AQA Paper 3H Practice Booklet

26 practice questions based on the advance information

Copies of this booklet, as well as hints & solutions, are available at bossmaths.com/advanceinfo

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Question 1

Write these in order of size, starting with the smallest:

$0.\dot{4}7\dot{8}$ $\qquad$ 0.478 $\qquad$ $0.47\dot{8}$ $\qquad$ $0.4\dot{7}\dot{8}$

$= 0.478478...$ $\qquad\qquad$ $= 0.4788...$ $\quad = 0.47878...$

Order: 0.478, $0.4\dot{7}\dot{8}$, $0.47\dot{8}$, $0.\dot{4}7\dot{8}$

Question 2

This diagram shows that there are three possible paths from A to B, five paths from B to C, and two paths from C to D. The arrowheads on each path show the direction of travel allowed on each path.
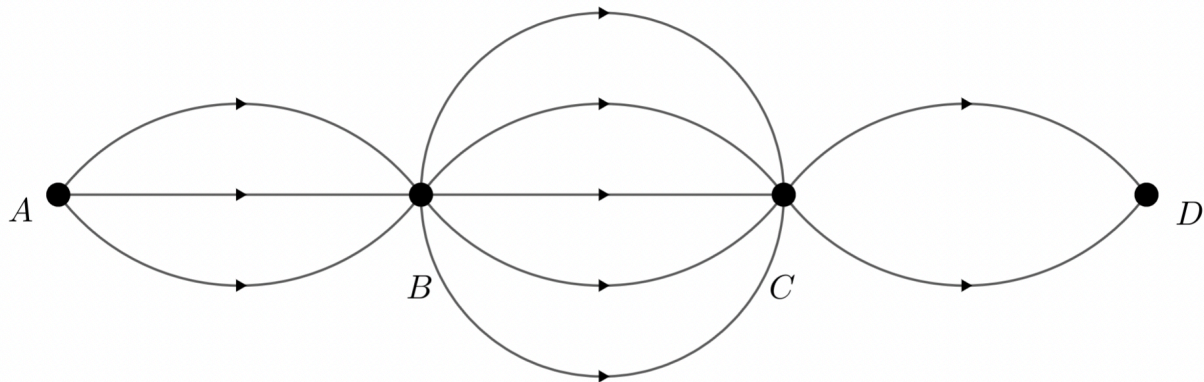
Assuming it is only possible to travel along each path in the direction of D, how many different routes are there from A to D?

