

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

**GCSE
MATHEMATICS****H**

Higher Tier Paper 1 Non-Calculator

Thursday 15 May 2025 Morning Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- mathematical instruments
- the Formulae Sheet (enclosed).

You must **not** use a calculator.**Instructions**

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

Advice

In all calculations, show clearly how you work out your answer.

For Examiner's Use

Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
TOTAL	



Please note that these worked solutions have neither been provided nor approved by AQA 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

Answer **all** questions in the spaces provided.**1** Solve the simultaneous equations

$$2x + 5y = 18 \quad \leftarrow \text{1st equation}$$

$$2x + y = 6 \quad \leftarrow \text{2nd equation}$$

[3 marks]

$$4y = 12 \quad \leftarrow \text{Subtracting the 2nd equation from the 1st equation cancels out the } x \text{ term and leaves an equation only in terms of } y$$

$$\text{Dividing both sides by 4 finds that } y = 3$$

$$2x + 3 = 6 \quad \leftarrow \text{Substituting 3 for } y \text{ in the 2nd equation}$$

$$2x = 3 \quad \leftarrow \text{Adding 3 to both sides gets the } x \text{ term on its own}$$

$$x = \frac{3}{2} \quad y = 3$$

$$\text{Dividing both sides by 2 gets } x \text{ on its own}$$

2 $1.07 < \frac{x}{9} < 1.17$ where x is an **integer**.Work out the value of x .**[2 marks]**

$$\frac{1.07 \times 9}{9.63}$$

 $\leftarrow \text{Multiplying all sides by 9 gets } x \text{ on its own in the middle. So } 9.63 < x \text{ meaning that } x \text{ must be 10 for there to be only one value of } x$

$$x = 10$$



3

A metal solid has volume 11 cm^3 The density of the metal is 8.5 g/cm^3

Work out the mass of the solid.

[2 marks] d^m_v

Writing a formula triangle for density, mass, volume

$$\begin{array}{r}
 85 \\
 \times 11 \\
 \hline
 85 \\
 850 \\
 \hline
 935
 \end{array}$$

Covering m in the formula triangle finds that mass = density $\times$ volume. Ignoring the decimal in 8.5Answer 93.5 g

There is one decimal place in 8.5 which was ignored so the final answer should be divided by 10 once

4

Here are 11 numbers.

2 8 10 12 12 14 19 23 26 31 33

Work out the inter-quartile range.

[2 marks]

$11 + 1$

$12 \div 4 = 3$

Using the formula $(n + 1)/4$, where n is the number of numbers, finds that the quartiles are every 3 numbers along the list when they are in order

$26 - 10$

Counting the first 3 numbers finds that the lower quartile is 10.

Counting another 3 then another 3 numbers finds that the upper quartile is 26. Interquartile range = upper quartile - lower quartile

Answer 16

5

The table shows information about the marks of students in a test.

	Mean mark	Range of marks
School A	61	14
School B	56	21

Tick **one** box for each statement.

[3 marks]

	True	May be true	Not true
On average, School A had higher marks	☒	☐	☐
There are more students in School B	☐	☒	☐
School B had a greater spread of marks	☒	☐	☐

Mean is a type of average and is higher for School A.

There is no data on the number of students and it is impossible to work out.

Range measures the spread and this is greater for School B



6 (a) Work out $0.6 \div 100$

Give your answer in standard form.

[2 marks]

0.006 ← Dividing by 100 can be done by moving the decimal point two times to the left

Answer 6×10^{-3}

6 is at least 1 and less than 10 and must be divided by 10 3 times to get 0.006

6 (b) Work out $40 \times 30 \times 10^5$

Give your answer in standard form.

[2 marks]

1200×10^5 ← $4 \times 3 = 12$ so $40 \times 30 = 1200$

Answer 1.2×10^8

Dividing 1200 by 10 3 times gives 1.2, which is at least 1 and less than 10.
Adding 3 to the power of 10^5 multiplies it by 10 3 times to keep it the same

Turn over for the next question



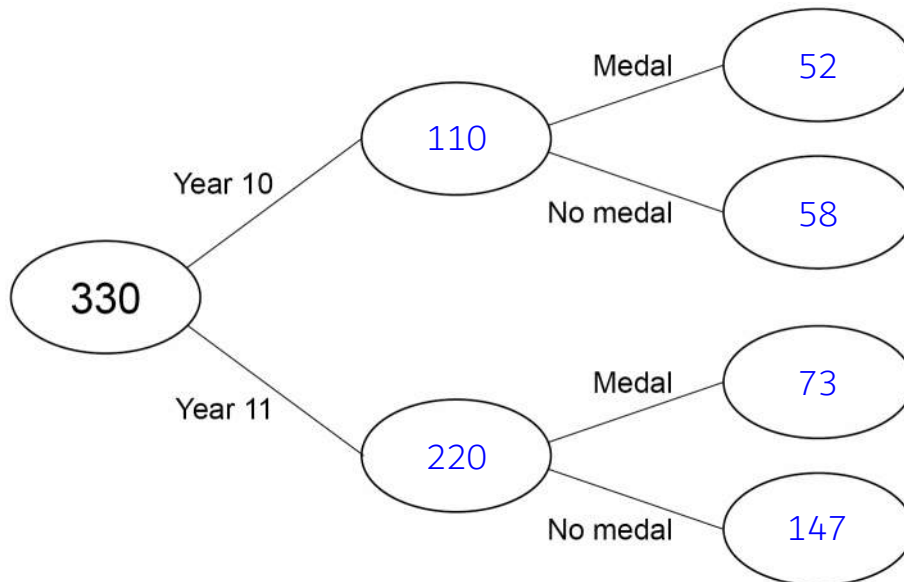
7

330 students from Year 10 and Year 11 take part in a competition.

- number of students in Year 10 : number of students in Year 11 = 1 : 2
- 125 students win a medal.
- 73 of the students who win a medal are in Year 11

Complete the frequency tree.

[4 marks]



$$\begin{array}{r} 110 \\ 3 \overline{) 330} \end{array}$$

1 + 2 = 3 parts in total in the ratio which represent the 330 total students. So dividing the 330 by 3 finds that 1 part of the ratio is worth 110, which is the number of year 10 students

$$\begin{array}{r} 110 \\ \times 2 \\ \hline 220 \end{array}$$

Multiplying the value of 1 part of the ratio by 2 finds that 2 parts of the ratio are worth 220, which is the number of year 11 students

$$\begin{array}{r} 125 \\ - 73 \\ \hline 52 \end{array}$$

Subtracting the 73 year 11 students who win a medal from the 125 students who win a medal finds that 52 year 10 students win a medal

$$\begin{array}{r} 110 \\ - 52 \\ \hline 58 \end{array}$$

Subtracting the 52 year 10 students who win a medal from the 110 year 10 students finds that there are 58 year 10 students who do not win a medal

$$\begin{array}{r} 220 \\ - 73 \\ \hline 147 \end{array}$$

Subtracting the 73 year 11 students who win a medal from the 220 year 11 students finds that there are 147 year 11 students who do not win a medal



8

Work out $\frac{4}{15} + \frac{1}{5} \div \frac{1}{2}$

Give your answer as a fraction.

[3 marks]

$\frac{1}{5} \times \frac{2}{1}$

The order of operations (BIDMAS) must be followed so the division is done first. To divide fractions: keep the 1st fraction, change the division to a multiplication, flip the 2nd fraction

$\frac{2}{5}$

To multiply fractions: multiply the numerators and multiply the denominators

$\frac{4}{15} + \frac{6}{15}$

Multiplying both the numerator and denominator of $\frac{2}{5}$ by 3 to make the denominator 15 so that the fractions can be addedAnswer $\frac{10}{15}$

To add fractions: the denominators must be the same then the numerators can be added

Turn over for the next question

Turn over ►



9

$$y = \frac{1}{x}$$

Which of these values of x gives the **greatest** value of y ?

Circle your answer.

[1 mark]

$$\frac{9}{20}$$

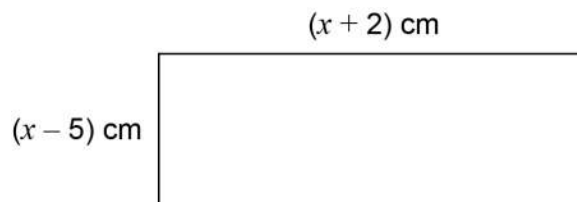
$$\frac{2}{5}$$

-80

95

Dividing 1 by the smallest positive amount will give the greatest value for y . $2/5 = 8/20$, so it is less positive than $9/20$

10



Not drawn
accurately

The area of the rectangle is 120 cm^2

Work out the value of x .

[4 marks]

- 1×8
- 2×9
- 3×10
- 4×11
- 5×12
- 6×13
- 7×14
- 8×15

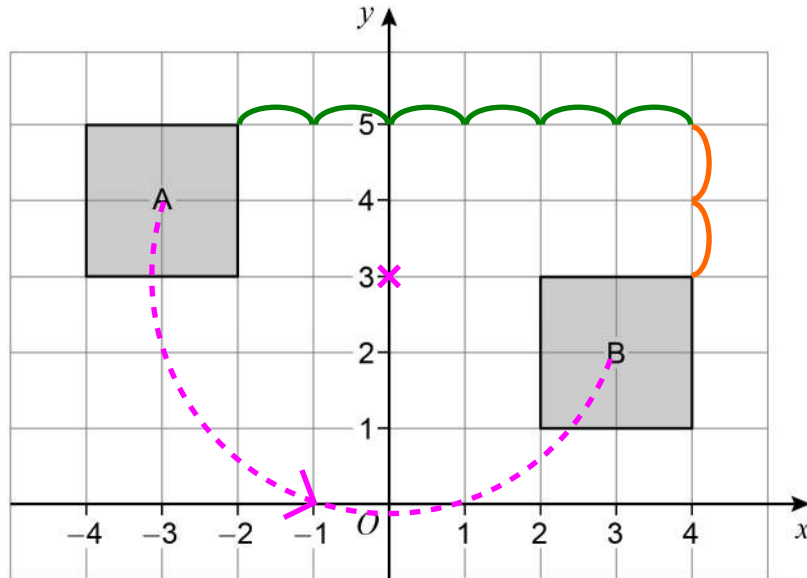
Trial and improvement can be used for this question and is easier than using an algebraic method in this case.

x must be greater than 5 as the width of the rectangle must be greater than 0.
 ← When $x = 6$, $x - 5 = 1$ and $x + 2 = 8$. Area of rectangle = length $\times$ width. Multiplying the length of 8 cm by the width of 1 cm finds that the area of the rectangle would be 8 cm^2 if $x = 6$. This is too small so x must be greater. Increasing x by 1 increases both the length and width by 1 cm. Keep increasing until one of the pairs of length and width multiply to give 120 cm^2 . x must be 13 if $x + 2 = 15$

$$x = \underline{\hspace{2cm} 13 \hspace{2cm}}$$



11



- 11 (a) Write down the **translation vector** that maps shape A to shape B.

[1 mark]

Answer $\begin{pmatrix} 6 \\ -2 \end{pmatrix}$

From A to B it has moved 6 in the x-direction (shown in green) and -2 in the y-direction (shown in orange)

- 11 (b) Describe fully a **rotation** that maps A to B.

[2 marks]

Rotation 180° centre (0, 3)



- 12** Oscar and Nikita share some money in the ratio 8 : 5
Oscar has £27 **more** than Nikita.

How much do they have altogether?

[3 marks]

$$8 - 5$$

Subtracting the 5 parts Nikita gets from the 8 parts Oscar gets finds that Oscar gets 3 more parts than Nikita in the ratio

$$27 \div 3 = 9$$

Dividing the £27 by these 3 parts finds that 1 part of the ratio is worth £9

$$8 + 5$$

This finds that there are 13 parts in total in the ratio

$$\begin{array}{r} 13 \\ \times 9 \\ \hline 117 \\ 2 \end{array}$$

Multiplying the value of 1 part of the ratio by the 13 parts which represent the total amount of money finds that they have £117 altogether

Answer £ 117

- 13** c and d are **consecutive cube numbers**, where $c < 4.5^3 < d$

Work out the value of $d - c$

[2 marks]

$$\begin{array}{r} 16 \\ \times 4 \\ \hline 64 \\ 2 \end{array}$$

Cube numbers are the result of cubing a whole number greater than 0. So c must be 4^3 and d must be 5^3 . $4^3 = 4 \times 4 \times 4 = 16 \times 4 = 64$ and $5^3 = 5 \times 5 \times 5 = 25 \times 5 = 125$

$$\begin{array}{r} 25 \\ \times 5 \\ \hline 125 \\ 2 \end{array}$$

c is 64 and d is 125. Subtracting these finds that $d - c = 61$

$$\begin{array}{r} 0 \\ 125 \\ - 64 \\ \hline 061 \end{array}$$

Answer 61



- 14 (a) Complete the table of values for $y = 2^x$

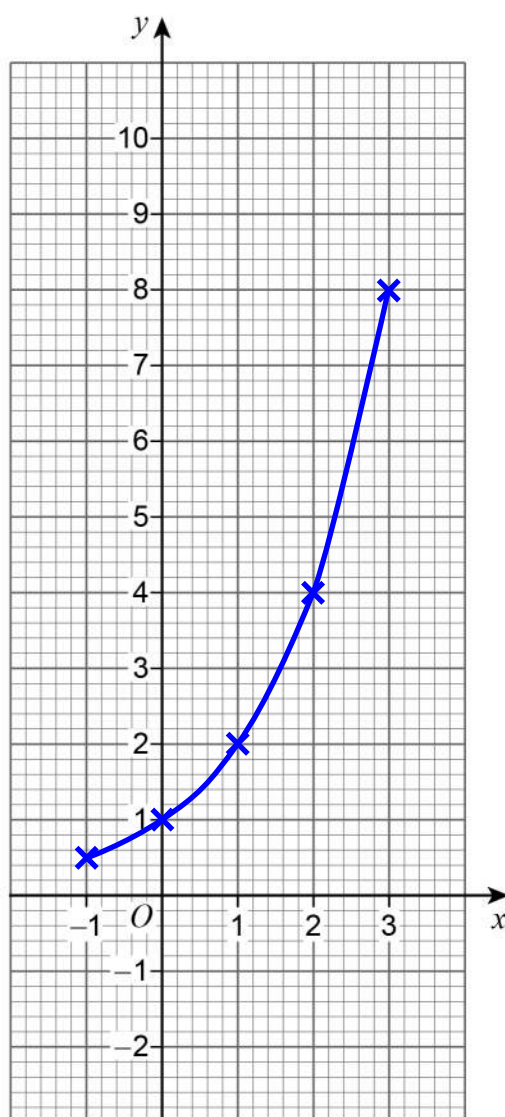
[2 marks]

x	-1	0	1	2	3
y	0.5	1	2	4	8

$2^{-1} = 1/2$ (as negative power does the reciprocal), which is 0.5. $2^1 = 2$ and $2^3 = 2 \times 2 \times 2 = 8$

- 14 (b) Draw the graph of $y = 2^x$ for values of x from -1 to 3

[2 marks]



Plotting the points from the table of values then connecting them with a smooth curve



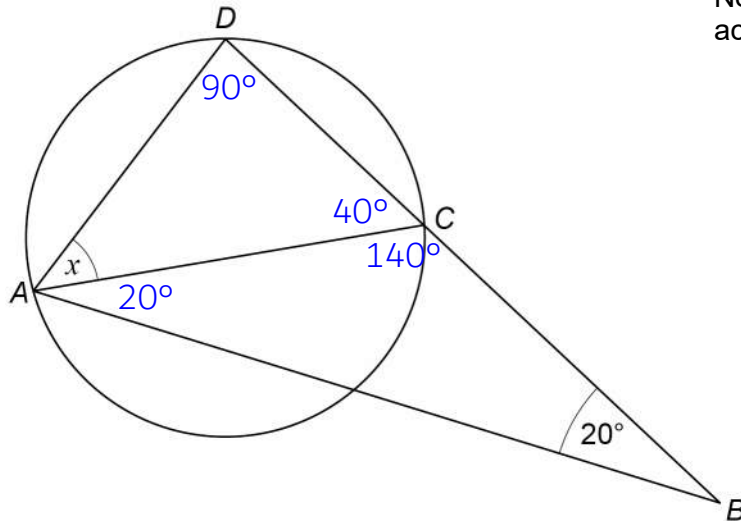
15

A , C and D are points on a circle, diameter AC .

ABC is an isosceles triangle with $AC = BC$

BCD is a straight line.

Not drawn
accurately



Work out the size of angle x .

[4 marks]

Angle $CAB = 20^\circ$ as the base angles of an isosceles triangle are equal. The base angles are opposite the equal sides.

Angle $ACB = 140^\circ$ as there are 180° in total in a triangle. Subtracting both 20° angles from 180° in triangle ABC leaves angle ACB .

Angle $ACD = 40^\circ$ as there are 180° around a point on a straight line. Subtracting the 140° from 180° leaves angle ACD .

Angle $ADC = 90^\circ$ as the angle in a semicircle is a right-angle.

Angle $x = 50^\circ$ as there are 180° in total in a triangle. Subtracting the 40° and 90° from 180° leaves angle x

$$x = \underline{\hspace{2cm} 50 \hspace{2cm}}^\circ$$

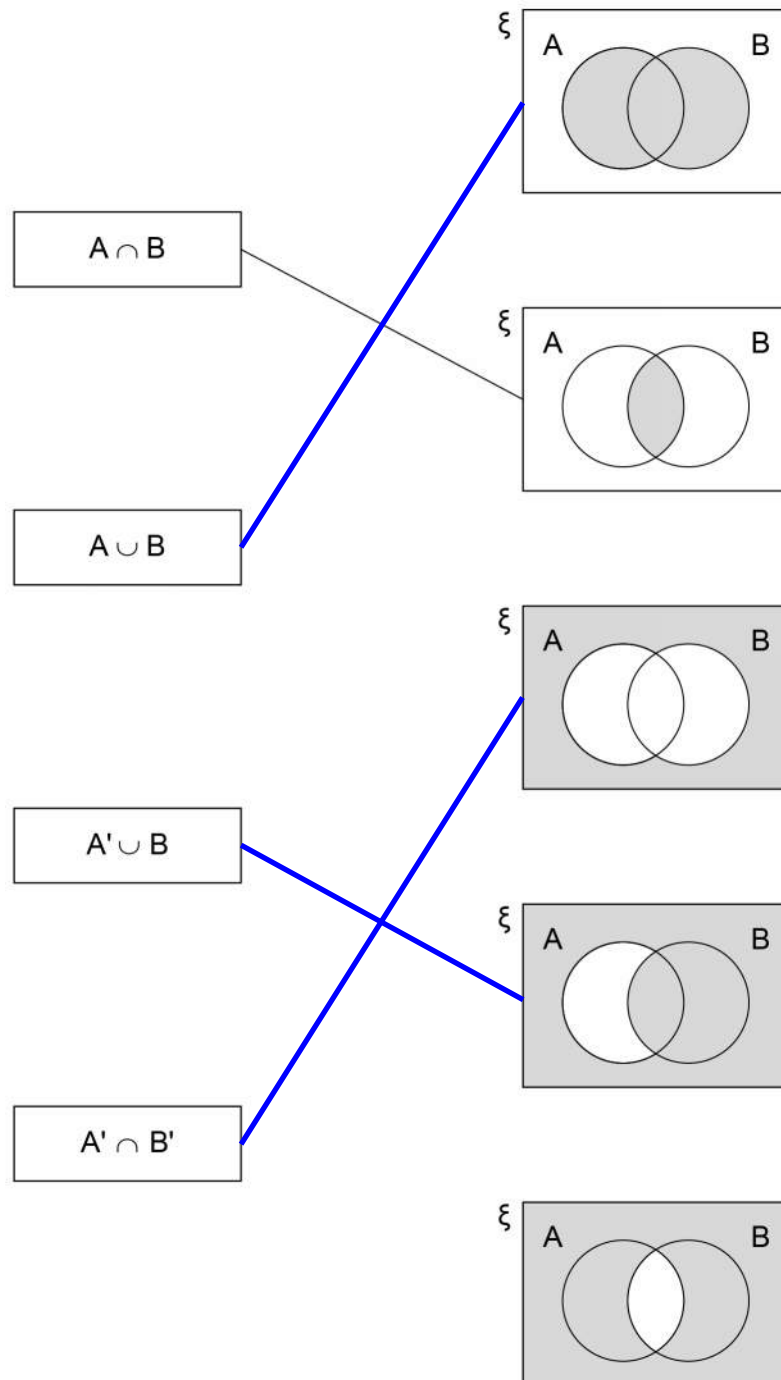


16

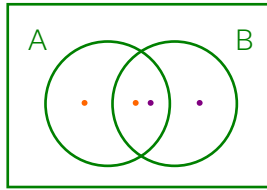
A and B are two events.

Match each box on the left to the correct **shaded** area on the Venn diagrams.

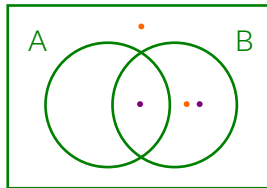
One has been done for you.

[3 marks]

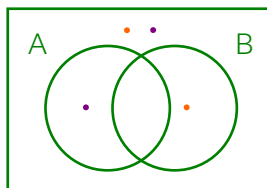
See the next page for an explanation



For $A \cup B$: Putting dots in each section for set A (shown in orange) and putting dots in each section for set B (shown in purple). The union is anywhere there is dots



For $A' \cup B$: Putting dots in each section which is not in set A (shown in orange) and putting dots in each section for set B (shown in purple). The union is anywhere there is dots

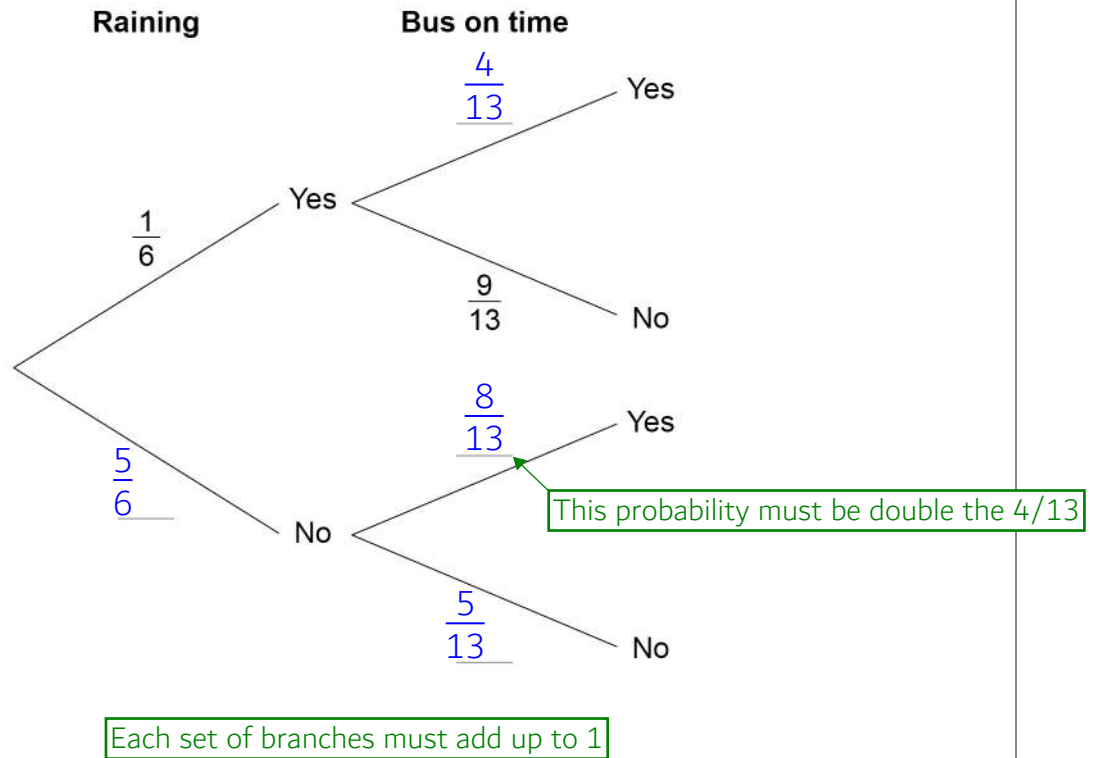


For $A' \cap B'$: Putting dots in each section which is not in set A (shown in orange) and putting dots in each section which is not set B (shown in purple). The intersection is anywhere there are two dots

- 17** A bus is due to arrive at a bus stop at 1 pm
The probability that the bus is on time is **halved** when it is raining.

17 (a) Complete the tree diagram.

[2 marks]



- 17 (b)** Work out the probability that at 1 pm it is raining and the bus is **not** on time.

[2 marks]

$\frac{1}{6} \times \frac{9}{13}$ ← AND means to multiply the probabilities

Answer $\frac{9}{78}$

To multiply fractions: multiply the numerators and multiply the denominators



18 Show that $\frac{\sin 30^\circ \times \cos 45^\circ}{\tan 60^\circ}$ can be written in the form $\frac{\sqrt{a}}{b}$

where a and b are integers.

[3 marks]

0	30	45	60	90
0	1	2	3	4
4	3	2	1	0

Listing the angles $0^\circ, 30^\circ, 45^\circ, 60^\circ, 90^\circ$. Listing 0, 1, 2, 3, 4 under these for the sin values. Square rooting the 1 and putting it over 2 finds that $\sin 30 = 1/2$. Square rooting the 3 and putting it over 2 finds that $\sin 60 = \sqrt{3}/2$. Listing 4, 3, 2, 1, 0 under these for the cos values. Square rooting the 2 and putting it over 2 finds that $\cos 45 = \sqrt{2}/2$. Square rooting the 1 and putting it over 2 finds that $\cos 60 = 1/2$

$$\frac{\sqrt{3}}{2} \div \frac{1}{2}$$

$\tan 60 = \sin 60 \div \cos 60$

$$\frac{\sqrt{3}}{2} \times \frac{2}{1} = \sqrt{3}$$

To divide fractions: keep the 1st fraction, change the division to a multiplication, flip the 2nd fraction. So $\tan 60 = \sqrt{3}$

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

Expressing $\sin 30 \times \cos 45$

$$\frac{\sqrt{2}}{4} \div \frac{\sqrt{3}}{1}$$

To multiply fractions: multiply the numerators and multiply the denominators. Then dividing by $\tan 60$, which is put over 1 so that it is written as a fraction

$$\frac{\sqrt{2}}{4} \times \frac{1}{\sqrt{3}}$$

To divide fractions: keep the 1st fraction, change the division to a multiplication, flip the 2nd fraction

$$\frac{\sqrt{2}}{4\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

To multiply fractions: multiply the numerators and multiply the denominators. Then rationalising the denominator by multiplying both the numerator and denominator by $\sqrt{3}$

$$\frac{\sqrt{6}}{12}$$

To multiply fractions: multiply the numerators and multiply the denominators

Turn over for the next question



19 (a) Work out the value of $\left(\frac{9}{16}\right)^{-\frac{3}{2}}$

[3 marks]

$$\frac{3}{4}$$

First dealing with the denominator of the power. The over 2 means to square root, which square roots both the numerator and denominator

$$\frac{27}{64}$$

Then dealing with the 3, which means to cube

Answer $\frac{64}{27}$

Then dealing with the negative, which means to do the reciprocal

19 (b) $\sqrt{125} = 5^n$

Work out the value of n .

[2 marks]

$n = \frac{3}{2}$

125 is 5^3 . Then it is square rooted so the denominator of the power must be 2



20 Express $\sqrt{44} + \sqrt{99} + \sqrt{275}$ in the form $a\sqrt{n}$ where a and n are integers.

[3 marks]

$$\sqrt{4}\sqrt{11} = 2\sqrt{11} \leftarrow \text{Simplifying } \sqrt{44} \text{ using } \sqrt{a} \times \sqrt{b} = \sqrt{ab}$$

$$\sqrt{9}\sqrt{11} = 3\sqrt{11} \leftarrow \text{Simplifying } \sqrt{99} \text{ using } \sqrt{a} \times \sqrt{b} = \sqrt{ab}$$

$$11 \overline{) \begin{array}{r} 0 \ 2 \ 5 \\ 2 \ 7 \ 5 \end{array}} \leftarrow \text{The } \sqrt{275} \text{ must also simplify to something involving } \sqrt{11} \text{ so that only one surd is involved. So dividing it by } \sqrt{11} \text{ to find that it must be } \sqrt{25}\sqrt{11}$$

$$\sqrt{25}\sqrt{11} = 5\sqrt{11} \leftarrow \text{Simplifying } \sqrt{275} \text{ using } \sqrt{a} \times \sqrt{b} = \sqrt{ab}$$

$$2 + 3 + 5 \leftarrow \text{Adding the coefficients of the } \sqrt{11}$$

Answer $\underline{\hspace{10em}} 10\sqrt{11}$

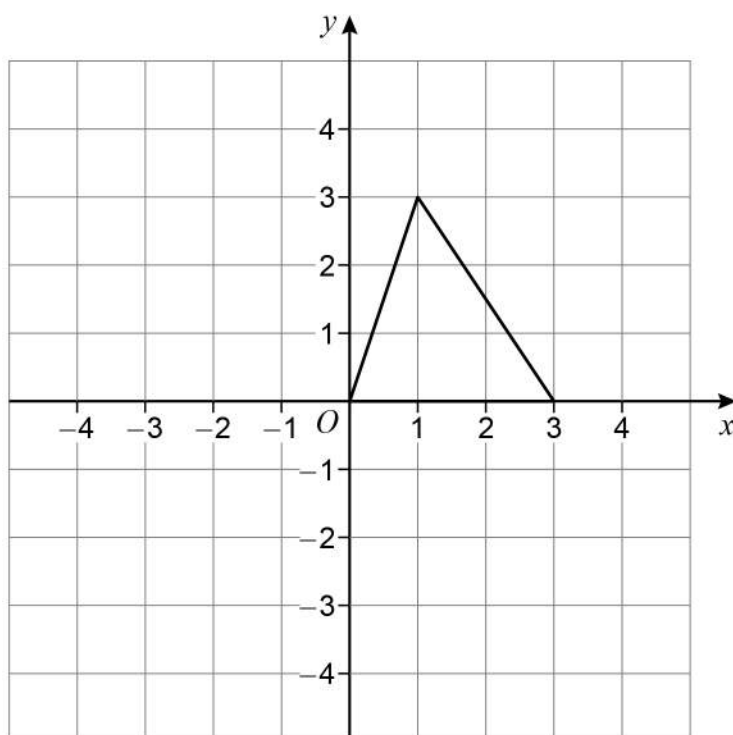
$$2x + 3x + 5x = 10x, \text{ so } 2\sqrt{11} + 3\sqrt{11} + 5\sqrt{11} = 10\sqrt{11}$$

Turn over for the next question

Turn over ►

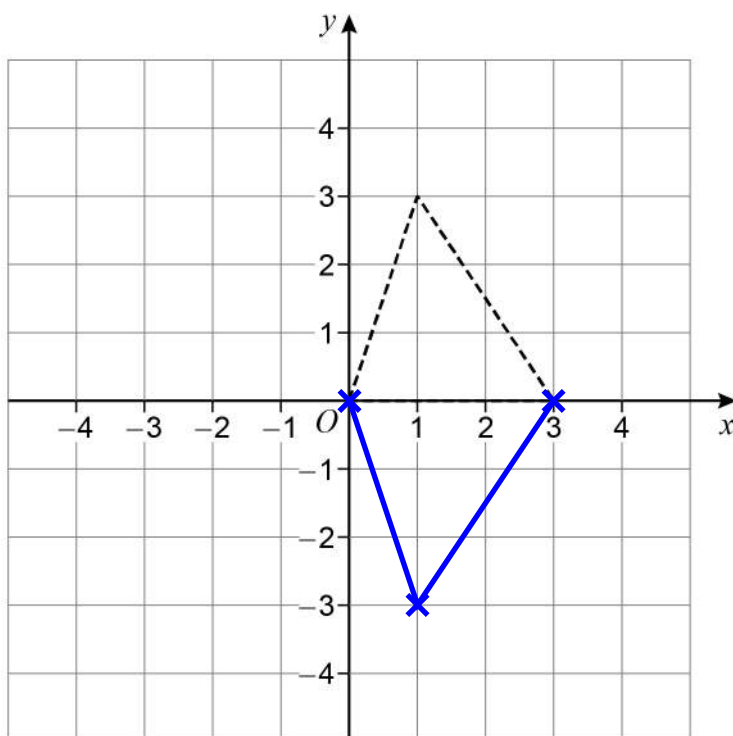


- 21** The graph of $y = f(x)$ for $0 \leq x \leq 3$ is shown.



- 21 (a)** On the grid below, draw the graph of $y = -f(x)$ for $0 \leq x \leq 3$.
The graph of $y = f(x)$ is shown to help you.

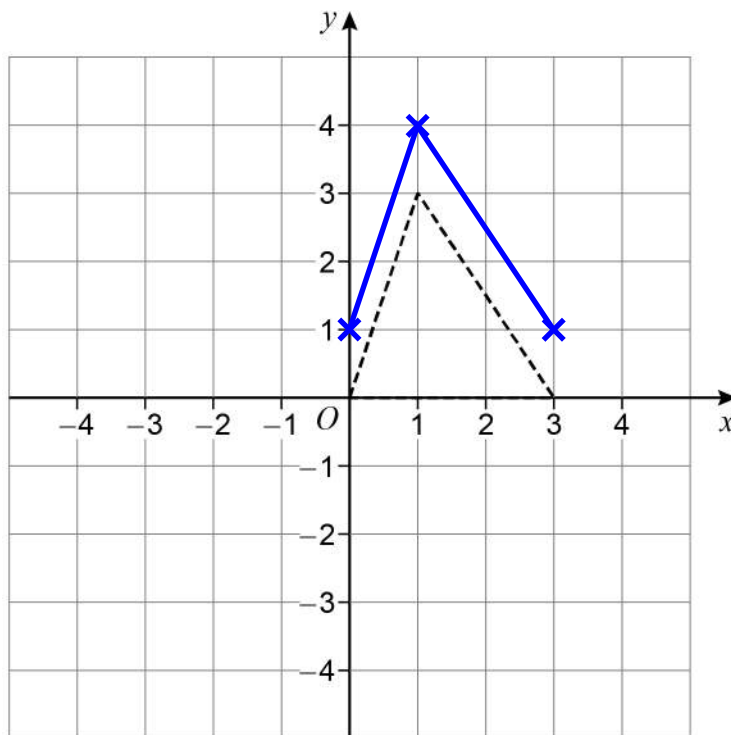
[1 mark]



Reflection in the x-axis

- 21 (b)** On the grid below, draw the graph of $y = f(x) + 1$ for $0 \leq x \leq 3$
The graph of $y = f(x)$ is shown to help you.

