OCR

Model Solutions

Oxford Cambridge and RSA

F

GCSE (9–1) Mathematics
J560/02 Paper 2 (Foundation Tier)

Monday 6 November 2017 – Morning
Time allowed: 1 hour 30 minutes

You may use:
• Geometrical instruments
• Tracing paper

Do not use:
• A calculator

First name	
Last name	

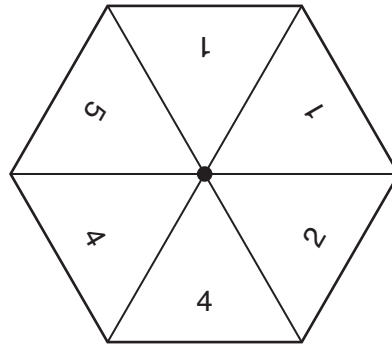| Centre number					Candidate number				

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.
• If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
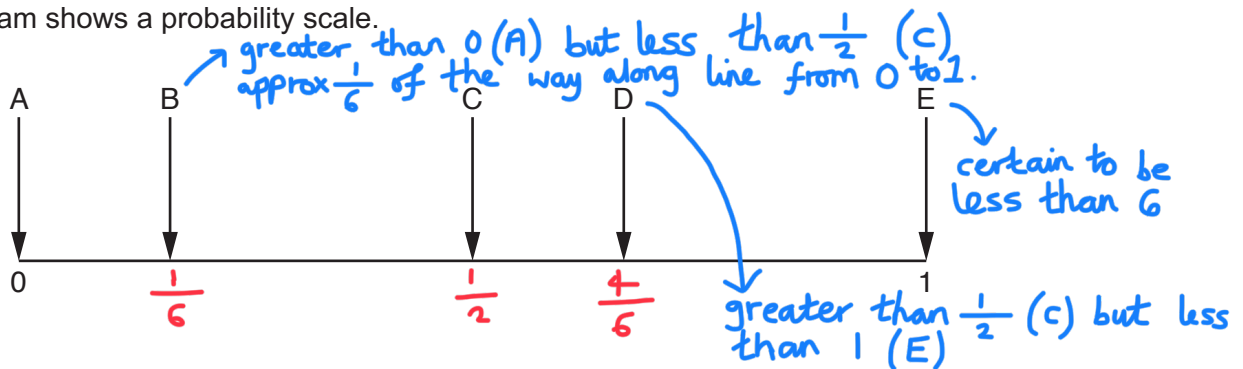• Do **not** write in the barcodes.

INFORMATION
• The total mark for this paper is **100**.
• The marks for each question are shown in brackets **[ ]**.
• This document consists of **20** pages.

OCR is an exempt Charity

Turn over

2

Answer **all** the questions.

1 A fair spinner has six sides.
They are labelled 1, 1, 2, 4, 4, 5.

(hexagonal spinner diagram with sides labelled 1, 1, 2, 4, 4, 5)

The diagram shows a probability scale.

(handwritten annotation) greater than 0 (A) but less than $\frac{1}{2}$ (C) approx $\frac{1}{6}$ of the way along line from 0 to 1.

(probability scale with arrows A, B, C, D, E at 0, $\frac{1}{6}$, $\frac{1}{2}$, $\frac{4}{6}$, 1)

(handwritten annotation) certain to be less than 6

(handwritten annotation) greater than $\frac{1}{2}$ (C) but less than 1 (E)

Which arrow shows the probability of

(a) scoring a 2,

(handwritten) number of sides labelled with 2

$$P(\text{scoring a } 2) = \frac{1}{6} \text{ total number of sides of spinner}$$

(handwritten answer) B

(a) ....[1]

(b) scoring a number less than 6,

(handwritten) all six sides of the spinner are numbers less than 6.

$$P(\text{scoring less than 6}) = \frac{6}{6} = 1$$

(handwritten answer) E

(b) ....[1]

(c) scoring a 1 or a 4?

(handwritten) two sides of the spinner are 1's and two sides of the spinner are 4's.

(handwritten answer) D

(c) ....[1]

$$P(\text{scoring a 1 or a 4}) = P(\text{scoring a 1}) + P(\text{scoring a 4}) = \frac{2}{6} + \frac{2}{6}$$

$$= \frac{4}{6}$$

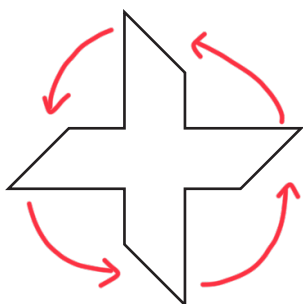**2** **(a)** Write down the number of lines of symmetry of this hexagon.
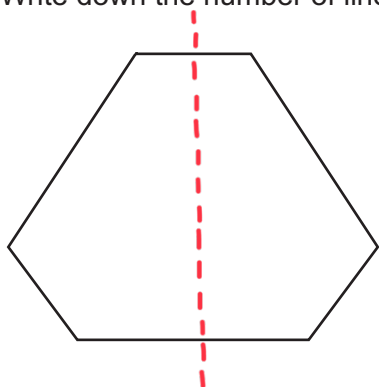
Lines of symmetry = 1

(a) .... 1 .... **[1]**

(b) Write down the order of rotation symmetry of this shape.

shape appears the same when rotated.

(b) .... 4 .... **[1]**

(c) A triangle has just one line of symmetry.

Write down the mathematical name of this type of triangle.

(c) .... isosceles .... **[1]**

(d) Sara says

All parallelograms have 2 lines of symmetry and rotation symmetry of order 2.

Explain why Sara is not correct.

.... Parallelograms do not have 2 lines of
.... symmetry. .... **[1]**

Turn over

3 A 100g packet of tea costs £4.16.
A 25g packet of the same tea costs £1.05.

Which packet is better value for money?
Show how you decide.

$100g = 4 \times 25g$ packets
cost of $4 \times 25g$ packets $= 4 \times £1.05 = £4.20$
$100g$ packet costs £4.16 which is less than
£4.20.

........$100g$ packet is better value for money. **[3]**

4 One morning, **eight** buses arrive at a bus stop.
The number of minutes late for each bus is shown below.

0   7   2   6   9   2   0   7

In the afternoon, two more buses arrive at the bus stop.

The median number of minutes late of **all ten** buses is 3.5.
The mode number of minutes late of **all ten** buses is 0.

How many minutes late were the two afternoon buses?

0 0 2 2 6 7 7 9

mode $= 0$ so at least 3 of the ten buses are
0 minutes late.
median $= \left(\frac{n+1}{2}\right)^{th}$ value $= \left(\frac{10+1}{2}\right)^{th} = 5.5^{th}$ value

$= \frac{5^{th} + 6^{th}}{2} = 3.5$

$7 = 2 + 6^{th}$ value
$5 = 6^{th}$ value

...........0...... and ....5.......... minutes **[3]**

5 Write 0.26 as a fraction.
Give your answer in its simplest form.

$$0.26 = \frac{26}{100} \xrightarrow{\div 2} \frac{13}{50}$$

$$\frac{13}{50}$$

.... [2]

6 (a) Simplify fully.

(i) $4(c + 2d) + 3(3c - 5d)$

(expand brackets) $4c + 8d + 9c - 15d$
(collect like terms to simplify) $= 13c - 7d$

(a)(i) .... $13c - 7d$ .... [3]

(ii) $4a \times 5b$

$4 \times a \times 5 \times b = 4 \times 5 \times a \times b = 20ab$

(ii) .... $20ab$ .... [1]

(b) Factorise fully.

common factor = 2

(i) $6g + 8h$

$6g + 8h = 2(3g + 4h)$

(b)(i) .... $2(3g + 4h)$ .... [1]

(ii) $5x^2 - 15x$

$5x(x - 3)$

common factor = $5x$

(ii) .... $5x(x - 3)$ .... [2]

Turn over

7 **(a)** Work out. $\color{red}{\text{BIDMAS}}$

(i) $1 + 4 \div 2$

$$1 + (4 \div 2)$$
$$= 1 + 2 = 3$$

(a)(i) .... 3 .... **[1]**

(ii) $2 + 5 \times (8 - 4)$

$$2 + (5 \times 4)$$
$$= 2 + 20$$
$$= 22$$

(ii) .... 22 .... **[1]**

(b) Evaluate.

