Big Win

Probability

4   A bag contains blue, red, yellow and green balls only.
     A ball is taken from the bag at random.
     The table shows some information about the probabilities.

Colour	Blue	Red	Yellow	Green
Probability	0.15	0.2	0.22	0.43

(a) Complete the table.

[2]

(b) Abdul takes a ball at random and replaces it in the bag.
     He does this 200 times.

     Find how many times he expects to take a red ball.

                                                40
     .... [1]

5   (a) The nth term of a sequence is $60 - 8n$.

         Find the largest number in this sequence.

         $n \geq 1$:

         $60 - 8(1)$

         $= 60 - 8$

         $= 52$ 52
     .... [1]

    (b) Here are the first five terms of a different sequence.

         12 $+7$ 19 $+7$ 26 $+7$ 33 $+7$ 40

         Find an expression for the nth term of this sequence.

         n^{th}: $a + (n-1)d$

         $= 12 + (n-1)(7)$

         $= 12 + 7n - 7$

         $= 7n + 5$

                                                $7n + 5$
     .... [2]

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3
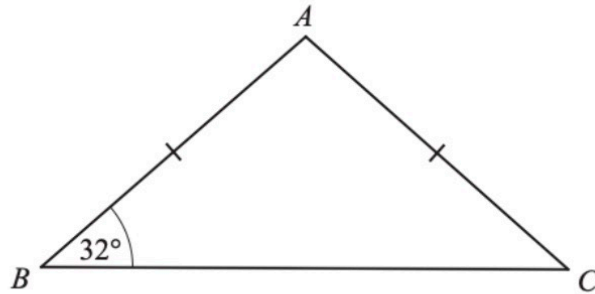
NOT TO SCALE

Triangle *ABC* is isosceles.
Angle *ABC* = 32° and *AB* = *AC*.

Find angle *BAC*.

$180 - 2(82)$

$= 116$

Angle *BAC* = ...116............................. [2]

4   A train journey takes 5 hours 54 minutes.

(a)   The journey starts at 09 15.

Find the time that the journey ends.

.............15 : 09............................. [1]

(b)   The average speed of the train for this journey is 80 km/h.

Calculate the distance travelled.

$5\frac{54}{60}$ h × 80 km/h

$= 472$

.............472............................. km [2]

5   Sofia has a bag containing 8 blue beads and 7 red beads only.
She takes one bead out of the bag at random and replaces it.
She does this 90 times.

Find the number of times she expects to take a red bead.

$\frac{7}{15} \times 90 = 42$

.............42............................. [2]

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2   The heights, h metres, of the 120 boys in an athletics club are recorded.
     The table shows information about the heights of the boys.

Height (h metres)	$1.3 < h \leqslant 1.4$	$1.4 < h \leqslant 1.5$	$1.5 < h \leqslant 1.6$	$1.6 < h \leqslant 1.7$	$1.7 < h \leqslant 1.8$	$1.8 < h \leqslant 1.9$
Frequency	7	18	30	24	27	14

   (a) (i) Write down the modal class.

                                                    1.5 .... $< h \leqslant$ ....1.6..... [1]

       (ii) Calculate an estimate of the mean height.

$$\frac{(7 \times 1.35) + (18 \times 1.45) + (30 \times 1.55) + (24 \times 1.65) + (27 \times 1.75) + (14 \times 1.85)}{120}$$

                                                    ......1.62...... m [4]

   (b) (i) One boy is chosen at random from the club.

            Find the probability that this boy has a height greater than 1.8 m.

                                                    $\frac{7}{60}$
                                                    .... [1]

       (ii) Three boys are chosen at random from the club.

            Calculate the probability that one of the boys has a height greater than 1.8 m and the other
            two boys each have a height of 1.4 m or less.