[1 mark]



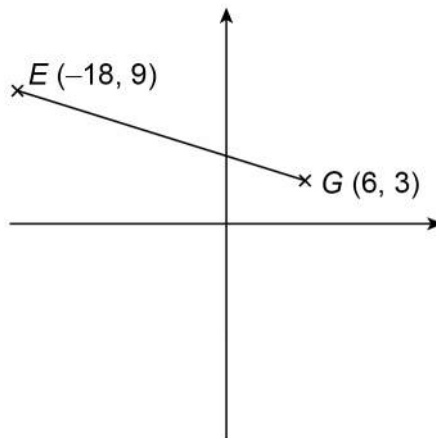
Moves upwards 1

Turn over for the next question

Turn over ►



22

Here is a sketch of straight line EG .

F is a point on EG such that $EF = \frac{1}{3} EG$

Work out the coordinates of F .

[3 marks]

$$6 - (-18)$$

$$6 + 18$$

$$24 \div 3$$

$$-18 + 8$$

$$3 - 9$$

$$-6 \div 3$$

$$9 - 2$$

Subtracting the x-coordinate of E from the x-coordinate of G finds that the distance EG is 24 in the x-direction. Double negative becomes positive

Dividing the distance EG in the x-direction by 3 finds that distance EF must be 8 in the x-direction

Adding distance EF in the x-direction to the x-coordinate of E finds that the x-coordinate of F is -10

Subtracting the y-coordinate of E from the y-coordinate of G finds that the distance EG is -6 in the y-direction

Dividing the distance EG in the y-direction by 3 finds that distance EF must be -2 in the y-direction

Adding distance EF in the y-direction to the y-coordinate of E finds that the y-coordinate of F is 7

Answer (-10 , 7)



23 (a) Write $x^2 + 12x + 50$ in the form $(x + a)^2 + b$ where a and b are integers.

[2 marks]

$(x + 6)^2 + 50 - 36$ ← Completing the square by halving the coefficient of x , putting this in a bracket with x , squaring the bracket, subtracting the square of half of the coefficient of x from the end

Answer $(x + 6)^2 + 14$

23 (b) A curve has the equation $y = (x - 3)^2 - 8$

Write down the coordinates of the turning point of the curve.

[2 marks]

Answer (3 , -8)

The turning point is when the squared bracket is worth 0. $x = 3$ for this to happen. When the squared bracket is worth 0, $y = -8$

Turn over for the next question

Turn over ►



24

Prove that

$$\frac{60x^4 - 15x^2}{-2x - 1} \times \frac{1}{6x - 3}$$

can never be positive.

[4 marks]

$$15x^2(4x^2 - 1) \leftarrow \text{Factorising the numerator of the 1st fraction}$$

$$\frac{15x^2(2x + 1)(2x - 1)}{-(2x + 1)} \times \frac{1}{3(2x - 1)}$$

Fully factorising all the numerators and denominators of both fractions. Using difference of two squares: $A^2 - B^2 = (A + B)(A - B)$. Bringing out a negative on the denominator of the 1st fraction so that the $2x + 1$ will cancel out

$$\frac{15x^2}{-1} \times \frac{1}{3} \leftarrow \text{Cancelling out the common factors to the numerators and denominators}$$

$$\frac{15x^2}{-3} \leftarrow \text{To multiply fractions: multiply the numerators and multiply the denominators}$$

x^2 cannot be negative. Multiplying x^2 by 15 will not make it negative. Dividing $15x^2$ by -3 cannot be positive

The only way of getting a positive when dividing by a negative is by dividing a negative by a negative



25

There are n counters in a box.

6 of the counters are black.

Two counters are chosen at random without replacement.

The probability that **both** counters are black is $\frac{1}{8}$

Use an algebraic method to work out the value of n .

[5 marks]

$$\frac{6}{n} \times \frac{5}{n-1}$$

Black AND black. AND means to multiply the probabilities. 6 out of the n counters are black for the 1st pick. There is one fewer black and one fewer in total for the 2nd pick

$$\frac{30}{n^2 - n} = \frac{1}{8}$$

To multiply fractions: multiply the numerators and multiply the denominators. This must be equal to the $1/8$

$$240 = n^2 - n$$

Multiplying both sides by the denominators to eliminate them

$$n^2 - n - 240 = 0$$

Subtracting 240 from both sides puts it into the quadratic form

10, 24

12, 20

15, 16

Listing the factor pairs of 240 (starting with 10 and 24) until they would add to the -1 (the coefficient of n) and multiply to the -240 when one of the pair is negative

$$(n + 15)(n - 16) = 0$$

Factorising the left side. 15 and -16 add to -1 and multiply to -240 so putting these in brackets with x

$$n = \underline{\hspace{10em} 16 \hspace{10em}}$$

Either $n + 15 = 0$ (so $n = -15$, but n cannot be negative) or $n - 16 = 0$ (so $n = 16$)

END OF QUESTIONS

