OCR Paper 6H Practice Booklet

22 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

Given that $\dfrac{(x^{-3})^5}{x^{-7}} \times \dfrac{x^{-\frac{1}{2}}}{x} \equiv x^m$, find the value of m.

$$\frac{(x^{-3})^5}{x^{-7}} \times \frac{x^{-\frac{1}{2}}}{x} = \frac{x^{-15}}{x^{-7}} \times \frac{x^{-\frac{1}{2}}}{x^1} = x^{-8} \times x^{-\frac{3}{2}} = x^{-\frac{19}{2}}$$

$$m = -\frac{19}{2}$$

Question 2

(a) Circle the cube number:

9260 5832 4911 2748

(b) A pudding recipe for 4 people requires 120 grams of butter.
Calculate the amount of butter needed to make the pudding for 12 people.

People	Butter
4	120g
12	360g

×30 ×3 ×3 ×30

360g

Question 3

The value of some machinery decreases by a fixed 4.5% every year.
Ten years after its construction, the machinery had a value of £820.31.

What was the value of the machinery 7 years after its construction?

Annual multiplier = 0.955

7 years after construction is 3 years before it is 10 years old.

Value after 7 years = $\dfrac{£820.31}{0.955^3}$ = £941.82

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

Roberto is x years old.
Diogo is 5 years younger than Roberto. $x-5$
Mohamed is 4 years older than Diogo. $x-1$

(a) Write an expression, in terms of x, for the sum of the ages, in years, of Roberto, Diogo, and Mohamed.

$$x + x-5 + x-1 = 3x-6$$

Moacir is 54 years older than Roberto. $x+54$
Moacir's age is equal to the sum of the ages of Roberto, Diogo, and Mohamed.

(b) Find Diogo's age.

