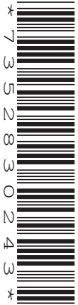


GCSE (9–1) Mathematics

J560/03 Paper 3 (Foundation Tier)

Tuesday 13 June 2017 – Morning

Time allowed: 1 hour 30 minutes



You may use:

- A scientific or graphical calculator
- Geometrical instruments
- Tracing paper



First name										
Last name										
Centre number						Candidate number				

INSTRUCTIONS

- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Read each question carefully before you start to write your answer.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the barcodes.

INFORMATION

- The total mark for this paper is **100**.
- The marks for each question are shown in brackets [].
- Use the π button on your calculator or take π to be 3.142 unless the question says otherwise.
- This document consists of **20** pages.

Answer **all** the questions.

- 1 (a) Complete this table of fractions, decimals and percentages.

Fraction		Decimal		Percentage
$\frac{1}{2}$	=	0.5	=	50%
$\frac{27}{100}$	=	0.27	$\xrightarrow{\times 100}$ =	27%
$\frac{4}{5} = \frac{8}{10}$	=	0.8	$\xrightarrow{\times 100}$ =	80%
$\frac{3}{100}$	=	0.03	$\xleftarrow{\div 100}$ =	3%

Percentage is the same as a fraction over 100

[3]

- (b) Write 45% as a fraction in its simplest form.

$$45\% = \frac{45}{100} \xrightarrow{\div 5} \frac{9}{20}$$

(b) [2]

- (c) Alan and Brian share a sum of money in the ratio $\overset{A}{1}:\overset{B}{4}$.

What fraction of the money does Alan receive?

$$1 + 4 = 5 \text{ parts}$$

Alan gets 1 part

$$\frac{1}{5}$$

(c) [1]

- 2 Corinne invests £8400 at a simple interest rate of 12% per year.

Work out the value of the investment after 3 years.

$$12\% \text{ interest: } 12\% \text{ of } 8400$$

$$8400 \times 0.12 = 1008 \text{ simple interest}$$

$$1008 \times 3 = 3024 \text{ 3 years}$$

$$8400 + 3024$$

£ [3]

- 3 (a) Find the value of y .

$$\begin{array}{cccccccc} 5 & \times & 5 & \times & 5 & \times & 5 & \times & 5 & \times & 5 & \times & 5 & = & 5^y \\ 1 & & 2 & & 3 & & 4 & & 5 & & 6 & & 7 & & \end{array}$$

(a) $y = \underline{7}$ [1]

- (b) Find the values of z .

$$\begin{array}{l} z^2 = 196 \\ \sqrt{} \\ z = \pm \sqrt{196} \end{array}$$

(b) $z = \underline{14}$ or $z = \underline{-14}$ [2]

- 4 (a) Expand and simplify.

$$\begin{array}{l} \overbrace{5(x-2)} \quad \overbrace{-2(x-4)} \\ \underline{5x - 10} \quad \underline{-2x + 8} \\ = 3x - 2 \end{array}$$

(a) $\underline{3x - 2}$ [2]

- (b) Factorise fully.

$$\begin{array}{l} 10x^2 + 6x \quad \leftarrow 2x \text{ is a factor} \\ 2x (5x + 3) \\ \begin{array}{l} 10x^2 \div 2x \\ 6x \div 2x \end{array} \end{array}$$

(b) $\underline{2x(5x + 3)}$ [2]

- (c) Simplify.

$$\begin{array}{l} (x^5)^2 \\ x^{5 \times 2} \end{array}$$

(c) $\underline{x^{10}}$ [1]

- 5 (a) Find the value of $3a + 2b$ when $a = 16$ and $b = 7$.

$$= 3(16) + 2(7)$$

$$= 48 + 14$$

$$(a) \quad \dots\dots\dots 62 \dots\dots\dots [2]$$

- (b) Use the formula

$$v = u + at$$

to find the final velocity, when

- the initial velocity is 2 m/s u
- the acceleration is 1.5 m/s^2 a
- the time is 6 seconds. t

$$v = 2 + 1.5 \times 6$$

$$v = 2 + 9$$

$$(b) \quad \dots\dots\dots 11 \dots\dots\dots \text{m/s} [2]$$

- (c) Make d the subject of this formula.

