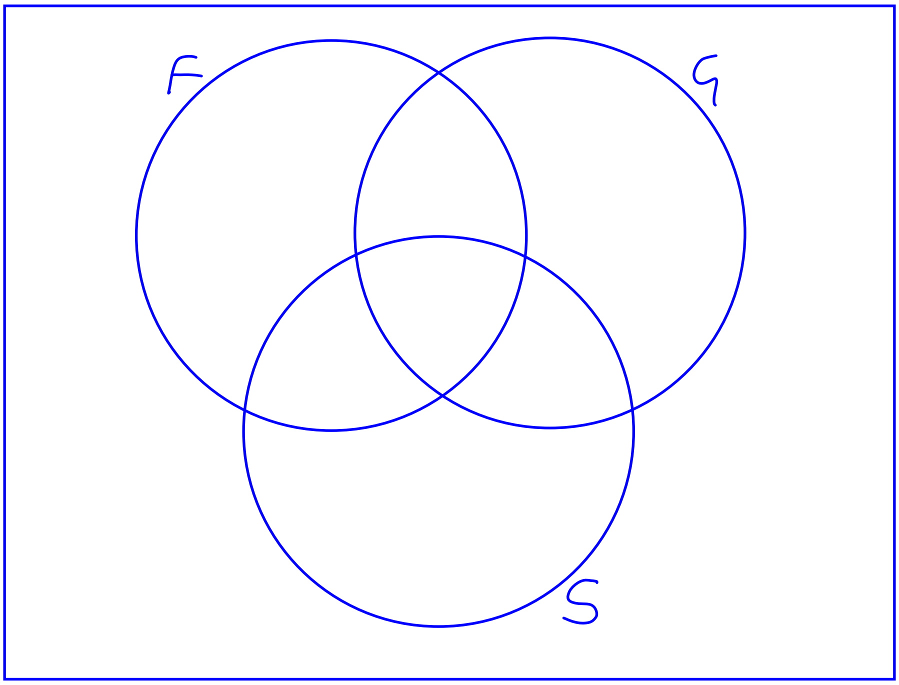
20 50 people were asked if they speak French or German or Spanish.

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.

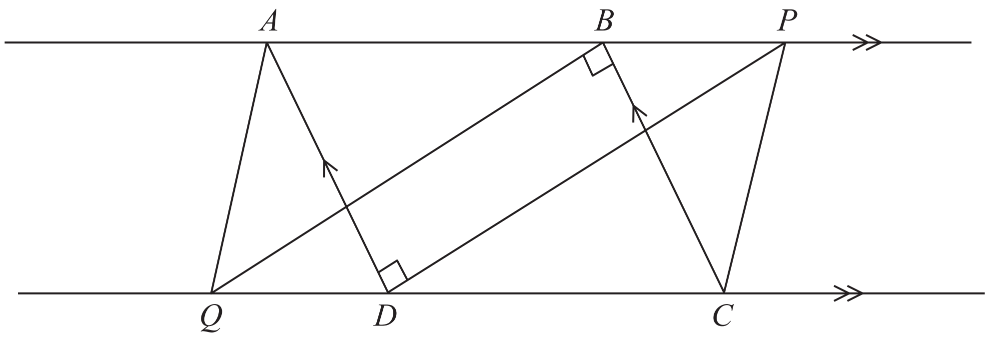


Draw a Venn diagram to organise the information and find out how many only speak Spanish. Then express the number of only Spanish speakers as a fraction of the total people and express the same fraction for the second pick (note that the number of people and Spanish speakers are effected by the first pick). The fractions express the probabilities and need to be combined to get the total probability. We are looking for only Spanish on the first pick AND only Spanish on the second pick

....

(Total for Question 20 is 5 marks)

21



ABCD is a parallelogram.
ABP and *QDC* are straight lines.
Angle *ADP* = angle *CBQ* = 90°

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

To prove triangles are congruent, we can use SSS, SAS or ASA. S stands for side and A stands for angle. For example, if two triangles have three identical sides, they are congruent as SSS.

It can be proved using the following facts: opposite angles in a parallelogram are equal and opposite sides of a parallelogram are equal

(3)

(b) Explain why *AQ* is parallel to *PC*.

AP = QC as they are sides on the congruent triangles

As AP and QC are equal and parallel, APCQ is a...

(2)

(Total for Question 21 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS