

Wednesday 4 June 2025 – Morning**GCSE (9–1) Mathematics****J560/05 Paper 5 (Higher Tier)****Time allowed: 1 hour 30 minutes****You must have:**

- the Formulae Sheet for Higher Tier (inside this document)

You can use:

- geometrical instruments
- tracing paper

Do not use:

- a calculator

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

Centre number

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Candidate number

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First name(s)

Last name

INSTRUCTIONS

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined page at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION

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

ADVICE

- Read each question carefully before you start your answer.



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

Any writing in blue should be written in the exam.

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

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

1 Work out.

(a) -3.5×-4

$$\begin{array}{r} 3.5 \\ \times 4 \\ \hline 14.0 \\ 2 \end{array}$$

← $3.5 \times 4 = 14$, so $-3.5 \times -4 = -14$, which is the same as 14 as the negatives cancel out

(a) 14 [1]

(b) $0.1 \div 0.4$

Multiplying both the 0.1 and the 0.4 by 10 gives $1 \div 4$, which is an equivalent division. This can be left as a fraction

$$\frac{1}{4}$$

(b) $\frac{1}{4}$ [1]

2 An examination has two parts.
A student scores 10 out of 15 marks on Part 1.
They score 4 out of 10 marks on Part 2.

To pass the examination the student needs to score 54% of the total marks.

Show that the student passes the examination.

[3]

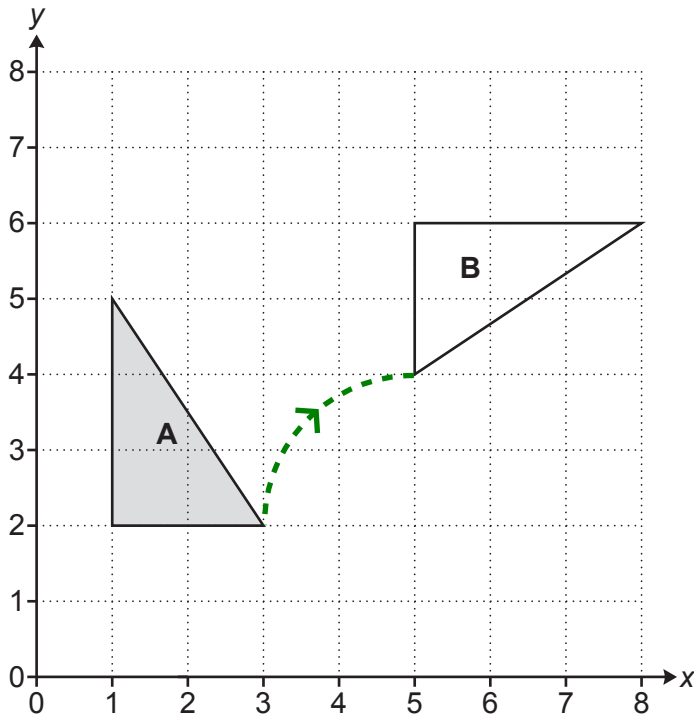
$10 + 4 = 14$ ← Adding the 10 and 4 marks scored finds that the student scores 14 marks in total

$15 + 10 = 25$ ← Adding the 15 and 10 available finds that the total marks is 25

$$\begin{array}{r} 14 \\ \times 4 \\ \hline 56 \\ 1 \end{array}$$

$\frac{14}{25} = \frac{56}{100} = 56\%$ ← 14 out of 25 is scored. This is $14/25$ as a fraction. Multiplying both the numerator and denominator by 4 gives $56/100$, which is equivalent to 56%. The student passes as 56% is more than the 54% needed

- 3 Triangle **A** and triangle **B** are drawn on the coordinate grid.



Describe fully the **single** transformation that maps triangle **A** onto triangle **B**.

Rotation, 90° clockwise, centre (5, 2)

It is the same shape and size but is not the same way up so is a rotation. 90° clockwise as it is a quarter turn. Centre (5, 2) as this is the centre of the circular motion

[3]

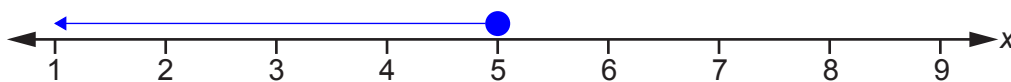
- 4 (a) Solve.

$$4x \leq 20$$

Dividing both sides by 4 gets x on its own

(a) $x \leq 5$ [1]

- (b) Show your solution to part (a) on the number line.