isolate d

$$c = 7d$$

$$c = 7d$$

$$\frac{c}{7} = d$$

$$d = \frac{c}{7}$$

$$(c) \quad \dots\dots\dots \frac{c}{7} \dots\dots\dots [1]$$

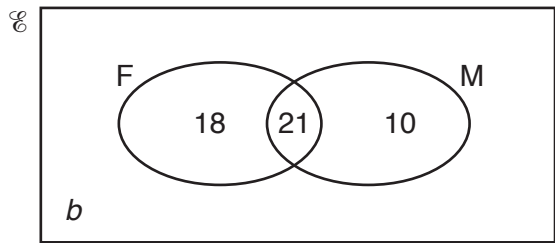
- 6 (a) Henry puts eight counters into a bag. Each counter has a different whole number on it between 1 and 8. He picks a counter at random from the bag and the number is noted.

Choose from the words in the box to complete each sentence.

likely impossible certain evens unlikely

- (i) It is certain that he picks a number less than 9. [1] *All numbers are less than 9*
- (ii) It is evens that he picks an odd number. [1] *4 odd 4 even*

- (b) The Venn diagram shows the number of students who passed their examination in French (F) and those who passed their examination in Mathematics (M). The number of students who did not pass either examination is b .



- (i) Find the value of b if the total number of students is 55.

$$55 - 18 - 21 - 10$$

$$55 - 49$$

(b)(i) $b =$ 6 students [1]

One of the 55 students is selected at random.

What is the probability that this student

- (ii) passed both French and Mathematics,

$$\frac{\text{Both} = 21}{\text{Total} = 55}$$

(ii) $\frac{21}{55}$ [1]

- (iii) passed exactly one of these two subjects?

$$\begin{aligned} \text{Only French} &= 18 \\ \text{Only maths} &= 10 \\ \text{Only 1 subject} &= 28 \end{aligned}$$

$$\frac{28}{55}$$

(iii) $\frac{28}{55}$ [1]

- 7 Hardeep buys 11 identical shirts and 24 identical ties for £403.51.
The cost of a shirt is £15.65.

Find the cost of a tie.

cost of 1 shirt \rightarrow

$$11 \text{ shirts} + 24 \text{ ties} = 403.51 \quad \text{setup equation}$$

$$11 \times 15.65 + 24t = 403.51$$

$$172.15 + 24t = 403.51$$

$$\quad \quad \quad -172.15$$

$$24t = 231.36$$

$$t = \frac{231.36}{24} = 9.64$$

£.....9.64..... [4]

- 8 (a) Harry needs dollars to go on holiday.
He can buy \$50 for £40.

How much will \$720 cost at the same rate?

$$\begin{array}{l}
 \div 50 \quad \$50 = \text{£}40 \\
 \times 720 \quad \$1 = \text{£}0.8 \\
 \times 720 \quad \$720 = \text{£}576
 \end{array}$$

(a) £.....576..... [2]

- (b) Tony returns from holiday with these notes.

Note	Number of notes
€50	2
€20	4
€10	9
€5	12

The exchange rate is £1 = €1.17.

Work out how much he will get in total when he changes these notes.

$$\begin{array}{l}
 \text{Total Money : } \text{€}50 \times 2 = \text{€}100 \\
 \text{€}20 \times 4 = \text{€}80 \quad + \\
 \text{€}10 \times 9 = \text{€}90 \\
 \text{€}5 \times 12 = \text{€}60 \\
 \hline
 \text{€}330
 \end{array}$$

$$\begin{array}{l}
 \text{£}1 = \text{€}1.17 \\
 \downarrow \times \frac{330}{1.17}
 \end{array}$$

$$\text{£}282.05 = \text{€}330$$

(b) £.....282.05..... [4]

- 9 (a) Round 7.3065 to 2 decimal places.