$$3x-6 = x+54$$

$$\Rightarrow 2x = 60$$

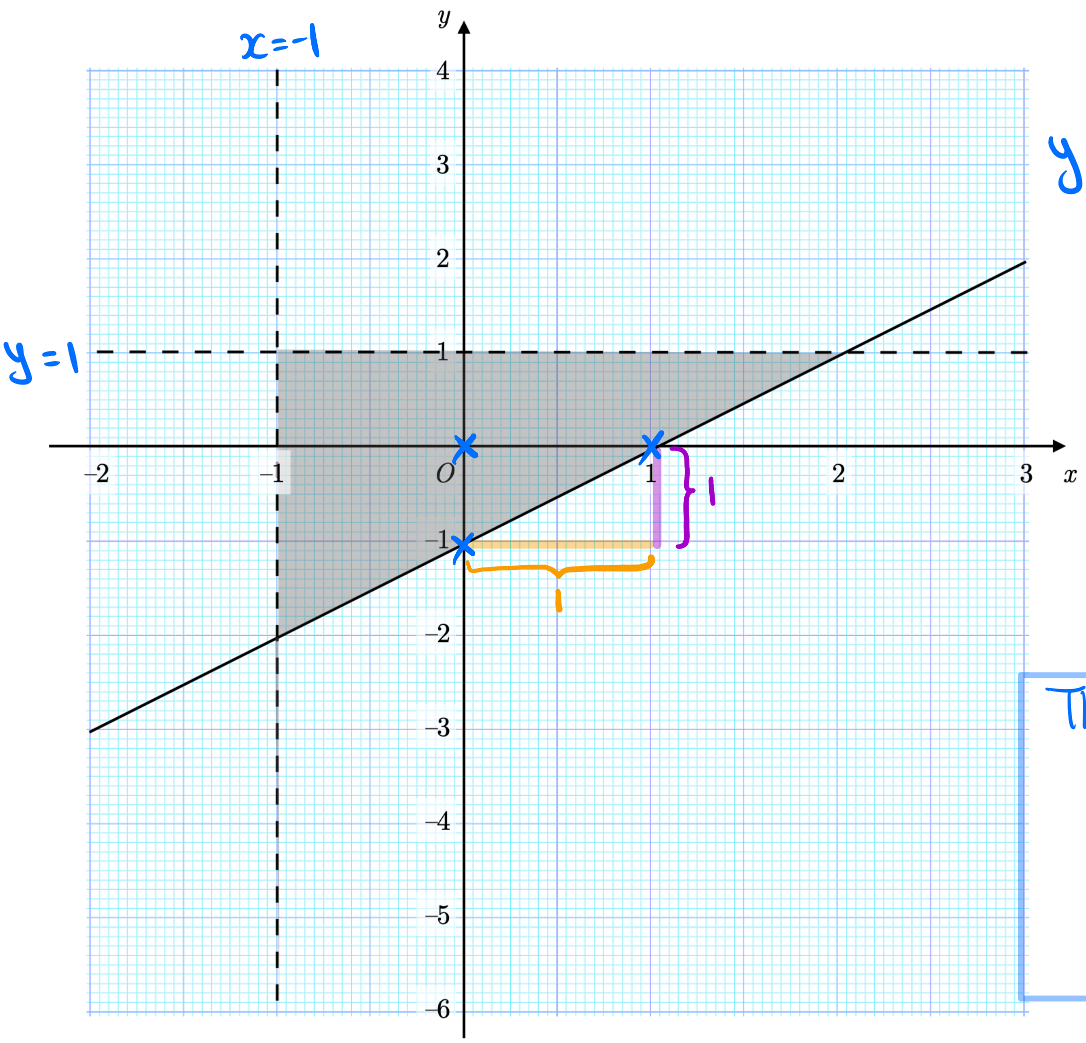
$$\Rightarrow x = 30$$

$$\Rightarrow x-5 = 25$$

Diogo is $\underline{25}$.

Question 6

(a) Write down the three inequalities that define the shaded region.



y-intercept

$y = mx + c$

gradient

$m = \frac{1}{1} = 1$

$c = -1$

$y = x - 1$

The inequalities are

$x > -1$

$y < 1$

$y \geqslant x - 1$

(b) x and y are integers. On the diagram, mark with a cross each of the three points that satisfy the three inequalities you wrote down in part (a).

Question 7

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 8

The circumference of a circle is 80 cm.
Calculate the area of the circle, correct to 3 significant figures.

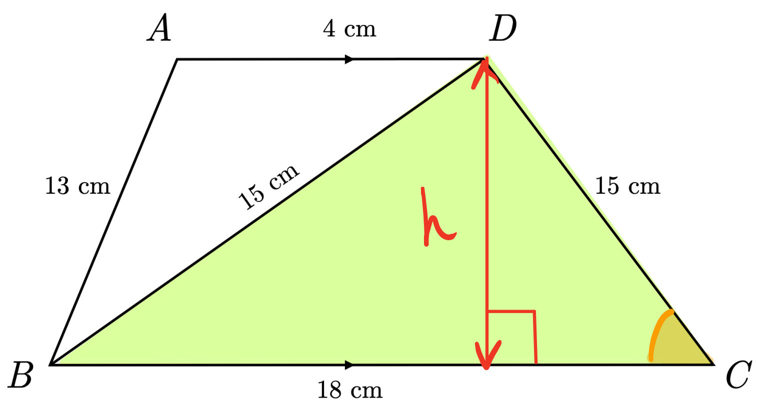
$$C = 2\pi r \Rightarrow 80 = 2\pi r$$

$$\Rightarrow r = \frac{80}{2\pi} = \frac{40}{\pi}$$

$$A = \pi r^2 = \pi \times \left(\frac{40}{\pi}\right)^2 = \underline{509 \text{ cm}^2} \text{ to 3sf}$$

Question 9

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



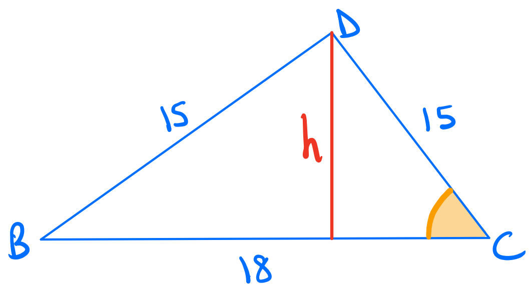
$$a^2 = b^2 + c^2 - 2bc\cos A$$

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

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

DIAGRAM NOT DRAWN ACCURATELY

Find the area of this trapezium.



