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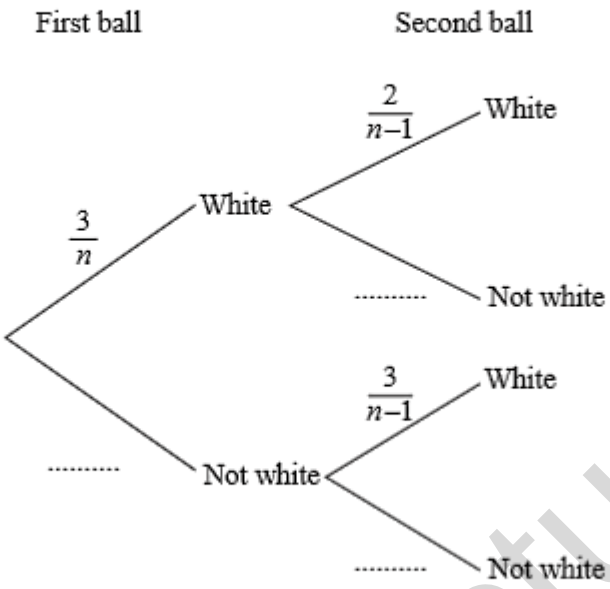
24 A bag contains n balls.
3 of the balls are white.
Two balls are taken from the bag, at random, without replacement.

(a) Complete the tree diagram.



[2]

(b) The probability that both balls are white is $\frac{1}{15}$.

Show that $n^2 - n - 90 = 0$.

[2]

(c) Find the value of n.

Answer ..... [2]

Answer:

24(a)	Correctly completed tree diagram $\frac{n-3}{n-1}$ oe $\frac{n-3}{n}$ oe $\frac{n-4}{n-1}$ oe	**2**	**C1** for one correct probability correctly positioned

24(b)	$\frac{3}{n}\times\frac{2}{n-1}=\frac{1}{15}$	**M1**	
	Correct rearrangement with at least one further step to reach $n^2-n-90=0$	**A1**	
24(c)	10	**2**	**B1** for solutions 10, –9 seen or **M1** for $(n-10)(n+9)\ [=0]$ or for $\frac{1\pm\sqrt{(-1)^2-4\times1\times-90}}{2\times1}$ or better

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3

Humanities:	Geography (G) History (H) Religious studies (R)

Science:	Physics (P) Chemistry (C) Biology (B)

A student has to choose one humanities subject and two different science subjects.

(a) Complete the table to show the possible outcomes.

Answer

Humanities	Science
G	P and C
G	P and B

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(b) Khalif chooses his subjects at random.

(i) Find the probability that he chooses Geography.

Answer ..... [1]

(ii) Find the probability that he chooses Physics.

Answer ..... [1]

(iii) Find the probability that he chooses **both** Religious studies and Chemistry.

Answer ..... [1]

Answer:

3(a)	GCB, HPC, HPB, HCB, RPC,RPB, RCB	**2**	**B1** for 5 correct and none incorrect or for 6 correct
3(b)(i)	$\frac{3}{9}$ or $\frac{1}{3}$ or 0.333(..) or 33.3(..)%	**1**	FT dep on B1 scored in **(a)**
3(b)(ii)	$\frac{6}{9}$ or $\frac{2}{3}$ or 0.666 – 0.667 or 66.6% – 66.7%	**1**	FT dep on B1 scored in **(a)**
3(b)(iii)	$\frac{2}{9}$ or 0.222(...) or 22.2(...)%	**1**	FT dep on B1 scored in **(a)** After 0 scored in **(i) (ii)** and **(iii)**, **SC1** for $\frac{3}{k},\frac{6}{k},\frac{2}{k}$

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3 Rowena spins two fair spinners, each numbered 1 to 4.
Her score is the value when the numbers on the two spinners are multiplied together.
The table shows some of Rowena's possible scores.

×	1	2	3	4
1	1	2	3	4
2	2	4		
3				
4				

(a) Complete the table of possible scores. [2]

(b) Find the probability that Rowena's score is less than 4.

Answer ..... [1]

(c) Find the probability that Rowena's score is an even number.
Give your answer as a fraction in its lowest terms.

Answer ..... [2]

(d) Phoebe says that Rowena's score is more likely to be a square number than a factor of 6.

Is she correct?
Show your working.

Answer

[2]

Answer:

3(a)	- - - - - - 6 8 3 6 9 12 4 8 12 16	2	**B1** for at least 6 correct
3(b)	$\frac{5}{16}$ or 0.3125 or 31.25%	1	FT *their* complete table (decimals or percentages correct to at least 3sf)
3(c)	$\frac{3}{4}$ cao	2	**B1** for $\frac{12}{16}$ or $\frac{6}{8}$ or $\frac{\textit{their}12}{16}$ oe
3(d)	No with square 6 **and** factors 7 seen or square $\frac{6}{16}$ **and** factors $\frac{7}{16}$ seen or 1 4 4 4 9 16 **and** 1 2 2 3 3 6 6 seen or 1^2 2^2 2^2 2^2 3^2 4^2 **and** 1 2 2 3 3 6 6 seen	2	**B1** for square $\frac{6}{16}$ or factors $\frac{7}{16}$ or 1 4 4 4 9 16 seen or 1^2 2^2 2^2 2^2 3^2 4^2 seen or 1 2 2 3 3 6 6 seen or square 6 **and** factors 7