(i) 2^5

$$2^5 = 2 \times 2 \times 2 \times 2 \times 2$$
$$= 32$$

(b)(i) .... 32 .... **[1]**

(ii) $\sqrt{400}$ $\quad \color{red}{\sqrt{a} \times \sqrt{b} = \sqrt{ab}}$

$$\sqrt{400} = \sqrt{4} \times \sqrt{100} = 2 \times 10 = 20$$

(ii) .... 20 .... **[1]**

(c) Estimate the value of

$$\frac{23.1 \times 3.9}{8.12}.$$

$$23.1 \longrightarrow 20$$
$$3.9 \longrightarrow 4$$
$$8.12 \longrightarrow 8$$

$\color{blue}{\text{'estimate'} = \text{round}}$
$\color{blue}{\text{all numbers to 1}}$
$\color{blue}{\text{significant figure.}}$

$$\approx \frac{20 \times 4}{8}$$

(c) .... 10 .... **[3]**

$$= \frac{80}{8} = 10$$

8 This is a rule to find the time, in minutes, needed to roast lamb.

weight,
in pounds $\longrightarrow$ × 30 $\longrightarrow$ + 20 $\longrightarrow$ time,
in minutes

(a) Use the rule to work out the time needed to roast a piece of lamb which weighs 4 pounds.

$4 \longrightarrow \times 30 \longrightarrow +20 \longrightarrow$ time to roast

$4 \times 30 = 120$

$120 + 20 = 140$

time to roast = 140 minutes

(a) .... 140 .... minutes **[2]**

(b) A different piece of lamb takes 95 minutes to roast.

Use the rule to work out the weight of this piece of lamb.

time to roast $\longrightarrow -20 \longrightarrow \div 30 \longrightarrow$ weight

$95 - 20 = 75$

$75 \div 30 = \dfrac{75}{30} = \dfrac{25}{10} = 2\cdot5$

(b) .... 2·5 .... pounds **[2]**

Turn over

9 The diagram represents a rectangular garden of length 10 m and width 8 m.
The flower bed is a triangle and the patio is a trapezium.
The rest of the garden is lawn.
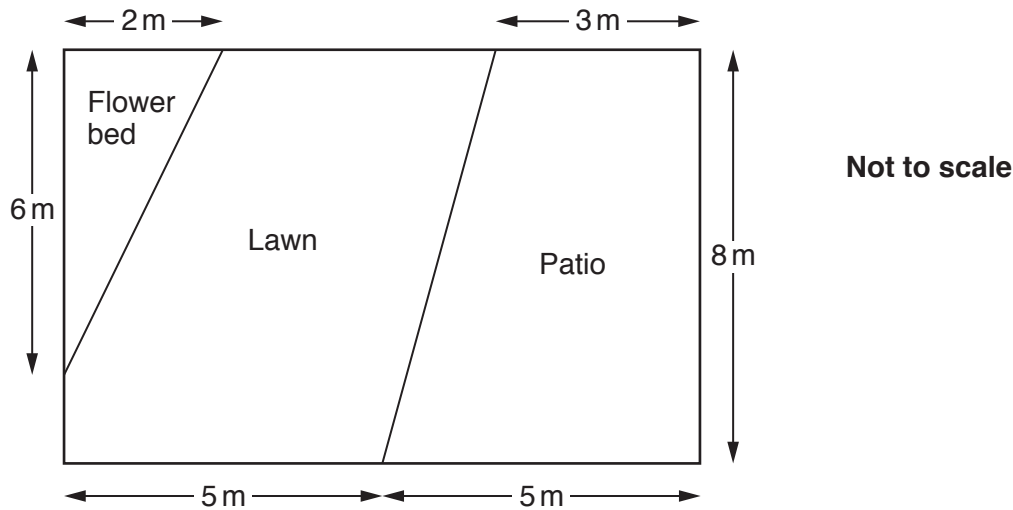
Work out the area of the lawn.