Shaded in circle above 5 as it can be equal to 5.
An arrow going to the left as x can be less than 5

[2]

5 $1\frac{1}{5} + \frac{22}{d} = 1\frac{3}{4}$

Find the value of d .

$$\frac{1}{5} + \frac{22}{d} = \frac{3}{4} \quad \leftarrow \text{Subtracting 1 from both sides cancels out the whole numbers from both sides}$$

$$\frac{22}{d} = \frac{3}{4} - \frac{1}{5} \quad \leftarrow \text{Subtracting } 1/5 \text{ from both sides cancels out the } 1/5 \text{ on the left and gets the term involving } d \text{ on its own}$$

$$= \frac{15}{20} - \frac{4}{20} \quad \leftarrow \text{Multiplying both the numerator and denominator of } 3/4 \text{ by 5 and multiplying both the numerator and denominator of } 1/5 \text{ by 4 makes the denominator of both fractions 20}$$

$$= \frac{11}{20} \quad \leftarrow \text{The numerators can be subtracted and the denominator stays the same}$$

$$= \frac{22}{40} \quad \leftarrow \text{Multiplying both the numerator and denominator by 2 gets the same numerator as on the left}$$

$$22/d = 22/40. \text{ So } d \text{ must be } 40$$

$$d = \dots\dots\dots 40 \quad [3]$$

- 6 Sara and Tom both make a sequence of numbers.
The first term in both sequences is 10.

The term-to-term rule for Sara's sequence is add 14.
The term-to-term rule for Tom's sequence is add 35.

Each sequence stops when a term reaches or goes above 500.

- (a) Find the **number of terms** that are the same in both Sara's and Tom's sequence.
You must show your working.

$$2 \times 7 \leftarrow \text{Expressing 14 as a product of its prime factors}$$

$$5 \times 7 \leftarrow \text{Expressing 35 as a product of its prime factors}$$

$$2 \times 5 \times 7 \leftarrow \text{The lowest common multiple of 14 and 35 is found by multiplying the highest power of each prime number in both lists. So the lowest common multiple of 14 and 35 is 70}$$

10, 80, 150, 220, 290, 360, 430, 500

Listing the terms which appear in both sequences. They both start with 10 and will have the same term every 70. So starting with 10 and counting in 70s and stopping at 500 as the sequences do not go above 500

There are 8 terms in the list

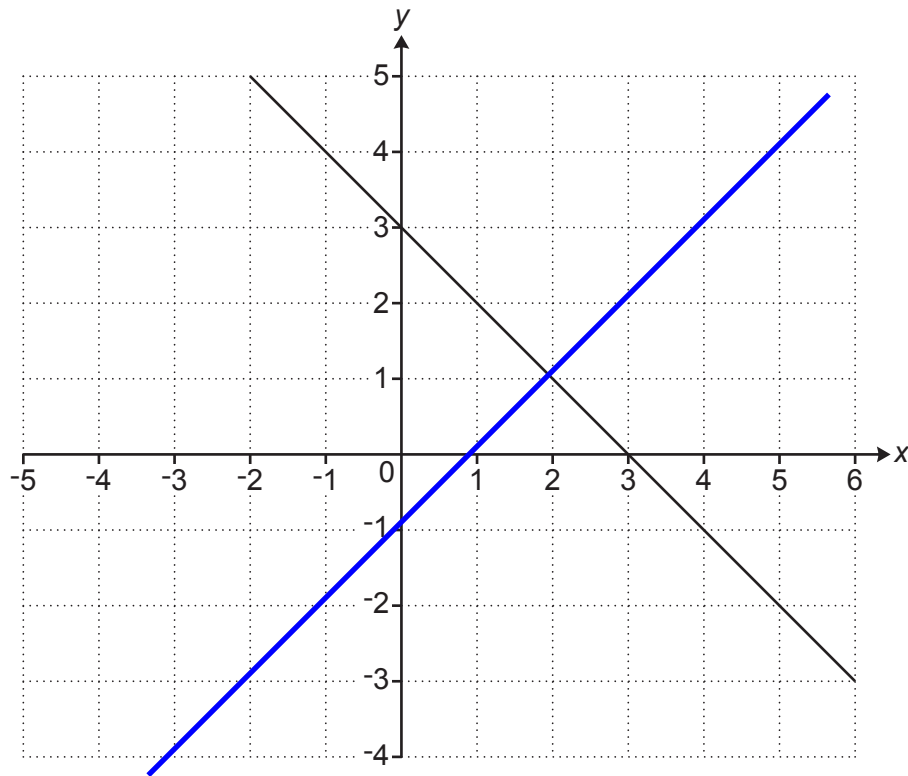
(a) 8 [4]