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

$$= 53.1\ldots^\circ$$

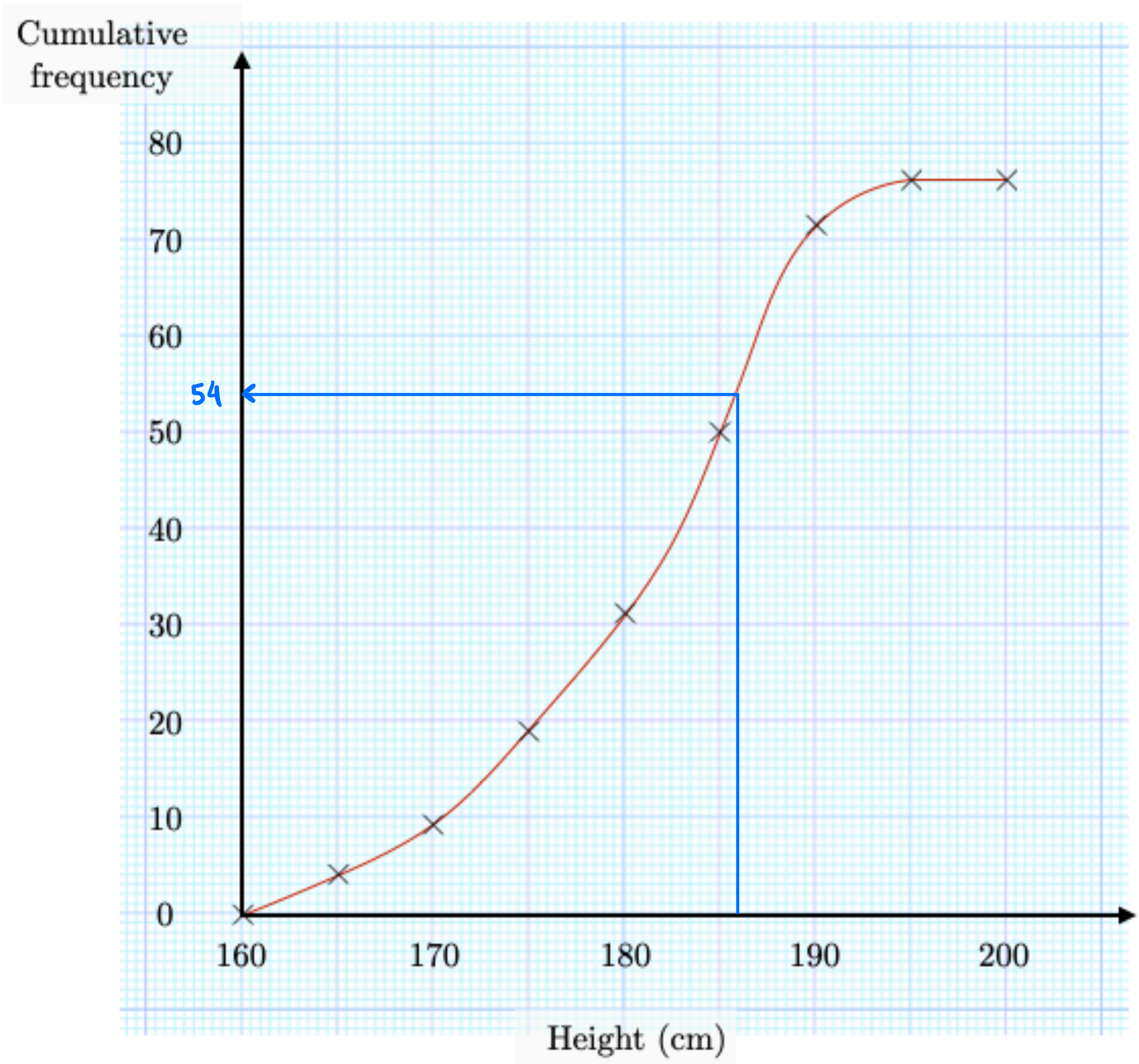
$$h = 15\sin(53.1\ldots) = 12\text{ cm}$$