area of garden = length × width
= 10 × 8 = 80m²

area of flower bed = $\frac{1}{2}$ × base × height
= $\frac{1}{2}$ × 2 × 6 = 6m²

area of patio = $\frac{1}{2}$ × (3 × 5) × 8
= $\frac{1}{2}$ × 8 × 8 = 4 × 8 = 32m²

area of lawn = 80 − 6 − 32
= 80 − 38
= 42m²

42 .... m² **[6]**

10 This pie chart shows how the employees of a business travel to work.

Not to scale

Cycle

72°

Walk   48°   240°

Car
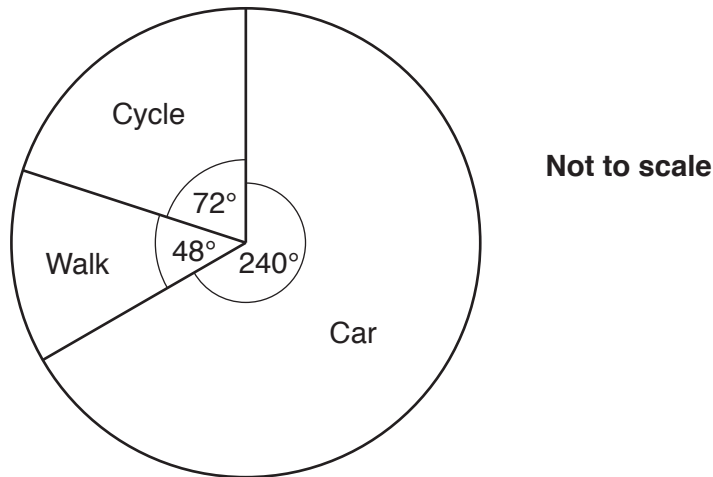
(a) Find the ratio of the number of employees who cycle to work to the number of employees who walk to work.
Give your answer in its simplest form.

cycle : walk
÷12 ⎰ 72° : 48° ⎱ ÷12
   ⎱ 6 : 4 ⎰
÷2 ⎰ 3 : 2 ⎱ ÷2

(a) ....3....... : ....2....... [2]

(b) 80 employees travel to work by car.

Work out the number of employees who cycle to work and the number of employees who walk to work.

cycle + walk = 72+48 = 120

cycle : walk
  3 : 2

40 ÷ 5 = 8

cycle = 3×8 = 24
walk = 2 × 8 = 16

(b) cycle ....24........
    walk ....16........ [3]

11 (a) Georgia is 4 feet 2 inches tall.
There are 12 inches in a foot.

Use the conversion, 1 inch = 2.5 centimetres, to convert Georgia's height into metres.

$4 \text{ feet} = 4 \times 12 = 48 \text{ inches}$

$4 \text{ feet } 2 \text{ inches} = 48 + 2 = 50 \text{ inches}$

$1 \text{ inch} = 2.5 \text{ cm}$

$50 \text{ inches} = 125 \text{ cm}$

$125 \text{ cm} = \underline{1.25 \text{ m}}$

(a) .... 1.25 .... m **[3]**

(b) Owen weighs 6 stones 4 pounds.
There are 14 pounds in a stone.

Use the conversion, 2.2 pounds = 1 kilogram, to convert Owen's weight into kilograms.

$6 \text{ stones} = 6 \times 14 = 84 \text{ pounds}$

$6 \text{ stones } 4 \text{ pounds} = 84 + 4 = 88 \text{ pounds}$

$2.2 \text{ pounds} = 1 \text{ kg}$

$88 \div 2.2 = \dfrac{88}{2.2} = \dfrac{880}{22} = 40$

(b) .... 40 .... kg **[3]**

12 Jack carries out a survey in his school.
He selects 50 students, at random, and asks them

Do you think that it is a good idea to have women-only railway carriages?

These are his results.

	Number of students
Yes	32
No	13
Don't know	5

(a) What percentage of the students in Jack's survey answered 'Yes'?

Yes: 32 out of 50 students

$$\frac{32}{50} = \frac{64}{100} \longrightarrow 64\%$$

(a) .... 64 .... % **[3]**

(b) Jack says

My survey shows that people in England think that it is a good idea to have women-only railway carriages.