- (b) Find an expression for the n th term of Sara's sequence.

The sequence increases by 14 between each term so must involve $14n$. Going backward in the sequence finds that the 0th term (the term before the 1st term) would be -4 as $10 - 14 = -4$. So the n th term is $14n - 4$

(b) $14n - 4$ [2]

- 7 The graph of the line $x + y = 3$ is shown on this grid.



- (a) By drawing a suitable line on the grid, solve these simultaneous equations.

$$x + y = 3 \text{ and } y = 2x - 3$$

Drawing the graph of $y = x - 1$. The general equation of a straight line is $y = mx + c$, where m is the gradient and c is the y -intercept. So the gradient is 1 (meaning that it goes up 1 for every 1 it goes to the right) and the y -intercept is -1

Where the two graphs cross are the solutions to the simultaneous equations. They cross at (2, 1). So $x = 2$ and $y = 1$

(a) $x = \dots\dots\dots 2 \dots\dots\dots$
 $y = \dots\dots\dots 1 \dots\dots\dots$

[4]

- (b) Umi says,

The simultaneous equations $y = 2x + 3$ and $2y - 4x = 7$ will have no solutions.

Is Umi correct?

Explain how you decide.

$2y = 4x + 7$ ← Rearranging the 2nd equation into the form $y = mx + c$. Adding $4x$ to both sides

$y = 2x + 3.5$ ← Dividing both sides by 2

Umi is correct because they are parallel

The general equation of a straight line is $y = mx + c$, where m is the gradient. Both lines have the same gradient of 2 so are parallel. This means they will not meet so there are no solutions to the simultaneous equations, which find the coordinates where they meet

[2]

- 8 Three lengths of wood are in the ratio 2 : 5 : 7.
The difference in size between two of the lengths of wood is 30 cm.

Kofi says,

The sum of the three lengths of wood **must be** at least 120 cm.

Is Kofi correct?

Show how you decide.

$$7 - 2$$

The 30 cm could be the difference between the longest and shortest length of wood. This has the greatest number of parts difference so will make each part of the ratio worth the least. Subtracting the 2 parts for the shortest from the 7 parts for the longest finds that 5 parts of the ratio could represent the 30 cm

$$30 \div 5 = 6$$

Dividing the 30 cm by the 5 parts finds that 1 part of the ratio would be worth 6 cm

$$2 + 5 + 7$$

Adding the numbers of parts in the ratio finds that the total length of the wood is represented by 14 parts of the ratio

$$\begin{array}{r} 14 \\ \times 6 \\ \hline 84 \end{array}$$

Multiplying the value of 1 part of the ratio by the 14 parts finds that the sum of the three lengths of wood could be as low as 84 cm

No

The 84 cm is not at least 120 cm, so the sum of the three lengths of wood does not have to be at least 120 cm

Kofi is because

..... [5]

- 9 A school has three terms, Autumn, Spring and Summer.

In class A there were 90 absences in the Autumn term, 120 absences in the Spring term and 40 absences in the Summer term.

Compared to class A, class B had:

- $\frac{3}{10}$ fewer absences in the Autumn term
- 5% more absences in the Spring term
- 7 more absences in the Summer term.

Design and complete a two-way table to show this information.