6 > 5 round up

(a) 7.31 [1]

- (b) Round each number to 3 significant figures.

(i) 408231

2 < 5
round down

(b)(i) 408,000 [1]

(ii) 0.00613702

7 > 5 round up

(ii) 0.00614 [1]

- 10 (a) Write down the second and third terms of the following two sequences.

- (i) Rule : To get the next term **subtract 4** from the previous term.
First term = 19.

19 ⁻⁴ 15 ⁻⁴ 11 [1]

- (ii) Rule : To get the next term **multiply** the previous term **by 5** and then **add 3**.
First term = 7.

7 ^{x5=35}
⁺³ 38 ^{x5=190}
⁺³ 193 [1]

- (b) Here are the first four terms of another sequence.

5 ⁺⁴ 9 ⁺⁴ 13 ⁺⁴ 17

Write an expression for the n th term of this sequence.

D: : difference = 4

n : x bgn n

O : Find 0th term +1

(b) 4n + 1 [2]

- 11 (a) Grapes cost £2 per kilogram. = 1000g

Calculate the cost of 380 g of grapes.

$$\begin{array}{l} \div 100 \quad \left(\begin{array}{l} \pounds 2 = 1000\text{g} \\ \pounds 0.02 = 10\text{g} \end{array} \right) \div 100 \\ \times 38 \quad \left(\begin{array}{l} \pounds 0.76 = 380\text{g} \end{array} \right) \times 38 \end{array}$$

(a) £ 0.76 [2]

- (b) Ruth buys 19 identical tickets for £280.25.

Estimate the cost of one ticket.

Show your working.

$$19 \approx 20$$

$$280.25 \approx 280$$

} Estimate

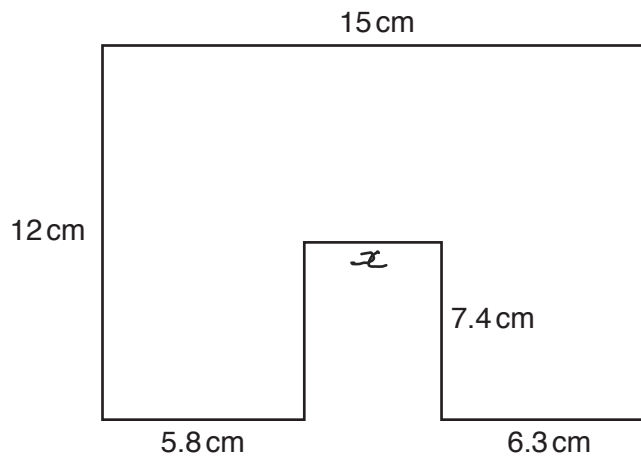
$$20 \text{ tickets} \approx 280$$

$$1 \text{ ticket} \approx \frac{280}{20} = 14$$

(b) £ 14 [2]

- 12 The shape below is formed from a rectangle measuring 12 cm by 15 cm from which a rectangle of length 7.4 cm has been removed.

Not to scale



Work out the perimeter of the shape.

$$5.8 + x + 6.3 = 15$$

$$12.1 + x = 15$$

$$x = 2.9 \text{ cm}$$

$$\begin{aligned} \text{Perimeter} &= 12 + 15 + 12 + 6.3 + 7.4 + 2.9 + 7.4 + 5.8 \\ &= 68.8 \end{aligned}$$

..... 68.8 cm [3]

- 13 (a) The mass, m tonnes, of a girder is 12.7, correct to 1 decimal place.

Complete the error interval for the mass, m .

all numbers in
interval round
to 12.7

$$(a) \quad 12.65 \dots \leq m < \dots 12.75 \dots \quad [2]$$

- (b) The length of a piece of wood is given as 8 metres, correct to the nearest metre.
The length of a metal rod is given as 8.5 metres, correct to 1 decimal place.