Explain why Jack may be wrong.

Jack's sample of 50 students from his school may not be representative of the entire population of England as the sample size is too small.

[1]

13 ABCD and PQRS are rectangles.
O is the centre of both rectangles.

A ─────────────────────── B
P   6 cm   Q

Not to scale

2 cm

O

S   R

D ─────────────────────── C
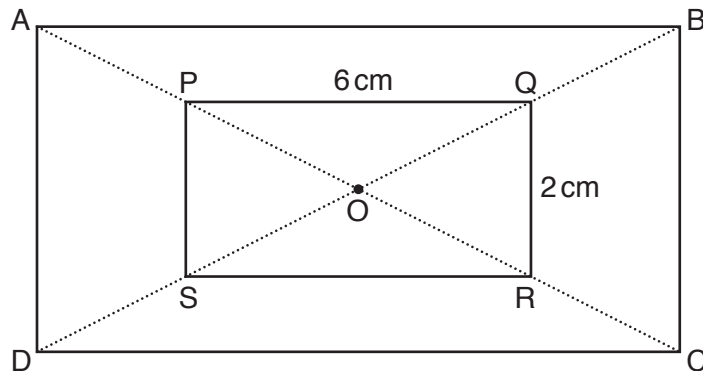
AC is a straight line passing through P, O and R.
BD is a straight line passing through Q, O and S.

PQ = 6 cm and QR = 2 cm.
The perimeter of rectangle ABCD is 40 cm.

Work out the length and width of rectangle ABCD.

$$PQ : QR$$

$$\div 2 \left(\begin{array}{c} 6 : 2 \\ 3 : 1 \end{array} \right) \div 2$$

$$\text{Length} : \text{width}$$

$$3 : 1$$

$$3w : w$$

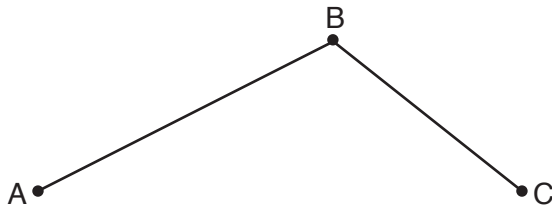$$\text{perimeter of ABCD} = 3w + w + 3w + w = 8w$$

$$8w = 40 \text{ cm}$$

$$w = 40 \div 8 = 5 = \text{width}$$

$$\text{length} = 3w = 3 \times 5 = 15$$

length = ...15................ cm

width = ...5................ cm **[3]**

14 Halina cycled from A to B at an average speed of 26 km per hour.
She then cycled from B to C at an average speed of 20 km per hour.

B

Not to scale

A   C

She left A at 10.00 am, did not stop at B and arrived at C at 3.00 pm.

(a) It took Halina x hours to cycle from A to B.

(i) Explain why the distance from A to B, in kilometres, is 26x.

speed = distance/time   distance = speed × time

26 × x = 26x

............[1]

(ii) Write down an expression, in terms of x, for the **time** taken to cycle from B to C.

total time from A to C = 3pm − 10am = 5 hours

time B → C = (5 − x) hours

(a)(ii) ..... 5 − x ..... hours [2]

(iii) Hence show that the **distance** from B to C, in kilometres, is 100 − 20x.

distance = speed × time
         = 20 × (5 − x) = 20(5 − x)
         = 100 − 20x

.....[1]

(b) The **total distance** cycled by Halina from A to C is 118 km.

Find the distance from A to B.
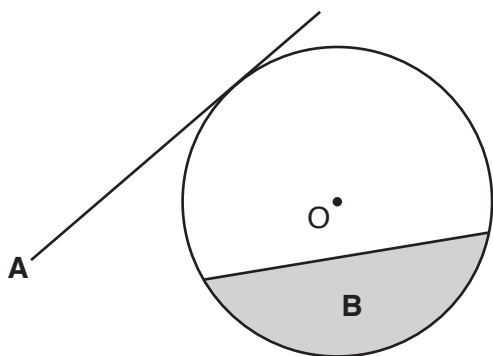
total distance = 26x + (100 − 20x)

118 = 6x + 100

18 = 6x

3 = x

distance from A to B (b) ..... 78 ..... km [4]
         = 26x

         = 26 × 3 = 78 km

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Turn over

15 The diagram shows a circle, centre O.

Write down the mathematical name of

(a) line **A**,

(a) .... *tangent* .... [1]

(b) shaded region **B**.