$3 \times 5 \times 2 = \underline{30\ \text{routes}}$

Question 3

$x = 0.4$ correct to 1 decimal place
$y = 7200$ correct to 2 significant figures

Find the error interval for xy

	UB	LB
x	0.45	0.35
y	7250	7150

$$2502.5 \leqslant xy < 3262.5$$

Question 4

(a) Factorise $16x^2 - 9$

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

(b) Expand and simplify $t(7t - 4) - 5(7t - 4) + t(4 - 7t) + 3(7t - 4)$
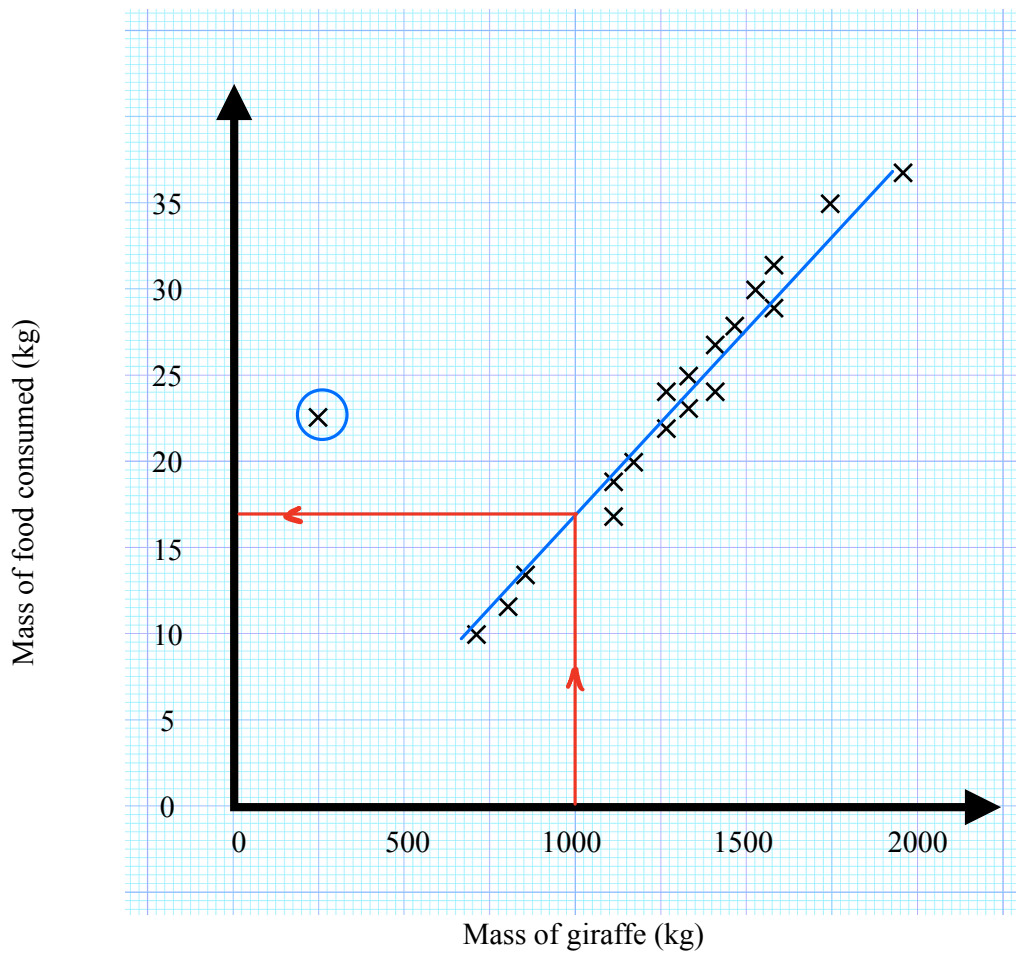
$$\equiv t(7t - 4) - 5(7t - 4) - t(7t - 4) + 3(7t - 4)$$

$$\equiv (t - 5 - t + 3)(7t - 4)$$

$$\equiv -2(7t - 4)$$

$$\equiv -14t + 8$$

Question 5

This scatter diagram shows information on the masses of food consumed in a day by 19 giraffes in a zoo, and the masses of those giraffes.

(a) An error was made when recording the mass of one giraffe. On the scatter diagram, circle the plot that is most likely to correspond to this giraffe.

(b) Draw a line of best fit on this diagram.

(c) Another giraffe was recorded as having a mass of 1000 kg. Use your line of best fit to estimate the mass of food consumed by this giraffe.

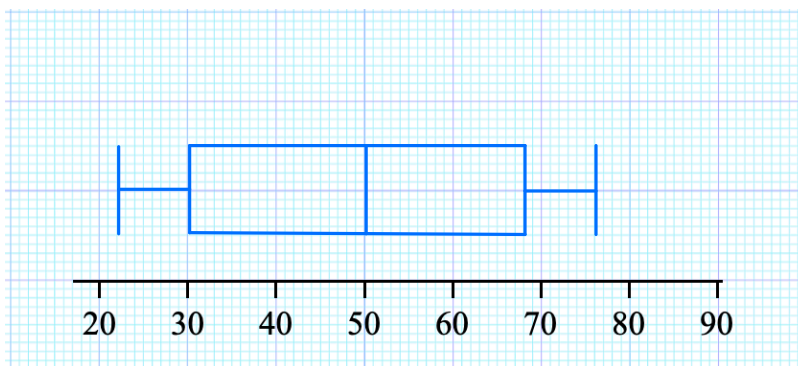17 kg

Question 6

A group of Year 10 students sit a test. The lowest mark achieved is 22. The median mark achieved is 50. The range in marks is 54. The upper quartile 68 and the interquartile range was 38.

Draw a box plot showing this information.

Question 7

Jasmine flipped a 10p coin, a 20p coin, and a £1 coin fifty times each.
The 10p coin came up tails 23 times. The £1 coin came up heads 24 times. Across the three coins, tails came up a total of 70 times.