[6]

$90 \div 10$ ← This finds that $1/10$ of the absences in the Autumn term for class A is 9

9×3 ← Multiplying the value of $1/10$ by 3 finds that $3/10$ of the absences in the Autumn term for class A is 27

$90 - 27 = 63$ ← Subtracting the value of $3/10$ from the 90 finds that there were 63 absences in the Autumn term for class B

$120 \div 10$ ← This finds that 10% of the absences in the Spring term for class A is 12

$12 \div 2$ ← 5% is half of 10% so this finds that 5% of the absences in the Spring term for class A is 6

$120 + 6 = 126$ ← Adding the value of 5% to the 120 finds that there were 126 absences in the Spring term for class B

$40 + 7 = 47$ ← Adding 7 to the 40 finds that there were 47 absences in the Summer term for class B

	Autumn	Spring	Summer
A	90	120	40
B	63	126	47

← Completing a two-way table. There is no need to include the totals at the end of each row and column

- 10 Heidi is x years old.
 Finley is 5 years younger than Heidi.
 Zayn is 4 times Finley's age.

Find an expression in terms of x for the **total** age of Heidi, Finley and Zayn.
 Write your answer as simply as possible.

$$\underline{x + x - 5 + 4x - 20}$$

← Adding expressions for each of their ages in terms of x expresses the total age

← Zayn's age. $4(x - 5) = 4x - 20$

← Finley's age is 5 less than Heidi's age

← Heidi's age

Collecting like terms

$$\dots\dots\dots 6x - 25 \quad [4]$$

- 11 A solid steel cube has a mass of 1.05 kg.
The density of the steel is 7.9 g/cm^3 .

Orla says,

The length of one side of the cube is approximately 10 cm.

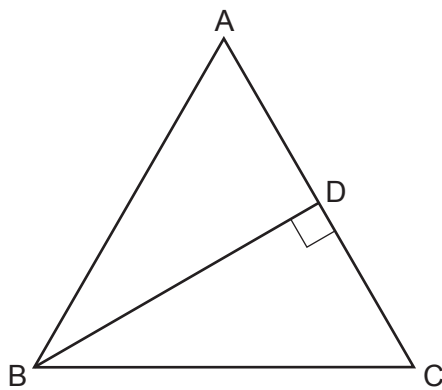
Use estimation to decide if Orla's statement is reasonable.
Show how you decide.

$1 \times 1000 = 1000$	←	The mass is roughly 1 kg. There are 1000 g in 1 kg so the mass is roughly 1000 g
$8 \times 10^3 = 8000$	←	Volume of cube = $\text{length}^3 = 10^3 = 1000 \text{ cm}^3$. Mass = density $\times$ volume. The density is roughly 8 g/cm^3 . So the mass would be roughly 8000 g if the side length was approximately 10 cm
Unreasonable	←	8000 g is not close to 1000 g

Orla's statement is because

.....

..... [5]



Not to scale

ABC is an equilateral triangle.
BD is perpendicular to AC.

Prove that triangle ABD is congruent to triangle CBD.

BD is shared

$AB = BC$ as they are both sides of an equilateral triangle

Angles ADB and BDC are right-angles

RHS

They are both right-angled triangles. The hypotenuse (the longest side) is equal in both triangles. Another of the sides are equal in both triangles

.....

.....

.....

.....

.....

[4]

- 13 p is directly proportional to the square root of m .
 $p = 15$ when $m = 25$.

Find the value of p when $m = 81$.

$$\begin{aligned}
 p &\propto \sqrt{m} && \leftarrow \text{Writing the proportion} \\
 p &= k\sqrt{m} && \leftarrow \text{Multiplying the right side by } k, \text{ which is an unknown constant, convert the proportion into an equation} \\
 15 &= k\sqrt{25} && \leftarrow \text{Substituting 15 for } p \text{ and 25 for } m \\
 15 &= 5k && \leftarrow \left[\sqrt{25} = 5. k \times 5 = 5k \right] \\
 k &= 3 && \leftarrow \text{Dividing both sides by 5 gets } k \text{ on its own} \\
 p &= 3\sqrt{81} && \leftarrow \text{Substituting 3 for } k \text{ and 81 for } m \text{ in the original equation} \\
 &= 3 \times 9 && \leftarrow \left[\sqrt{81} = 9 \right]
 \end{aligned}$$

$$p = \dots\dots\dots 27 \quad [3]$$

- 14 (a) Find the value of $4^{\frac{5}{2}}$.