Show that the piece of wood could be longer than the metal rod. [2]

$$\text{Wood interval : } \quad 7.5 \leq \text{wood} < 8.5 \text{m}$$

$$\text{Metal interval : } \quad 8.45 \leq \text{metal} < 8.55 \text{m}$$

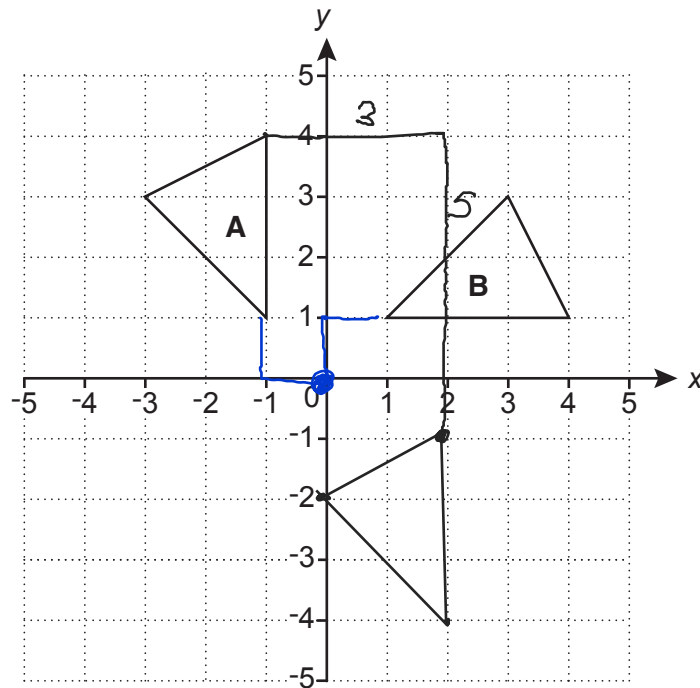
The wood could be $8.45 < m < 8.5$

and the metal could be 8.45m

meaning the wood would be
longer than the metal

$$\text{Eg } \begin{array}{l} \text{wood} = 8.46 \\ \text{metal} = 8.45 \end{array}$$

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



- (a) Translate triangle **A** by vector $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$. *3 right
5 down* [2]
- (b) Describe fully the **single** transformation that maps triangle **A** onto triangle **B**.

Rotation, 90° clockwise centre (0,0)

..... [3]

- 15 Students at a school must choose one subject from Option 1 and one from Option 2. The school offers two languages, French and Spanish.

The subjects are given in this table.

Option 1	Option 2
French	Spanish
Art	Geography
Music	History
Economics	

Work out the percentage of all the subject combinations which have exactly one language.

$$\begin{aligned} \text{Number of combinations: } & 4 \times 3 \\ & = 12 \text{ ways} \end{aligned}$$

Exactly 1 language:

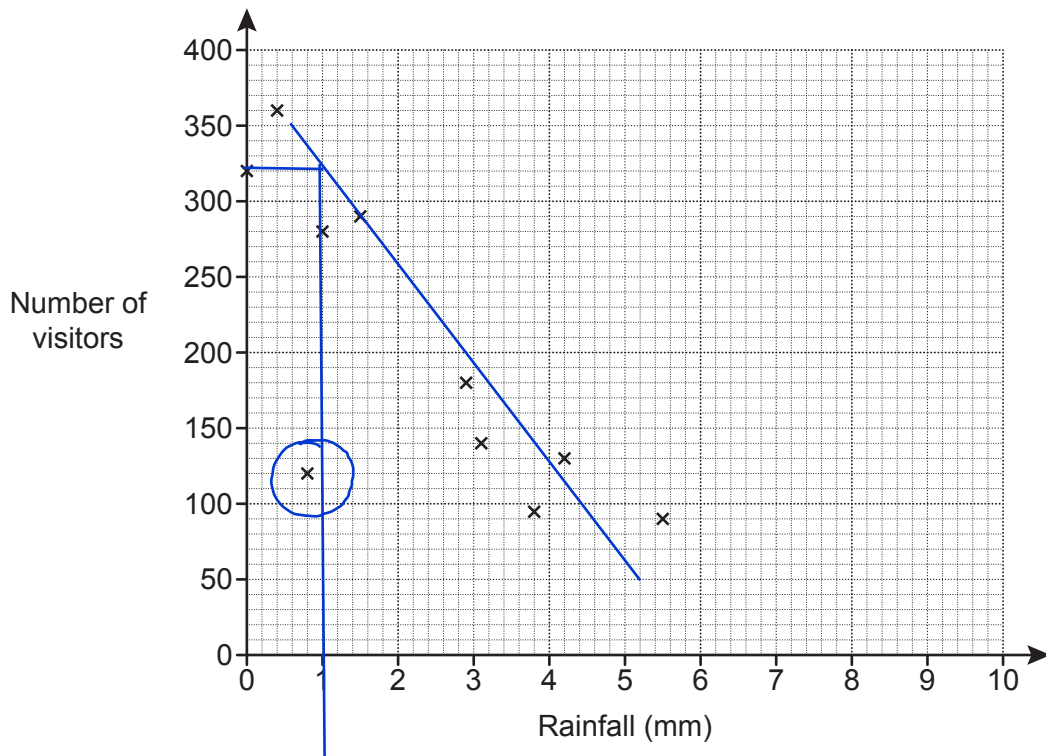
$$\begin{aligned} \text{Option 1 lang, Option 2 not lang: } & 1 \times 2 \\ & = 2 \text{ ways} \\ \text{Option 1 not lang, Option 2 lang: } & 3 \times 1 \\ & = 3 \text{ ways} \end{aligned}$$

$$3 + 2 = 5 \text{ ways in total}$$

$$\begin{aligned} \text{Percentage: } & \frac{5}{12} \times 100 \\ & = 41.666\dots\% \end{aligned}$$

..... 41.7% [4]

- 16 (a) The owner of a tourist attraction records the amount of rainfall, in millimetres, and the number of visitors each day. The results for 10 days are shown in the scatter diagram.



- (i) Circle the outlier on the scatter diagram. [1]
- (ii) The owner claims that he would expect around 320 visitors on a day with 2 mm of rainfall.

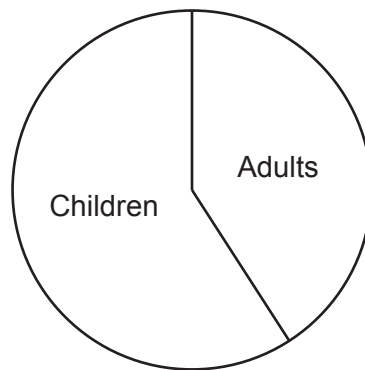
Does the scatter diagram support his statement?
Explain how you made your decision.

No, from the line, we can estimate that
320 visitors would visit on a day with 1mm
of rainfall not 2. [2]

- (iii) Explain why the scatter diagram should not be used to estimate the number of visitors on a day with 9 mm of rainfall.

Because 9mm of rainfall would be
outside the data range collected [1]

- (b) The pie chart summarises information about the visitors to the tourist attraction on a different day.



Explain why the pie chart cannot be used to work out how many adults visited on that day.

Because it only shows the proportion
of adults and children. We don't know the
total number of visitors so we cannot
work it out. [1]

17 (a) The scale of a map is 1 cm represents 25 m.

(i) The length of a path is 240 m.

Work out the length, in centimetres, of the path on the map.

$$1 \text{ cm} = 25 \text{ m}$$

$$9.6 = \downarrow \times \frac{240}{25}$$

$$9.6 = 240 \text{ m}$$

(a)(i) 9.6 cm [1]

(ii) The scale 1 cm represents 25 m can be written in the form 1 : k.