Complete this two-way table.

	10p	20p	£1	Total
Heads	27	29	24	80
Tails	23	21	26	70
Total	50	50	50	150

Question 8

The bearing of *B* from *A* is 241°. Work out the bearing of *A* from *B*.

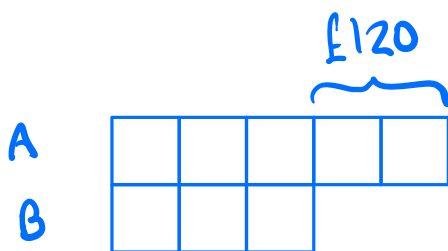Opposite directions $\Rightarrow$ difference between the bearings is 180°

$$241 - 180 = 61$$

So the bearing is __061°__

Question 9

Amy and Bob would like to share some money in the ratio 5 : 3 so that Amy gets £120 more than Bob.

How much money should they each receive?

£120

i.e. each box is worth £60

so

Amy gets 5 × £60 = £300

Bob gets 3 × £60 = £180

Question 10

Sarah travels 120 miles from London to Leicester at an average speed of 40 mph.
She later travels 120 miles from Leicester to York at an average speed of 60 mph.

Calculate Sarah's average speed for her journey from London to York.

Time taken

London – Leicester $\dfrac{120 \text{ miles}}{40 \text{ mph}} = 3 \text{ hours}$

Leicester – York $\dfrac{120 \text{ miles}}{60 \text{ mph}} = 2 \text{ hours}$

Overall average speed $= \dfrac{240 \text{ miles}}{5 \text{ hours}} = \underline{48 \text{ mph}}$

Question 11

James invests £1350 into a savings account on 1 January 2022.
The account pays 5.8% compound interest on 1 January each subsequent year.
In which year will the amount in James' account first exceed £2000?

$$£1350 \times 1.058^6 < £2000$$
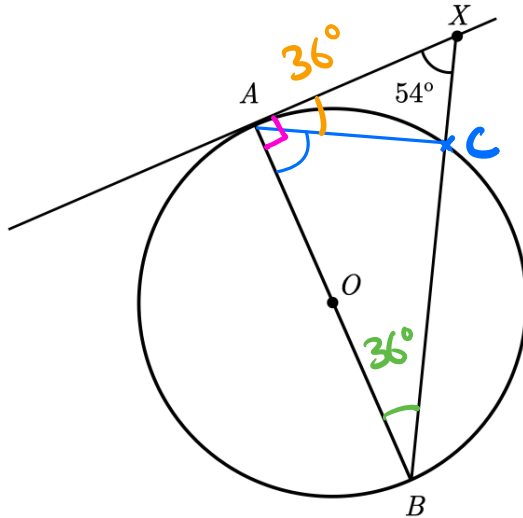
$$£1350 \times 1.058^7 > £2000$$

i.e. it takes 7 years, so $\underline{2029}$.

Question 12

The diagram shows a circle with centre O, a tangent to the circle at point A, point X on the tangent, diameter AB, and a line segment BX.

Angle $AXB = 54°$

BX intersects the circle at two points: B and C.

(a)   Label the point C on the diagram.

(b)   Work out the size of angle BAC. Give reasons for your answer

$\angle XAB = 90°$ (angle between a tangent and diameter or radius)