(b) .... *Segment* .... [1]

16 (a) Write the next term in each of these sequences.

→ *fibonacci sequence*

(i) 1   1   2   3   5   8 , *13*

$5 + 8 = 13$

(a)(i) .... *13* .... [1]
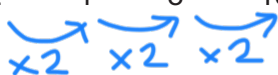
(ii) 2   4   8   16   32   64 , *128*   → *geometric progression with common ratio 2*

×2 ×2 ×2

(ii) .... *128* .... [1]

(b) Write an expression for the *n*th term of the sequence below.

0th term

n = 0   1   2   3   4
18   15   12   9   6

−3 −3 −3 −3
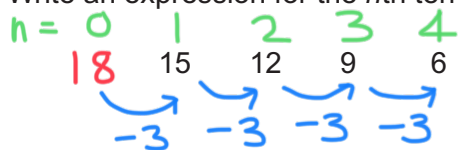
$\text{nth term} = -3n + k$

$= -3n + 18$

$= 18 - 3n$

(b) .... *18 − 3n* .... [2]

17 Andrew is thinking of a number.

- It is between 1 and 150.
- It is one more than a square number.
- It is three less than a cube number.
- It is not a prime number.

What is Andrew's number?
You must show all your reasoning.

n^2: 1 4 9 16 25 36 49 64 81 100 121 144

$n^2 + 1$: 2 ⑤ 10 17 26 37 50 65 82 101 ⑫⑫ 145

n^3: 1 8 27 64 125

$n^3 - 3$: -2 ⑤ 24 61 ⑫⑫

5 is a prime number $\longrightarrow$ Andrew's number can't be 5

.... 122 .... **[4]**

18 (a) Factorise.

$$x^2 - 43^2 = (x + 43)(x - 43)$$

$\longrightarrow$ difference of two squares

(a) .... **[1]**

(b) Calculate.

$$57^2 - 43^2 = (57 + 43)(57 - 43)$$
$$= 100 \times 14 = 1400$$

(b) .... 1400 ...... **[2]**

19 The angles in a triangle are in the ratio 1 : 2 : 3.

(a) Show that the triangle is a right-angled triangle. **[2]**

$$1 : 2 : 3 \longrightarrow 1 + 2 + 3 = 6$$

6 parts $= 180°$

$180 \div 6 = 30$

$\times 30 \left(\begin{array}{ccc} 1 : 2 : 3 \\ 30° : 60° : 90° \end{array} \right) \times 30$

(b) The hypotenuse of the triangle is 15 cm long.

Calculate the length of the shortest side in the triangle.

$$\sin \theta = \frac{O}{H}$$
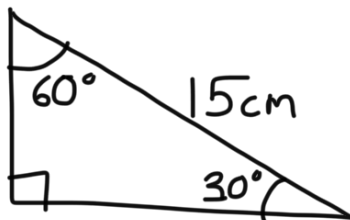
$$\sin 30 = \frac{x}{15}$$

$$x = 15 \times \frac{1}{2} = 7.5$$

(b) .... 7.5 .... cm **[4]**

20 There is a total of 250 men, women and children on a train.
The ratio of men to women is 4 : 5.
The ratio of women to children is 10 : 7.

How many men are on the train?

men : women   women : children

$\times 2 \left(\begin{array}{cc} 4 : 5 \\ 8 : 10 \end{array} \right) \times 2$ $10 : 7$

men : women : children
8 : 10 : 7

$8 + 10 + 7 = 25$

$250 \div 25 = 10$

number of men $= 8 \times 10 = 80$

.... 80 .... **[4]**

21 (a) Noah starts to draw a tree diagram showing the outcomes of throwing a six when a fair dice is thrown twice.