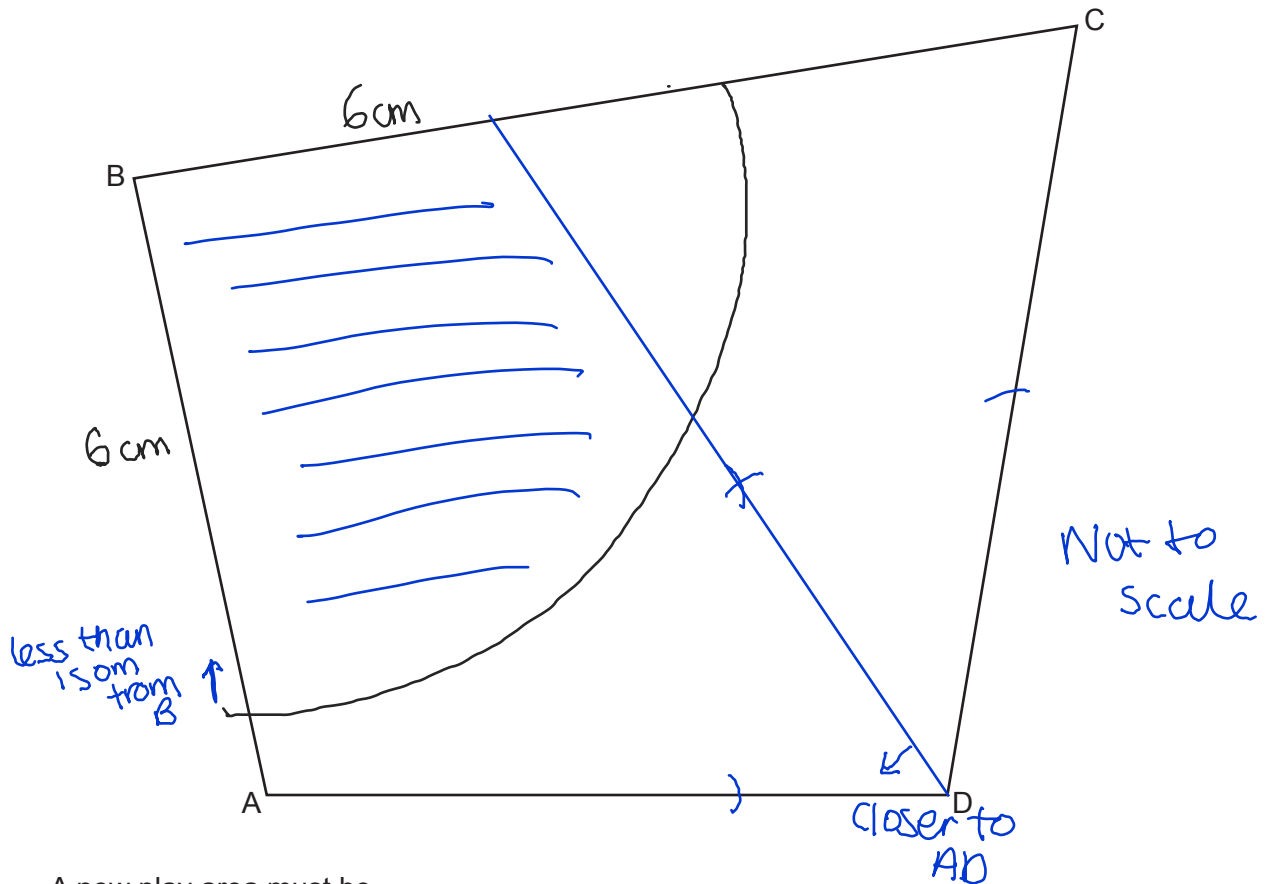
Find the value of k. $25 \text{ m} = 2500 \text{ cm}$

$$1 : 2500$$

(ii) k = 2500 [1]

(b) The scale drawing represents a park.

Scale: 1 cm represents 25 m



A new play area must be

- no more than 150 m from B
 - closer to AD than to CD.
- $1 \text{ cm} = 25 \text{ m}$
 $6 \text{ cm} = 150 \text{ m}$
 bisect angle ADC

Construct and shade the region where the play area can be positioned. Show all your construction lines.

[5]

- 18 A village has a population of 4200 and a population density of 700 people per km².
An estate is built next to the village.
The estate has an area of 2 km² and a population density of 800 people per km².