$$\begin{aligned}
 2^5 &\leftarrow \text{The denominator of the power means to square root. } \sqrt{4} = 2 \\
 2, 4, 8, 16, 32 &\leftarrow \text{Raising 2 to the power of 5 by starting with 2 and keep multiplying by 2 until the 5th number in the sequence is found}
 \end{aligned}$$

$$(a) \quad \dots\dots\dots 32 \quad [2]$$

(b) Simplify.

$$(3x^2)^{-3} \times 9x^8$$

$$\begin{aligned}
 3^{-3}x^{-6} \times 3^2x^8 &\leftarrow \begin{array}{l} \text{Raising both the 3 and the } x^2 \text{ to the power of } -3. (x^2)^{-3} = x^{2 \times -3} = x^{-6}. \\ \text{Expressing 9 as } 3^2 \text{ so that it is also a power of 3} \end{array} \\
 3^{-1}x^2 &\leftarrow \left[3^{-3} \times 3^2 = 3^{-3+2} = 3^{-1}. x^{-6} \times x^8 = x^{-6+8} = x^2 \right]
 \end{aligned}$$

$$3^{-1} = 1/3 \text{ as negative power means to do the reciprocal (one over or flip the fraction)}$$

$$(b) \quad \dots\dots\dots \frac{1}{3}x^2 \quad [4]$$

15 (a) Write $x^2 - 6x + 5$ in the form $(x - a)^2 - b$.

$(x - 3)^2 + 5 - (-3)^2$ ← Completing the square by halving the coefficient of x and putting this in a squared bracket with x then subtracting the square of the -3 from the end

$5 - 9$ ← $(-3)^2 = 9$

$$5 - 9 = -4$$

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

(b) Write down the coordinates of the turning point of $y = x^2 - 6x + 5$.

$y = (x - 3)^2 - 4$. The turning point occurs when the square bracket is equal to zero as this is the minimum value a squared value can be. $x = 3$ for this to happen. When the bracket is equal to zero, $y = -4$

(b) (..... 3 , ... -4 ) [2]

16 Rearrange this formula to make a the subject.

$$p = \frac{a + 2b}{3 - a}$$

$p(3 - a)$ ← Multiplying both sides by $3 - a$ will eliminate the denominator

$3p - ap = a + 2b$ ← Expanding the bracket on the left. The denominator was eliminated on the right

$3p - 2b = ap + a$ ← Adding ap to both sides and subtracting $2b$ from both sides so that all the terms involving a are on the same side and all the terms not involving a are on the other side

$= a(p + 1)$ ← Bringing a out as a factor on the right side

Dividing both sides by $p + 1$ gets a on its own

$$a = \frac{3p - 2b}{p + 1}$$

..... [4]

Frequency on a histogram is represented by the area of each bar. Area of rectangle = base $\times$ height.
So height = area $\div$ base

- 17 The mass of some parcels are recorded.
The table and the histogram each show part of this information.

Mass (m kg)	$0 < m \leq 2$	$2 < m \leq 5$	$5 < m \leq 10$	$10 < m \leq 20$
Frequency	5	12	18	3

$$2 \times 2.5$$

Multiplying the base of the 1st bar by the height of the 1st bar finds that the 1st bar represents a frequency of 5