$\angle ABX = 180 - 90 - 54 = 36°$ (angles in a triangle add up to $180°$)
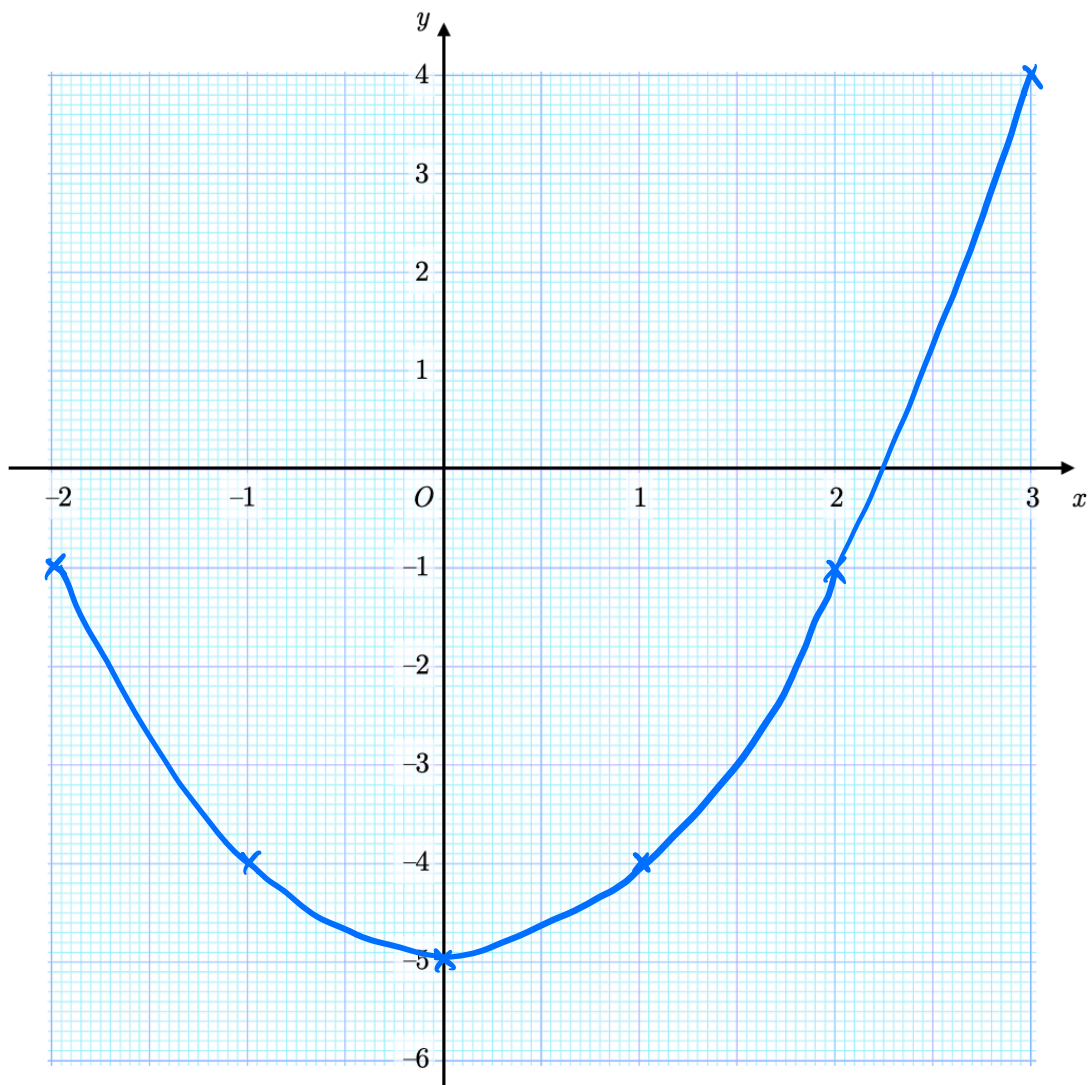
$\angle XAC = 36°$ (alternate segment theorem)

$\angle BAC = 90 - 36 = \underline{54°}$

Question 13

(a) Complete the table of values for $y = x^2 - 5$

x	-2	-1	0	1	2	3
y	-1	-4	-5	-4	-1	4

(b) On the grid, draw the graph of $y = x^2 - 5$ for values of x from -2 to 3.

(c) Write down the coordinates of the turning point of the graph. $(0, -5)$

Question 14

Work out $\begin{pmatrix} 5 \\ 7 \end{pmatrix} + \begin{pmatrix} 3 \\ 14 \end{pmatrix} =$ $\begin{pmatrix} 8 \\ 21 \end{pmatrix}$

Question 15

① The highest common factor of m and n is 21.
② The lowest common multiple of m and n is 126.
③ m is an even number less than 50.

Find the values of m and n.

① m and n are multiples of 21

② m and n are factors of 126

So m and n could be 21, 42, 63, 126.