First Throw   **Second Throw**
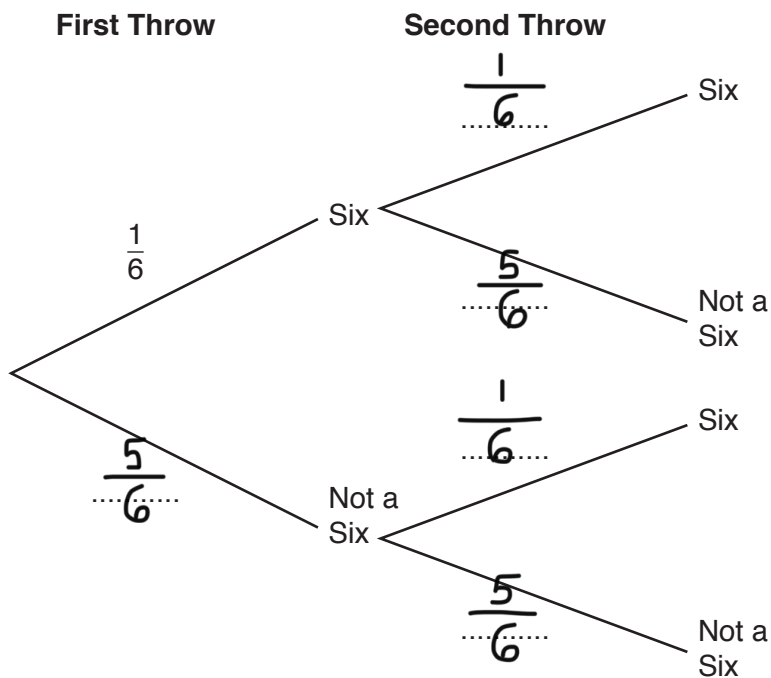
(i) Complete the tree diagram. **[1]**

(ii) What is the probability of throwing two sixes?

$$\frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$$

(a)(ii) .... $\frac{1}{36}$ .... **[2]**

(b) Cara throws the same dice three times.

Show that the probability that Cara does not throw a six until her third throw is $\frac{25}{216}$. **[2]**

$$P(\text{not a six}) \times P(\text{not a six}) \times P(\text{six})$$

$$= \frac{5}{6} \times \frac{5}{6} \times \frac{1}{6} = \frac{25}{36 \times 6} = \frac{25}{216}$$

Turn over

22 (a) Beth is given the following question.

> Work out
>
> $$4.1 \times 10^5 \times 3 \times 10^2.$$
>
> Give your answer in standard form.

This is Beth's answer to the question.

$$12.3 \times 10^7$$

Explain why Beth's answer is incorrect.

12.3 is greater than 10 so Beth's answer is not in standard form. **[1]**

(b) Show that

$$4.5 \times 10^2 + 7.3 \times 10^3 = 7.75 \times 10^3.$$

$4.5 \times 10^2 = 450$

$7.3 \times 10^3 = 7300$

$4.5 \times 10^2 + 7.3 \times 10^3 = 450 + 7300$

$= 7750$

$7750 = 7.75 \times 10^3$

[2]

23 **(a)** *n* is an integer.

    (i) Explain why $2n + 1$ is an odd number.

$2n$ is a multiple of 2 so will always be even. $2n + 1$ will always be odd.

        [1]

    (ii) Write down an algebraic expression for the next odd number after $2n + 1$.

odd   +1

$2n+1 \longrightarrow$ $\overset{even}{2n+2} \to \overset{odd}{2n+3}$

(a)(ii) $2n + 3$

        [1]

(b) Use algebra to show that the sum of two consecutive odd numbers will always be a multiple of 4. **[2]**

two consecutive odd numbers $= 2n+1,$
                         $2n+3$

sum of two consecutive odd numbers $=$
             $2n+1 \;+\; 2n+3 \;+$
                    $4n+4$

$4n + 4 = 4(n-1)$

$\hookrightarrow$ common factor of 4 so $4n+4$ is a multiple of 4. the sum of two consecutive odd numbers is always a multiple of 4.

END OF QUESTION PAPER

20

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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