$$\text{Area of trapezium} = \frac{1}{2}h(a+b)$$

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

Question 10

This cumulative frequency graph shows information about the heights, in cm, of rowers at a rowing club.



A rower is selected at random from the club. Estimate the probability that this rower is more than 186 cm tall.

80 rowers in total

$80 - 54 = 26$ over 186 cm

Probability $= \frac{26}{80} = \underline{0.325}$

Question 11

y is directly proportional to $\sqrt{x}$.

When $x = 4 \times 10^{40}$, $y = 15$.

Find the value of y when $x = 9 \times 10^{26}$. Write your answer in standard form.

x	$\sqrt{x}$	y
4×10^{40}	2×10^{20}	15
	$\downarrow \times 1.5 \times 10^{-7}$	$\downarrow \times 1.5 \times 10^{-7}$
9×10^{26}	3×10^{13}	2.25×10^{-6}

When $x = 9 \times 10^{26}$, $y = \underline{2.25 \times 10^{-6}}$

Question 12

At the start of an experiment, the mass of the bacteria in a petri dish is 1.35 g.
The mass of the bacteria increases by 5.8% every hour. → hourly multiplier $= 1.058$
A scientist notes the mass of the bacteria every hour.
After n hours, the scientist recorded a mass of 2.00 grams.
Find the value of n.

On a calculator, type 1.35×1.058 and press $\boxed{=}$

This gives the mass after 1 hour. It is less than 2.00 grams.

Now hit $\boxed{\text{ANS}}$ $\times\ 1.058$ and repeatedly press $\boxed{=}$ until the mass reaches 2.00 grams.