$\underline{M = 42}$ because ③

$\underline{n = 63}$ because it is the only one of the four possible numbers that gives the correct HCF and LCM.
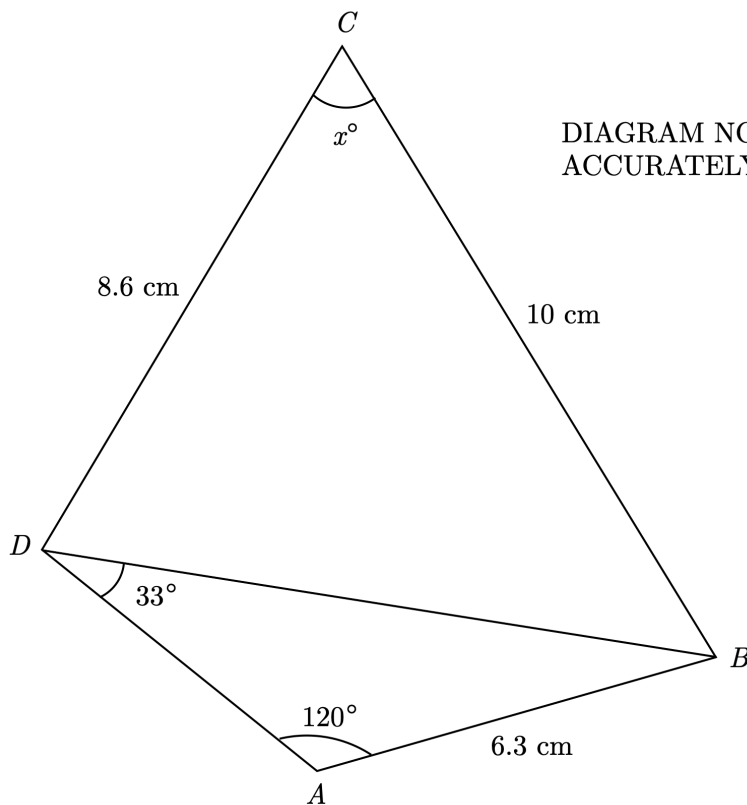
Question 16

ABCD is a quadrilateral.

C

$x°$

DIAGRAM NOT
ACCURATELY DRAWN

8.6 cm

10 cm

D

33°

B

120°

6.3 cm

A

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

$\Rightarrow \cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

$\Rightarrow A = \cos^{-1}\left(\dfrac{b^2 + c^2 - a^2}{2bc}\right)$

Find the value of *x*.

$\dfrac{BD}{\sin(120)} = \dfrac{6.3}{\sin(33)} \Rightarrow BD = \dfrac{6.3\sin(120)}{\sin(33)} = 10.017... \text{ cm}$

$x = \cos^{-1}\left(\dfrac{8.6^2 + 10^2 - 10.017...^2}{2 \times 8.6 \times 10}\right)$

$= \underline{64.7°}$ to 3 s.f.

Question 17

(a) Which of these form the first four terms of a geometric progression?
Circle your answer.

2, 10, 18, 26   (2, 10, 50, 250)

2, 10, 12, 22   2, 10, 50, 112

(b) The nth term of a sequence is $7n - 3$. Calculate the 23rd term of this sequence.