$$3\left(\frac{14}{120} \times \frac{7}{119} \times \frac{6}{118}\right)$$

$$\geq \frac{21}{20\,060}$$

                                                    $\frac{21}{20\,060}$
                                                    .... [4]
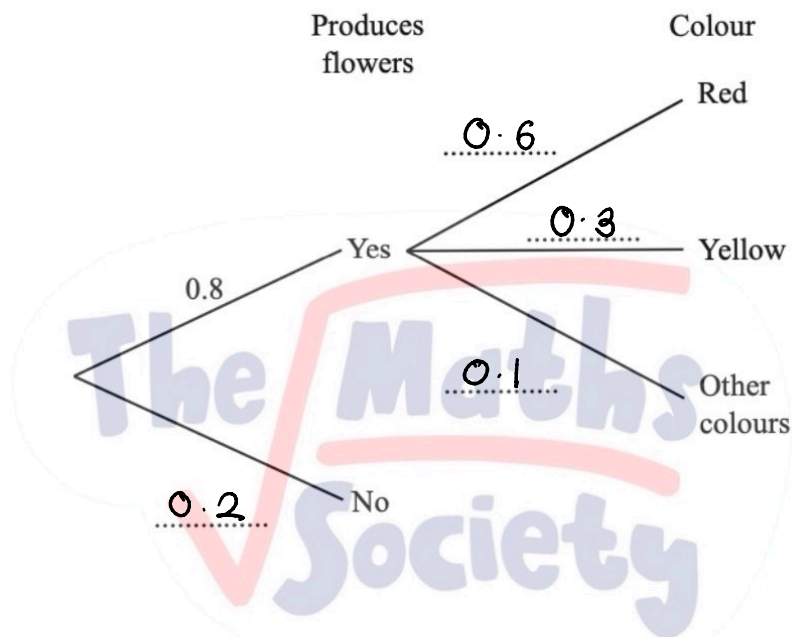
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7   Tanya plants some seeds.
The probability that a seed will produce flowers is 0.8 .
When a seed produces flowers, the probability that the flowers are red is 0.6 and the probability that the flowers are yellow is 0.3 .

(a)   Tanya has a seed that produces flowers.

Find the probability that the flowers are not red and not yellow.

..............................0·1.............................. [1]

(b)   (i)   Complete the tree diagram.

Produces
flowers

Colour

Red

....0·6....

....0·3.... Yellow

Yes

0.8

....0·1.... Other
colours

....0·2.... No

[2]

(ii)   Find the probability that a seed chosen at random produces red flowers.

0·8 × 0·6

= $\frac{8}{10} × \frac{6}{10}$

= $\frac{12}{25}$

$\frac{12}{25}$

.... [2]

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(iii) Tanya chooses a seed at random.

Find the probability that this seed does not produce red flowers and does not produce yellow flowers.

$$\left(0.8 \times 0.1\right) + 0.2$$

$$= \frac{7}{25}$$

.... **[3]** $\frac{7}{25}$

(c) Two of the seeds are chosen at random.

Find the probability that one produces flowers and one does not produce flowers.
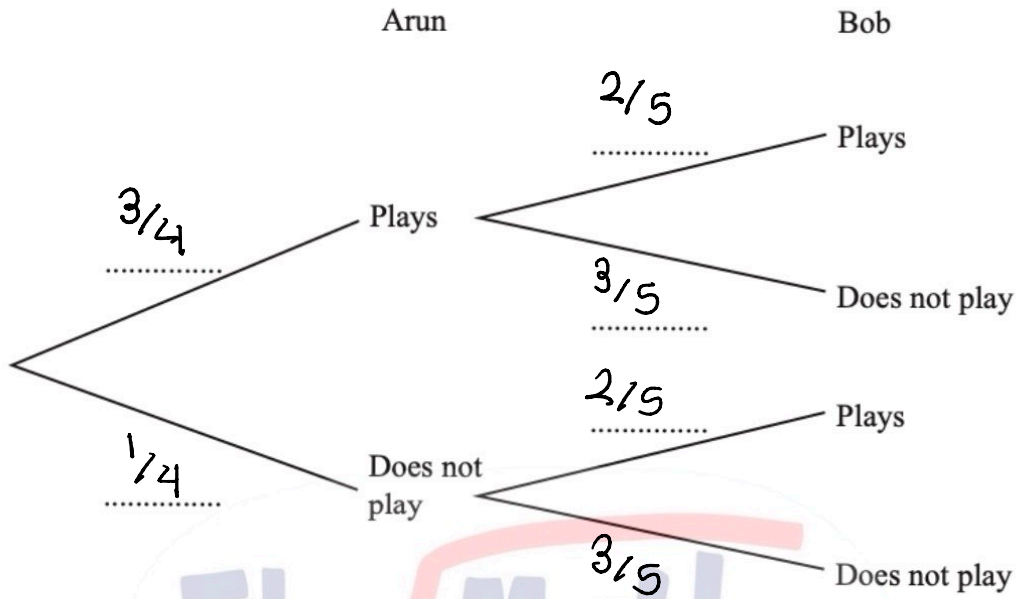
$$2\left(\left(0.8\right)\left(0.2\right)\right)$$

$$= 2\left(\frac{8}{10} \times \frac{2}{10}\right)$$

$$= \frac{8}{25}$$

.... **[3]** $\frac{8}{25}$

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7 On any Saturday, the probability that Arun plays football is $\frac{3}{4}$.