$$12 \div 3$$

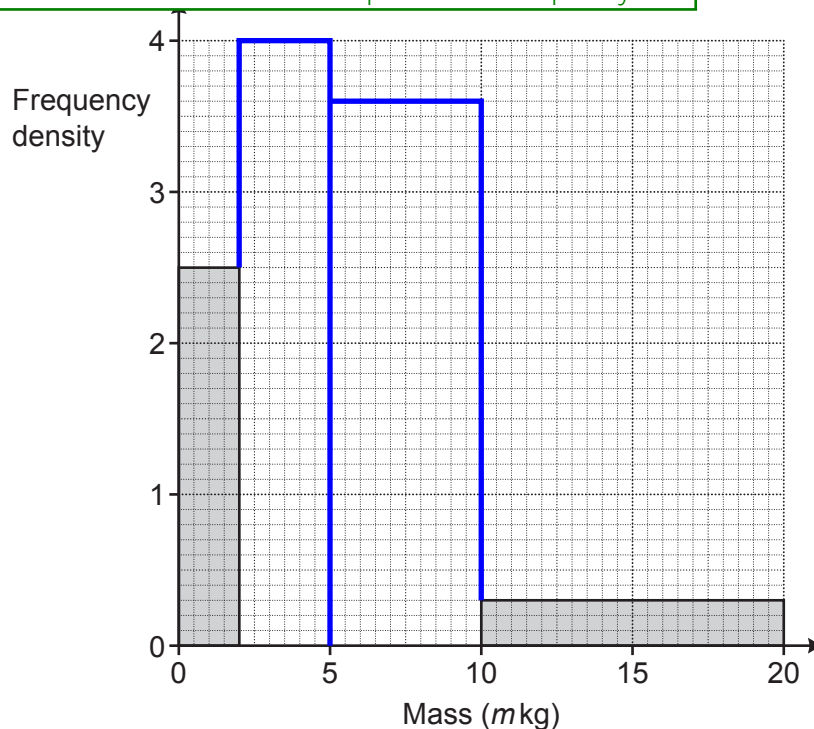
Dividing the area of 12 (as this is the frequency) by the base of 3 finds that the height of the 2nd bar must be 4

$$\begin{array}{r} 0 \ 3. \ 6 \\ 5 \overline{) 18.30} \end{array}$$

Dividing the area of 18 (as this is the frequency) by the base of 5 finds that the height of the 3rd bar must be 3.6

$$10 \times 0.3$$

Multiplying the base of the 4th bar by the height of the 4th bar finds that the 4th bar represents a frequency of 3



- (a) Complete the table and the histogram.

[4]

- (b) The heaviest parcel is 19.5 kg.

Complete the inequality to represent the range, R kg, of the masses of the parcels.

Range = largest - smallest. The smallest mass is $0 < m \leq 2$. So the range could be at least $19.5 - 2 = 17.5$ and must be lower than $19.5 - 0 = 19.5$

(b) 17.5..... $\leq R <$ 19.5..... [2]

18 Work out.

$$1.4\dot{2} \div 0.\dot{2}$$

Give your answer as a mixed number in its simplest form.

You must show your working.

$$x = 1.4\dot{2} \quad \leftarrow \text{Letting } x \text{ be the 1st recurring decimal}$$

$$10x = 14.2\dot{2} \quad \leftarrow \text{There is 1 digit which recurs so multiplying by 10 1 time rewrites the recurring decimal with the recurring digit in the same decimal place}$$

$$9x = 12.8 \quad \leftarrow \text{Subtracting } x \text{ from } 10x \text{ cancels out the recurring digit}$$

$$x = \frac{12.8}{9} \quad \leftarrow \text{Dividing both sides by 9 expresses } x \text{ as a fraction}$$

$$= \frac{128}{90} \quad \leftarrow \text{Eliminating the decimal in the fraction by multiplying both the numerator and denominator by 10}$$

$$y = 0.\dot{2} \quad \leftarrow \text{Letting } y \text{ be the 2nd recurring decimal}$$

$$10y = 2.\dot{2} \quad \leftarrow \text{There is 1 digit which recurs so multiplying by 10 1 time rewrites the recurring decimal with the recurring digit in the same decimal place}$$

$$9y = 2 \quad \leftarrow \text{Subtracting } y \text{ from } 10y \text{ cancels out the recurring digit}$$

$$y = \frac{2}{9} \quad \leftarrow \text{Dividing both sides by 9 expresses } y \text{ as a fraction}$$

$$\frac{128}{90} \div \frac{2}{9} \quad \leftarrow \text{Rewriting the original division with fractions instead of recurring decimals}$$

$$\frac{128}{90} \times \frac{9}{2} \quad \leftarrow \text{To divide fractions: keep the 1st fraction, change the division to a multiplication, flip the 2nd fraction}$$