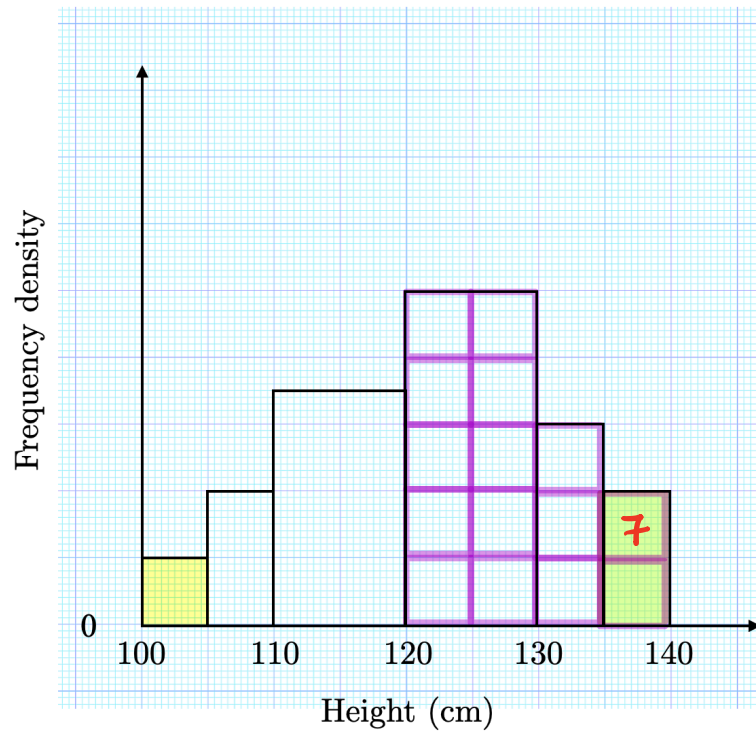Substitute $n = 23$ into $7n - 3$

$7 \times 23 - 3 = 158$

Question 18

The country of Mauritius has an area of 2040 km² and a population of 1,265,500.
Calculate the population density of Mauritius in people/km².

$$\frac{1,265,500}{2040} = 620 \text{ people} / km^2$$

to 3 s.f.

Question 19

This histogram shows information about the heights of a number of children.

The number of children are taller than 135 cm is seven greater than the number of children that are at most 105 cm tall.

How many children are more than 120 cm tall?

$$15 \times 7 = 105 \text{ children}$$

Question 20

Solve algebraically the simultaneously equations

$$-6x + 3y = 24 \implies 3y = 24 + 6x \implies y = 8 + 2x$$
$$y = x^2 - 7x + 8$$

$$8 + 2x = x^2 - 7x + 8$$
$$\implies 0 = x^2 - 9x$$
$$\implies 0 = x(x - 9)$$
$$\implies x = 0, \quad x = 9$$

Substituting these into $y = 8 + 2x$, we get

$$\underline{x = 0, \quad y = 8}$$
$$\underline{x = 9, \quad y = 26}$$
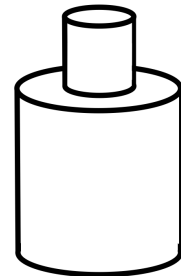
A solid cylinder of radius 2 cm and height 6 cm is glued, as shown, on to another solid cylinder of radius 5 cm and height 10 cm.

(a)   Work out the volume of the combined solid.

Large cylinder $V = \pi r^2 h = \pi \times 5^2 \times 10$

$= 250\pi \ cm^3$

Small cylinder $V = \pi r^2 h = \pi \times 2^2 \times 6$

$= 24\pi \ cm^3$

Total volume $= 250\pi + 24\pi = 274\pi \ cm^3$

$\approx 861 \ cm^3 \ \text{to 3sf.}$

(b)   Work out the surface area of the combined solid.

Total SA = SA of large cylinder + SA of small cylinder − 2 × base of small cylinder