On any Saturday, the probability that Bob plays football is $\frac{2}{5}$.

(a) (i) Complete the tree diagram.

Arun   Bob

2/5 .... Plays

3/4 .... Plays

3/5 .... Does not play

1/4 .... Does not play

2/5 .... Plays

3/5 .... Does not play

[2]

(ii) Calculate the probability that, one Saturday, Arun and Bob both play football.

$3/4 \times 2/5$

$= 3/10$

$3/10$ .... [2]

(iii) Calculate the probability that, one Saturday, either Arun plays football or Bob plays football, but not both.

Both Plays: $3/10$

Both don't play: $1/4 \times 3/5 = 3/20$

$1 - 3/10 - 3/20$

$= 11/20$

$11/20$ .... [3]

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(b) Calculate the probability that Bob plays football for 2 of the next 3 Saturdays.

$$3 \left(\frac{2}{5} \times \frac{2}{5} \times \frac{3}{5} \right)$$

$$= 3 \left(\frac{12}{125} \right)$$

$$= \frac{36}{125}$$

.... $\frac{36}{125}$ .... [3]

(c) When Arun plays football, the probability that he scores the winning goal is $\frac{1}{7}$.

Calculate the probability that Arun scores the winning goal one Saturday.

$$\frac{3}{4} \times \frac{1}{7}$$

$$= \frac{3}{28}$$

.... $\frac{3}{28}$ .... [2]

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6   Suleika has six cards numbered 1 to 6.

$$\boxed{1} \quad \boxed{2} \quad \boxed{3} \quad \boxed{4} \quad \boxed{5} \quad \boxed{6}$$

(a) She takes one card at random, records the number and replaces the card.

(i) Write down the probability that the number is 5 or 6.

$1/3$

.... [1]

(ii) Suleika does this 300 times.

Find how many times she expects the number 5 or 6.

100

.... [1]

(b) Suleika takes two cards at random, without replacement.

(i) Find the probability that the sum of the numbers on the two cards is 5.

$$\frac{4}{30} = \frac{2}{15}$$

.... [3]

(ii) Find the probability that at least one of the numbers on the cards is a square number.

$$\frac{18}{30} = \frac{3}{5}$$

(b) A bag contains 54 red marbles and some blue marbles.
36% of the marbles in the bag are red.

Find the number of blue marbles in the bag.

$0.36x = 54$

$x = \dfrac{54}{0.36}$

$x = 150$

$150 - 54 = 96$

.... 96 .... [2]

(c) Another bag contains 15 red beads and 10 yellow beads.
Ariana picks a bead at random, records its colour and replaces it in the bag.
She then picks another bead at random.

(i) Find the probability that she picks two red beads.

$\dfrac{15}{25} \times \dfrac{15}{25}$

$= 9/25$

.... [2]

(ii) Find the probability that she does not pick two red beads.

16/25

.... [1]

(d) A box contains 15 red pencils, 8 yellow pencils and 2 green pencils.
Two pencils are picked at random without replacement.

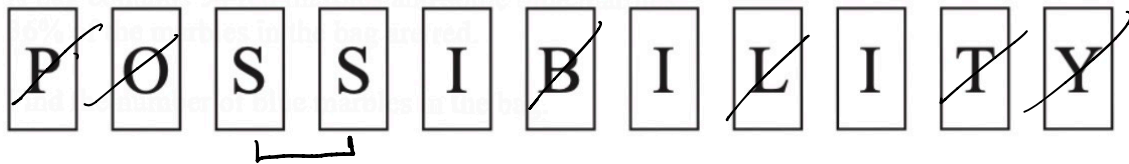Find the probability that at least one pencil is red.

$15 + 8 + 2 = 25$

1 − no red

$= 1 - \left(\dfrac{10}{25} \times \dfrac{9}{24} \right) = \dfrac{17}{20}$

.... [3]

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4

| P | O | S | S | I | B | I | L | I | T | Y |

Morgan picks two of these letters, at random, **without** replacement.

(a) Find the probability that he picks

(i) the letter Y first,

$$\frac{1}{11}$$

.... [1]

(ii) the letter B then the letter Y,

$$\frac{1}{11} \times \frac{1}{10}$$

$$= \frac{1}{110}$$

$$\frac{1}{110}$$ .... [2]

(iii) two letters that are the same.

$$\left(\frac{2}{11} \times \frac{1}{10}\right) + \left(\frac{3}{11} \times \frac{2}{10}\right)$$

$$= \frac{4}{55}$$

$$\frac{4}{55}$$ .... [3]

(b) Morgan now picks a third letter at random.