Keep count of how many times you press $\boxed{=}$ altogether to find $n = 7$

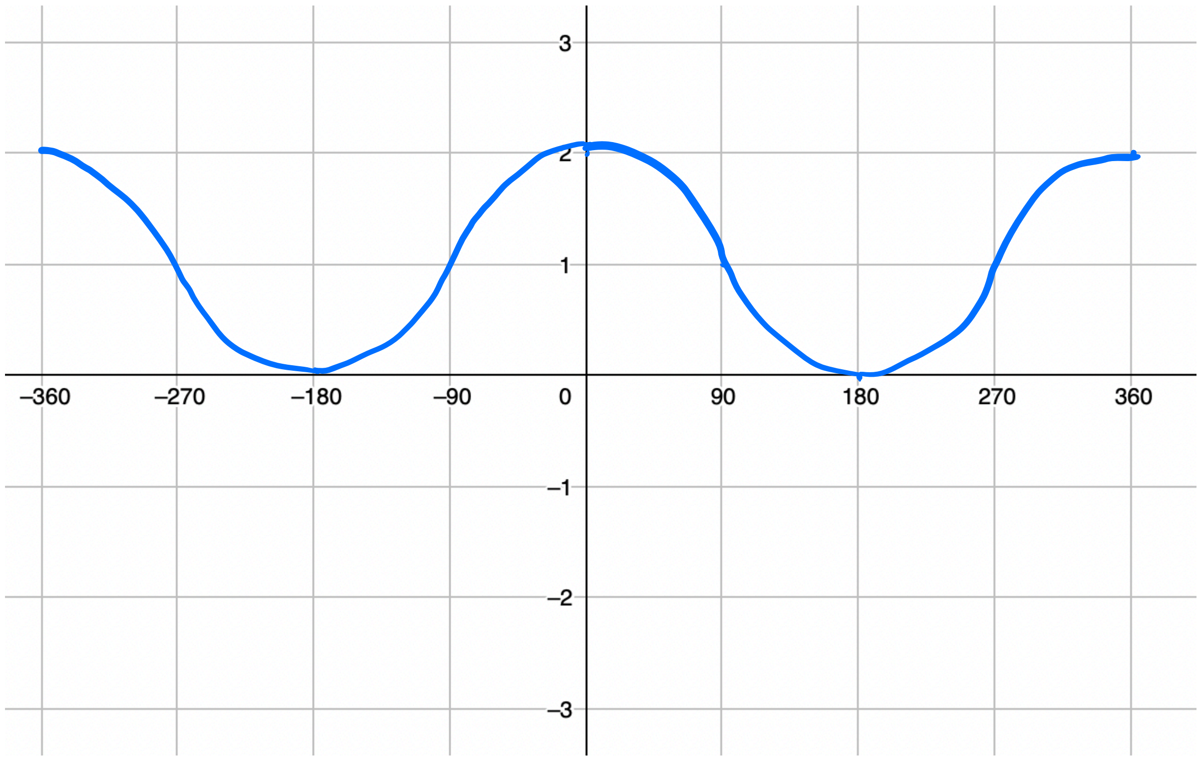
Question 13

Write $x^2 + 10x - 19$ in the form $(x + a)^2 + b$

$$(x+5)^2 - 6$$

Question 14

On the grid, sketch the graph of $y = \cos x° + 1$ for $-360° \leq x \leq 360°$



Question 15

The chemical element gallium has a density of 5.91 g/cm^3.

Convert this density into kg/m^3.

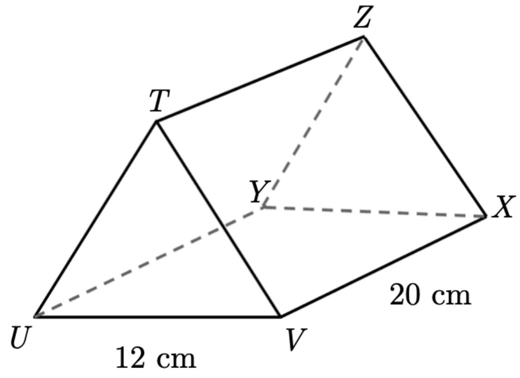
$5.91 g/cm^3$

$= 5,910,000 g/m^3$ because $1m^3 = 1000000 cm^3$

$= \underline{5910 kg/m^3}$ because $1kg = 1000g$

Question 16

The diagram shows a triangular prism.



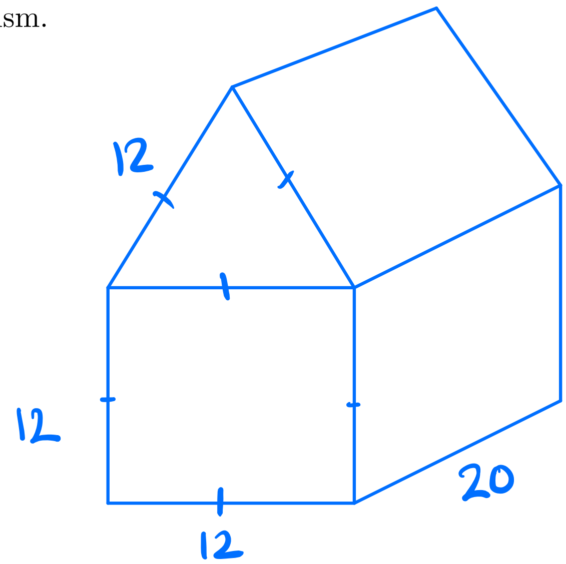
The triangular faces of this prism are equilateral triangles.

A rectangular face of the triangular prism is then glued to a congruent face of a cuboid measuring 12 cm × 12 cm × 20 cm.

Once glued, the resulting solid is a pentagonal prism.