$= 50\pi + 100\pi + 8\pi + 24\pi - 8\pi$
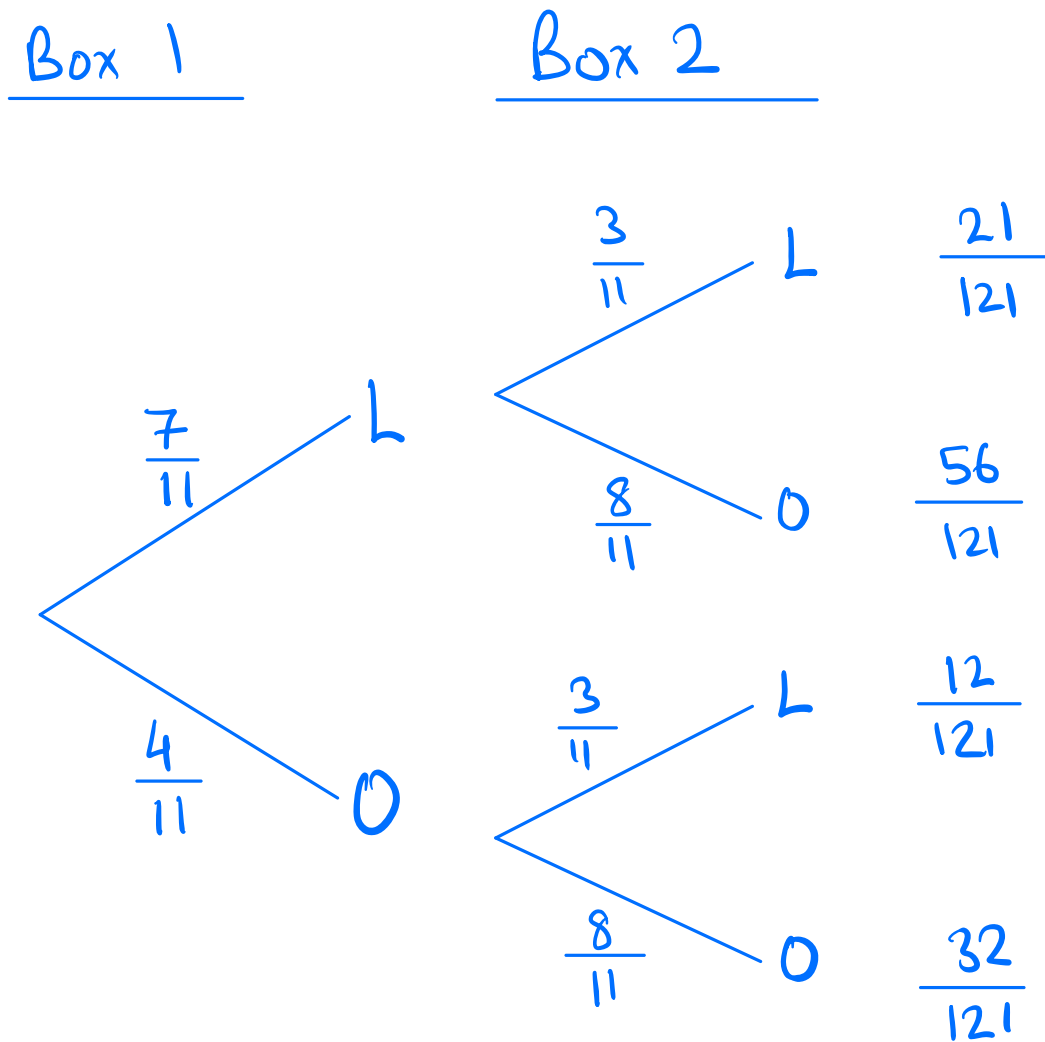
$= 174\pi \ cm^2$

$\approx 547 \ cm^2 \ \text{to 3s.f.}$

Question 22

A box contains 7 lemon sweets and 4 orange sweets.
Another box contains 3 lemon sweets and 8 orange sweets.

Anne picks one sweet at random from each box. Find the probability that the two sweets are the same flavour.

Box 1   **Box 2**

$\dfrac{7}{11}$ L

$\dfrac{3}{11}$ L $\dfrac{21}{121}$

$\dfrac{8}{11}$ O $\dfrac{56}{121}$

$\dfrac{4}{11}$ O

$\dfrac{3}{11}$ L $\dfrac{12}{121}$

$\dfrac{8}{11}$ O $\dfrac{32}{121}$

$$P\left(2 \text{ lemons}\right) + P\left(2 \text{ oranges}\right)$$

$$= \frac{21}{121} + \frac{32}{121} = \frac{53}{121}$$

Question 23

$f(x) = \dfrac{2x+3}{3}$ and $g(x) = 9 - 3x$

Find an expression for $fg(x)$, writing your answer as simply as possible.