Find the probability that ●

(i) all three letters are the same,

$$\frac{3}{11} \times \frac{2}{10} \times \frac{1}{9}$$

$$= \frac{1}{165}$$

$$\frac{1}{165}$$ .... [2]

(ii) exactly two of the three letters are the same,
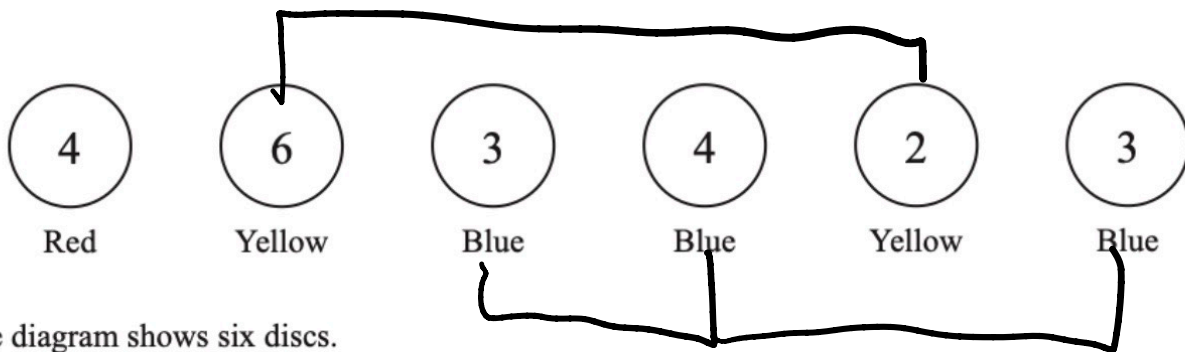
$I : 3\left(\dfrac{3}{11} \times \dfrac{2}{10} \times \dfrac{8}{9}\right)$

$S : 3\left(\dfrac{2}{11} \times \dfrac{1}{10} \times \dfrac{9}{9}\right)$ $\Bigg] = \dfrac{1}{5}$

$\dfrac{1}{5}$

.... [5]

(iii) all three letters are different.

$1 - \dfrac{1}{5} - \dfrac{1}{165}$

$= \dfrac{131}{165}$

$\dfrac{131}{165}$

.... [2]

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6

(4)	(6)	(3)	(4)	(2)	(3)
Red	Yellow	Blue	Blue	Yellow	Blue

The diagram shows six discs.
Each disc has a colour and a number.

(a) One disc is picked at random.

Write down the probability that

(i) the disc has the number 4,

$1/3$

.... [1]

(ii) the disc is red and has the number 3,

0

.... [1]

(iii) the disc is blue and has the number 4.

$1/6$

.... [1]

(b) Two of the six discs are picked at random **without** replacement.

Find the probability that

(i) both discs have the number 3,

$$\frac{3}{6} \times \frac{1}{5} = \frac{1}{15}$$

$1/15$

.... [2]

(ii) both discs have the same colour.

$$\left(\frac{2}{6} \times \frac{1}{5}\right) + \left(\frac{3}{6} \times \frac{2}{5}\right)$$

$$= \frac{4}{15}$$

$4/15$

.... [3]

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11   A bag contains 7 red discs, 5 green discs and 2 pink discs.

(a) Helen takes one disc at random, records the colour and replaces it in the bag.
     She does this 140 times.

     Find how many times she expects to take a green disc.

$$\frac{5}{7+5+2} \times 140 = 50$$

50

.... [2]

(b) Helen adds 9 green discs and some pink discs to the discs already in the bag.
     The probability of taking a green disc is now $\frac{2}{7}$.

     Find the number of pink discs that Helen added to the bag.

$$\frac{14}{7+5+2+9+x} = 2/7 \quad \rightarrow \quad 98 = 46+2x$$
$$52 = 2x$$
$$x = 26$$
$$\frac{14}{28+x} = 2/7$$

26

.... [2]

12   A straight line, l, has equation $y = 5x + 12$.

(a) Write down the gradient of line l.

5

.... [1]

(b) Find the coordinates of the point where line l crosses the x-axis.

$$0 = 5x + 12$$
$$-12 = 5x$$
$$x = -12/5$$

(.....-2.4..... , ...0.....) [2]

(c) A line perpendicular to line l has gradient k.

     Find the value of k.

$$-1/5$$

$k =$ .... [1]

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