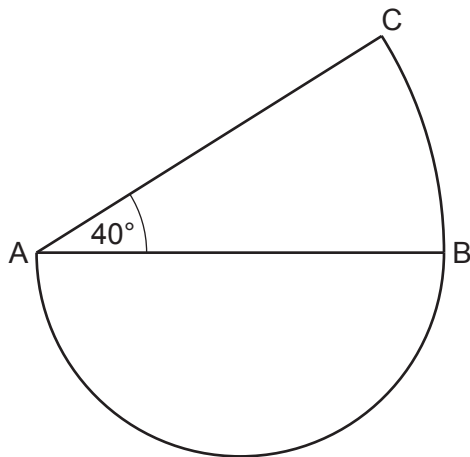
$$\frac{64}{10} \quad \leftarrow \text{Simplifying by dividing the 128 by the 2 to give 64 and dividing the 90 by the 9 to give 10}$$

$$\frac{32}{5} \quad \leftarrow \text{Simplifying by dividing both the numerator and denominator by 2. It cannot go simpler as 32 and 5 cannot be divided by the same amount to get smaller whole numbers}$$

$$\dots\dots\dots 6\frac{2}{5} \quad [5]$$

Converted to a mixed number by dividing the 32 by the 5. The 5 goes into the 32 6 times with a remainder of 2. So the 6 becomes the whole number and the remainder of 2 is left in the fraction

- 19 The diagram shows a shape formed by a semicircle joined to a sector of a circle, BAC, along a common length AB.



Not to scale

The area of the sector BAC is $16\pi \text{ cm}^2$.

Work out the total area of the shape.

Give your answer in terms of π .

You must show your working.

$$\frac{40}{360} = \frac{4}{36} = \frac{1}{9}$$

There are 360° around the centre of a circle. Putting the 40° over the 360° expresses the area of the sector as a fraction of the area of the whole circle. Simplifying the fraction finds that the sector is $1/9$ of a whole circle

$$\frac{1}{9} \times \pi \times AB^2 = 16\pi$$

Area of circle = $\pi \times \text{radius}^2$. AB is the radius of the sector. Doing $1/9$ of the area of the whole circle gives the area of the sector. This must be equal to the 16π

$$AB^2 = 16 \times 9$$

Multiplying both sides by 9 eliminates the $1/9$ on the left. Dividing both sides by π eliminates it from both sides

$$AB = 4 \times 3 = 12$$

Square rooting both sides gets AB on its own. Both the 16 and the 9 can be square rooted. So AB is 12 cm

$$\frac{1}{2} \times \pi \times 6^2$$

Area of circle = $\pi \times \text{radius}^2$. The semicircle is half of a full circle. The radius is 6 cm as it is half of AB

$$18\pi + 16\pi$$

$6^2 = 36$ then $1/2 \times 36 = 18$, so the area of the semicircle is $18\pi \text{ cm}^2$. Adding the area of the sector gives the total area

..... 34π cm^2 [5]

20 Simplify.

$$\frac{x^2 - 36}{x^2 - x - 42}$$

$$\frac{(x + 6)(x - 6)}{(x + 6)(x - 7)}$$

Factorising the numerator using difference of two squares. $A^2 - B^2 = (A + B)(A - B)$.
 $A = x$ and $B = 6$.

Factorising the denominator by finding two numbers which multiply to the -42 and
 add to -1 (as this is the coefficient of the x term). -7 and 6 do this, so putting them
 in brackets with x

$x + 6$ is a common factor to the numerator and denominator so this can be cancelled
 out. There are no other common factors so the fraction does not go any simpler

$$\frac{x - 6}{x - 7}$$

..... [4]

- 21 There are 10 sweets in a bag.
4 of the sweets are red, 4 are green and 2 are yellow.

(a) Charlie says,

The probability of picking the two yellow sweets at random from the bag can be found by working out $\frac{2}{10} \times \frac{2}{10}$.

Write down the assumption that Charlie has made.

The sweet is put back into the bag after the first pick

..... If it was not put back into the bag, the probability for the 2nd yellow would be $\frac{1}{9}$ as there would be one fewer yellow and one fewer in total [1]

- (b) Mia takes one of the 10 sweets from the bag at random and eats it.
Ben then takes a sweet from the bag and eats it.