$$fg(x) = f(g(x))$$

$$= \frac{2g(x) + 3}{3}$$
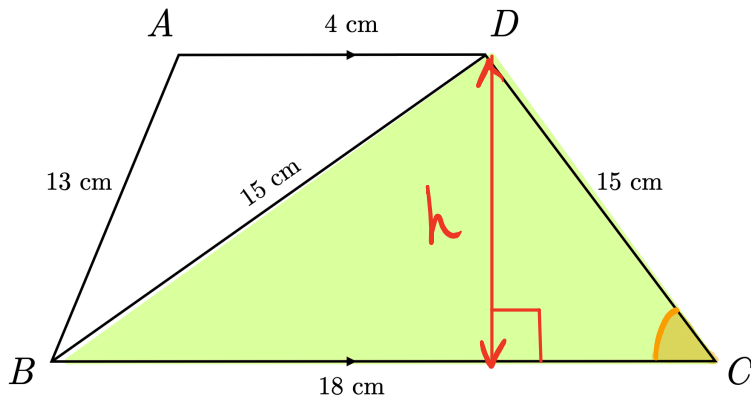
$$= \frac{2(9-3x) + 3}{3}$$

$$= \frac{18 - 6x + 3}{3}$$

$$= \frac{21 - 6x}{3}$$

$$= 7 - 2x$$

Question 24

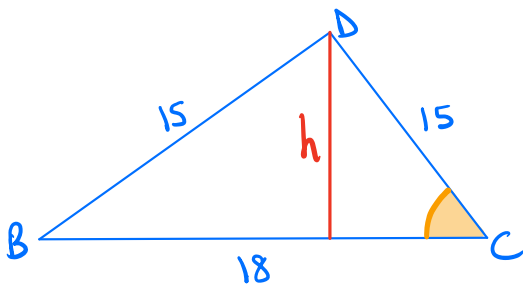The diagram shows a trapezium $ABCD$ and one of its diagonals, BD.

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

$$\Rightarrow \cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\Rightarrow A = \cos^{-1}\left(\frac{b^2 + c^2 - a^2}{2bc}\right)$$

DIAGRAM NOT DRAWN ACCURATELY

Find the area of this trapezium.

$$\angle BCD = \cos^{-1}\left(\frac{18^2 + 15^2 - 15^2}{2 \times 18 \times 15}\right)$$

$$= 53.1\ldots{}^\circ$$

$$h = 15\sin\left(53.1\ldots\right) = 12\text{ cm}$$
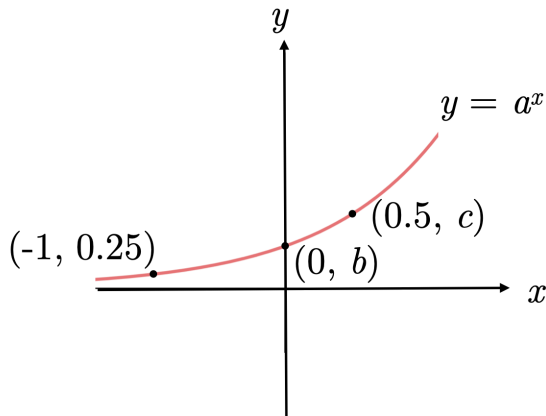
Area of trapezium $= \frac{1}{2}h(a+b)$

$$= \frac{1}{2} \times 12 \times (4 + 18) = \underline{132\text{ cm}^2}$$

Question 25

The sketch shows the graph of $y = a^x$.
The points with coordinates $(-1, 0.25)$, $(0, b)$, and $(0.5, c)$ all lie on the curve.

Find the values of a, b, and c.

Substituting $(-1, 0.25)$ into $y = a^x$, we get

$$0.25 = a^{-1} \implies \underline{a = 4}$$

Substituting $(0, b)$ into $y = 4^x$, we get

$$b = 4^0 \implies \underline{b = 1}$$

Substituting $(0.5, c)$ into $y = 4^x$, we get

$$c = 4^{0.5} \implies \underline{c = 2}$$

Question 26

(a) Expand and simplify $(x-4)(x+1)(x-5)$

$$\equiv (x^2 - 3x - 4)(x - 5)$$

$$\equiv x^3 - 5x^2 - 3x^2 + 15x - 4x + 20$$

$$\equiv x^3 - 8x^2 + 11x + 20$$

(b) Solve $x + 4 = \dfrac{10}{x}$

Round your solutions to 3 decimal places.

$$x + 4 = \frac{10}{x}$$

Multiply both sides by x

$$x^2 + 4x = 10$$

$$-10 \qquad\qquad -10$$

$$x^2 + 4x - 10 = 0$$

Using a calculator, we get

$$x = 1.742, \quad x = -5.742$$