Work out the surface area of this pentagonal prism.
Round your answer to 3 significant figures.

- Each rectangular face is a $20 \times 12 = 240 \text{ cm}^2$ rectangle.



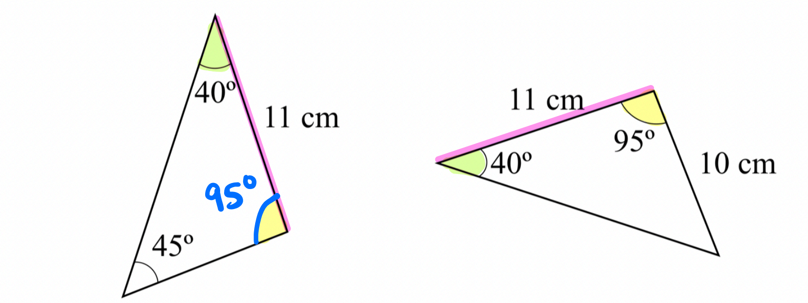
- Each pentagonal face is made up of a $12 \times 12 = 144 \text{ cm}^2$ square and a $\frac{1}{2} \times 12 \times 12 \times \sin(60) = 62.35\ldots \text{ cm}^2$ triangle.

Total SA $= 5 \times 240 + 2 \times (144 + 62.35\ldots)$

$= 1612.7\ldots = 1610 \text{ cm}^2$ to 3s.f.

Question 17

Show that these triangles are congruent.



The third angle in the first triangle is $180-(40+45) = 95°$

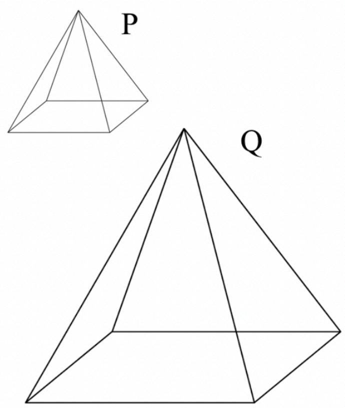
The two triangles are congruent because of the ASA criterion: 95°, 11cm, 40°

Question 18

P and Q are two mathematically similar pyramids.

Q has a surface area of 90 cm^2 and a volume of 54 cm^3.

P has a surface area of 40 cm^2. Find the volume of P.



$Q \rightarrow P$

Area scale factor $= \frac{40}{90} = \frac{4}{9}$

Length scale factor $= \sqrt{\frac{4}{9}} = \frac{2}{3}$

Volume scale factor $= \left(\frac{2}{3}\right)^3 = \frac{8}{27}$

$\therefore$ Volume of $P = 54 \times \frac{8}{27} = 16 \text{ cm}^3$

Question 19

Solve $x + 4 = \dfrac{10}{x}$
Round your solutions to 3 decimal places.

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

Multiply both sides by x

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

$$-10 \qquad -10$$

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

Using a calculator, we get

$$\underline{x = 1.742, \quad x = -5.742}$$

Question 20

(a) Make p the subject of the formula $m = \dfrac{8(q+3p)}{p}$

Multiply both sides by p

$$mp = 8q + 24p$$

Subtract 24p from both sides

$$mp - 24p = 8q$$

Factorise out p

$$p(m-24) = 8q$$

Divide both sides by (m−24)

$$p = \frac{8q}{m-24}$$

(b) Work out the value of p when $q = 0.34$ and $m = 0.7$

$$p = \frac{8 \times 0.34}{0.7 - 24} = -\frac{136}{1165}$$

Question 21

Jonny plays a game which involves picking numbered cards.
The first bag contains four cards, numbered from 1 to 3.
The second bag contains six cards, numbered from 1 to 5.

Jonny picks one card at random from each bag and multiplies the numbers on his two cards.

(a) Draw a sample space to show all the possible outcomes.

Bag 2

Bag 1	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15

Players win a prize if the product of the numbers on their cards is even.

(b) Given that Jonny wins a prize, find the probability that the product of his two numbers is greater than 9.