Work out the population density for the village and the estate together.

$$\text{population density} = \frac{\text{size of pop}}{\text{area}}$$

↙ × ↘

$$\text{area} = \frac{\text{size of pop}}{\text{pop density}}$$

$$\text{size} = \text{area} \times \text{pop density}$$

$$\text{Village area} = \frac{4200}{700} = 6 \text{ km}^2$$

$$\text{Estate population size} = 2 \times 800 = 1600 \text{ people}$$

$$\text{Overall pop density} = \frac{4200 + 1600}{6 + 2} = \frac{5800}{8} = 725 \text{ people per km}^2 \quad [4]$$

- 19 Two numbers have these properties.

- Both numbers are greater than 6.
- Their highest common factor (HCF) is 6.
- Their lowest common multiple (LCM) is 60. — Factors of 60

Find the two numbers.

Factors of 60

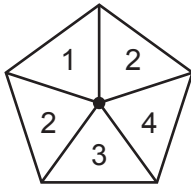
1	60		
2	30		
3	20	6	a
4	15		
5	12		
6	10		

$$60 \text{ and } 30 \quad \text{HCF} = 30 \times$$

$$30 \text{ and } 12 \quad \text{HCF} = 6$$

..... 30 and 12 [3]

20 (a) This is a fair 5-sided spinner.



Ciara spins the spinner twice and records the product of the two scores.

(i) Complete the table.

		First spin				
		1	2	2	3	4
Second spin	1	1	2	2	3	4
	2	2	4	4	6	8
	2	2	4	4	6	8
	3	3	6	6	9	12
	4	4	8	8	12	16

[2]

(ii) Find the probability that the product is a multiple of 3. *- 9 multiples*
 $5 \times 5 = 25$ total

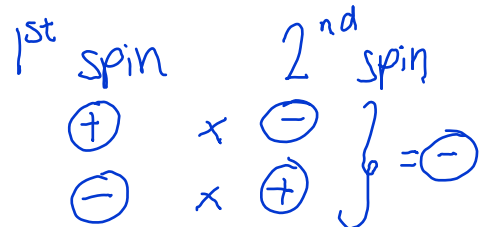
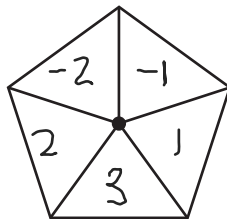
(a)(ii) $\frac{9}{25}$ [2]

(b) Ciara makes a different fair 5-sided spinner. She spins the spinner twice and records the product of the two scores.

Ciara says

The probability that the product is negative is 0.48. $= \frac{48}{100} = \frac{12}{25}$ *12 outcomes*

Write numbers on the spinner below so that Ciara's statement is correct.



[3]