Find the probability that the bag now holds more red sweets than green sweets.
You must show your working.

GG, GY, YG

Listing the outcomes which will result in more red than green. No red can be picked as this would result in there being 3 red sweets and at least 3 green sweets, so there would not be more red sweets. At least 1 green sweet needs to be picked so that there are fewer than the 4 red sweets

$$\frac{4}{10} \times \frac{3}{9} + \frac{4}{10} \times \frac{2}{9} + \frac{2}{10} \times \frac{4}{9}$$

Green AND green OR green AND yellow OR yellow AND green. AND means to multiply the probabilities. OR means to add the probabilities

$$\frac{12}{90} + \frac{8}{90} + \frac{8}{90}$$

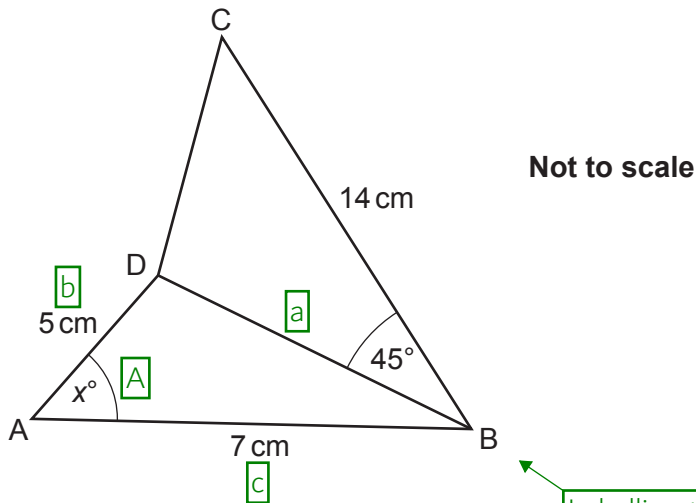
To multiply fractions: multiply the numerators and multiply the denominators

To add fractions: the numerators can be added when the denominators are the same

$$\frac{28}{90}$$

..... [5]

- 22 The diagram shows a quadrilateral ABCD.
DB is a diagonal of the quadrilateral.



AD = 5 cm, AB = 7 cm and BC = 14 cm.
Angle DAB = x° and angle DBC = 45° .

$\cos x^\circ = 0.8$ and $\sin x^\circ = 0.6$.

Work out the area of triangle BDC.
You must show your working.

$$DB^2 = 5^2 + 7^2 - 2 \times 5 \times 7 \times 0.8$$

Triangle ABD does not have a known right-angle. It does not have two opposite pairs of sides and angles. So the cosine rule can be used to find side DB. $a^2 = b^2 + c^2 - 2bccosA$

$$= 25 + 49 - 56$$

$5^2 = 25$. $7^2 = 49$. $2 \times 5 = 10$ then $10 \times 7 = 70$ then $70 \times 0.8 = 56$ (as $70 \times 8 = 560$ then $560 \div 10 = 56$)

$$= 18$$

So $DB^2 = 18$

$$DB = \sqrt{18}$$

Square rooting both sides gets DB on its own

0	30	45	60	90	Listing the angles of 0° , 30° , 45° , 60° , 90° . Under these, listing 0, 1, 2, 3, 4. The 2 is under the 45° . Square rooting the 2 and putting it over 2 finds that $\sin 45^\circ = \frac{\sqrt{2}}{2}$
0	1	2	3	4	

$$\frac{1}{2} \times 14 \times \sqrt{18} \times \frac{\sqrt{2}}{2}$$

Area of triangle = $\frac{1}{2} ab \sin C$, where a and b are two sides and C is the angle between them. $a = DB$, $b = 14$ and $\sin 45^\circ = \frac{\sqrt{2}}{2}$

$$\frac{7 \times 6}{2}$$

$\frac{1}{2} \times 14 = 7$. $\sqrt{18} \times \sqrt{2} = \sqrt{36} = 6$

$$7 \times 6 = 42 \text{ then } 42/2 = 21$$

..... 21 cm^2 [6]

END OF QUESTION PAPER

[illegible]

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