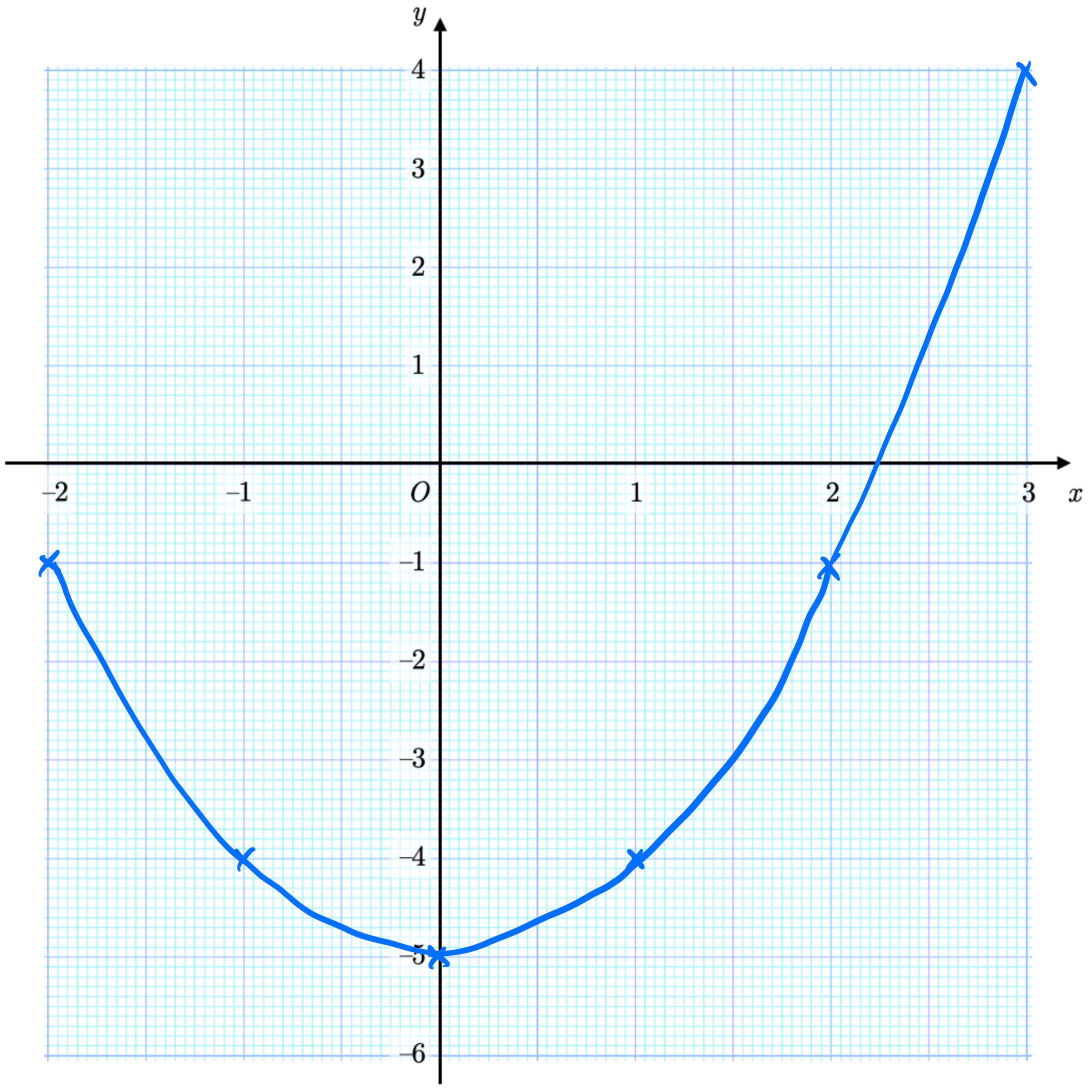
$$\frac{2}{9}$$

Question 22

(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. $(0, -5)$