or 3 negative and 2 positive

*If 2 are negative and 3 positive
 $2 \times 3 + 3 \times 2 = 12$ ways*

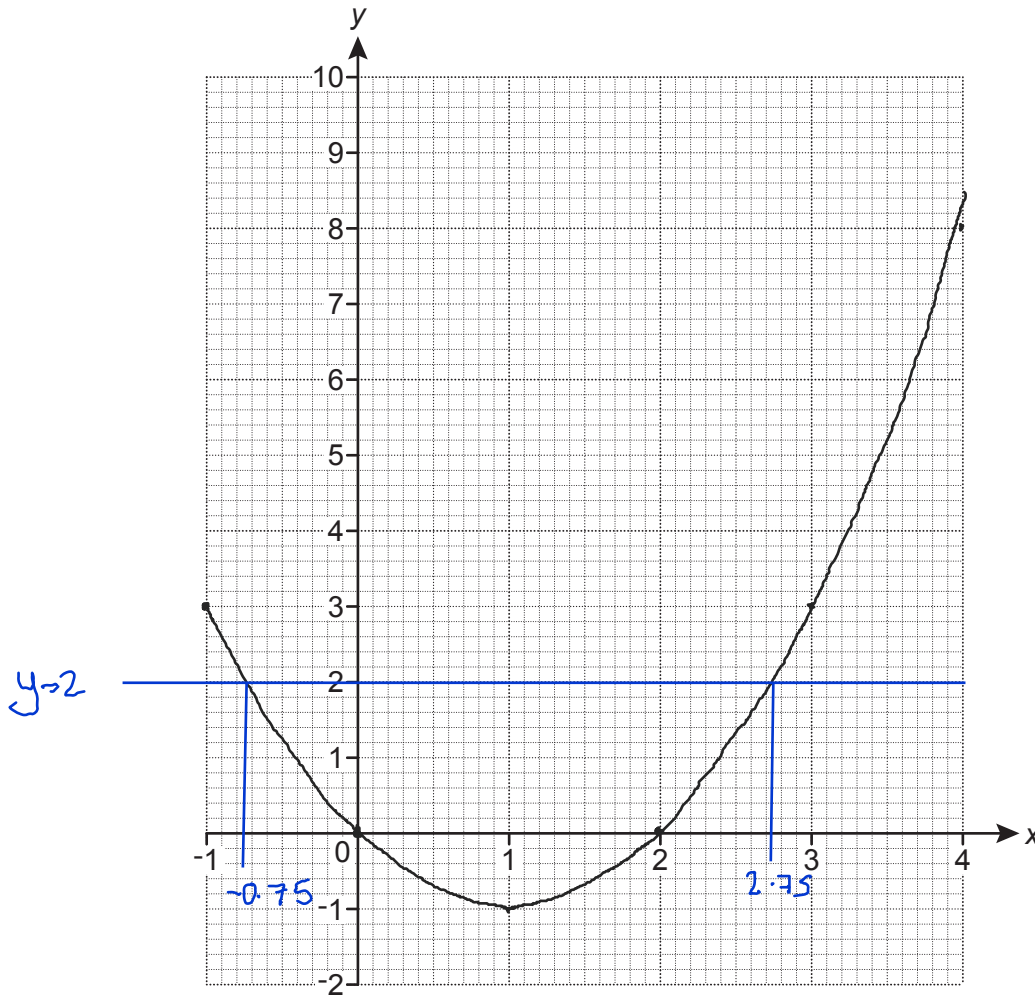
$$4^2 - 2 \times 4$$

21 (a) Complete the table for $y = x^2 - 2x$.

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

[1]

(b) Draw the graph of $y = x^2 - 2x$ for $-1 \leq x \leq 4$.



[2]

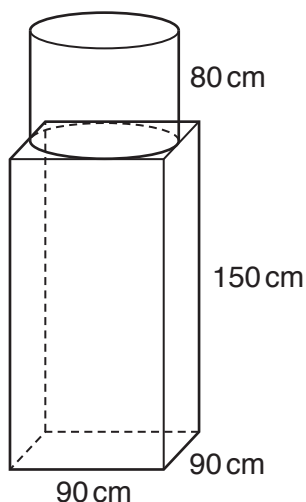
(c) Use your graph to solve $x^2 - 2x = 2$.

$$y = 2$$

$$x = -0.75$$

$$x = 2.75$$

(c) [2]



A sculpture is formed from a cylinder resting on top of a cuboid.
 The cylinder has radius 45 cm and height 80 cm.
 The cuboid measures 90 cm by 90 cm by 150 cm.

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

The sculpture is made of granite.
 The granite has a density of 2.7 g/cm³.

Calculate the total mass of the sculpture in tonnes.

Volume of cylinder: $\pi r^2 \times h$
 $= \pi \times 45^2 \times 80 = 162000\pi \text{ cm}^3$

Volume of cuboid = $90 \times 90 \times 150 = 1,215,000 \text{ cm}^3$

Total volume: $1,215,000 + 162,000\pi = 1,723,938.01 \text{ cm}^3$

Mass = $1,723,938.01 \times 2.7 = 4,654,632.627 \text{ g}$
 $\div 1,000,000$

g $\xrightarrow{\div 1000}$ kg $\xrightarrow{\div 1000}$ tonnes
 $\div 1,000,000$

$= 4.65 \dots \text{tonnes [5]}$ (3sf)

END OF QUESTION PAPER

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