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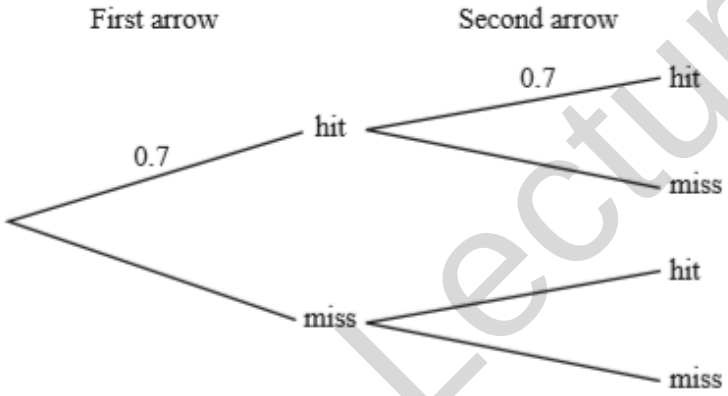
19 Each time an archer fires an arrow, the probability that she hits the target is 0.7 .
She fires two arrows.

(a) Complete the tree diagram.



[1]

(b) Find the probability that

(i) she hits the target twice,

Answer ..... [1]

(ii) she hits the target exactly once.

Answer ..... [1]

Answer:

19(a)	Probabilities 0.7 and 0.3 on the correct branches	**1**	
19(b)(i)	0.49 oe	**1**	
19(b)(ii)	0.42 oe	**1**	FT from their diagram, provided their diagram probabilities are less than 1, and 0 < ans. < 1.

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4 Adam has a bag containing 9 balls, numbered from 1 to 9.

(a) Adam takes a ball at random from the bag and replaces it.

Find the probability that the ball has an odd number.

Answer ..... [1]

(b) Adam takes a ball from the 9 balls in the bag, notes the number and replaces it.
He then takes a second ball from the bag, notes the number and replaces it.

(i) Work out the probability that both numbers are odd.

Answer ..... [1]

(ii) Work out the probability that one number is odd and the other is even.

Answer ..... [2]

(c) Adam now takes two balls from the 9 balls in the bag, **without replacement**.

Work out the probability that the two numbers are either both odd or both even.

Answer ..... [3]

Answer:

4(a)	$\frac{5}{9}$ oe	**1**	
4(b)(i)	$\frac{25}{81}$ oe	**1**	
4(b)(ii)	$\frac{40}{81}$ oe	**2**	**M1** for $\frac{their\,5}{9}\times\frac{(9-their\,5)}{9}$ soi or $\frac{their\,5}{9}\times\frac{4}{9}$
4(c)	$\frac{4}{9}$ oe **nfww**	**3**	**M2** for $\frac{5}{9}\times\frac{4}{8}+\frac{4}{9}\times\frac{3}{8}$ or **M1** for $\frac{4}{9}\times\frac{3}{8}$ or $\frac{5}{9}\times\frac{4}{8}$

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6 **(a)** $\mathscr{E} = \{x : x \text{ is an integer and } 10 \leqslant x \leqslant 20\}$

$A = \{x : x \text{ is an odd number}\}$

$B = \{x : x \text{ is a multiple of } 5\}$

(i) Find $n(A \cap B)$.

Answer ..... [1]

(ii) Find $A' \cup B$.

Answer ..... [1]

(iii) A number, r, is chosen at random from $\mathscr{E}$.

Find the probability that $r \in A \cup B$.

Answer ..... [1]

(b) In a survey, 40 people were asked what they had read that day.

- A total of 10 people had read a book
- A total of 24 people had read a newspaper
- 14 people had read neither a book nor a newspaper

(i) By drawing a Venn diagram, or otherwise, find the number of people who had read both a book and a newspaper.

Answer ..... [2]

(ii) Two of the 10 people who had read a book are selected at random.

Work out the probability that they had both read a book and a newspaper.

Answer ..... [2]

Answer:

6(a)(i)	1	**1**	
6(a)(ii)	10, 12, 14, 15, 16, 18, 20	**1**	
6(a)(iii)	$\frac{7}{11}$ oe	**1**	
6(b)(i)	8	**2**	**M1** for $14 + 10 + 24 - x = 40$ oe or for correct Venn diagram with algebraic expressions. **Or B1** for Venn diagram with at least 3 numbers
6(b)(ii)	$\frac{28}{45}$ oe	**2FT**	**M1** for $\frac{their\,8}{k} \times \frac{their\,7}{k-1}$ [×2] where $k >$ their 8 Or **SC1** for $\left(\frac{their\,8}{10}\right)^2$

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4

T	R	I	G	O	N	O	M	E	T	R	Y

Twelve lettered tiles spelling the word TRIGONOMETRY are placed inside a bag.

(a) A tile is taken at random from the bag.

Find the probability that the tile shows a letter R.
Give your answer as a fraction in its simplest form.

Answer ..... [1]

(b) All the tiles are placed back in the bag, a tile is then taken at random and placed on the table.
A second tile is taken at random and placed to the right of the first tile.
A third tile is taken at random and placed to the right of the second tile.

1st	2nd	3rd
☐	☐	☐

Find the probability that, in the order the tiles were placed on the table, they spell GET.

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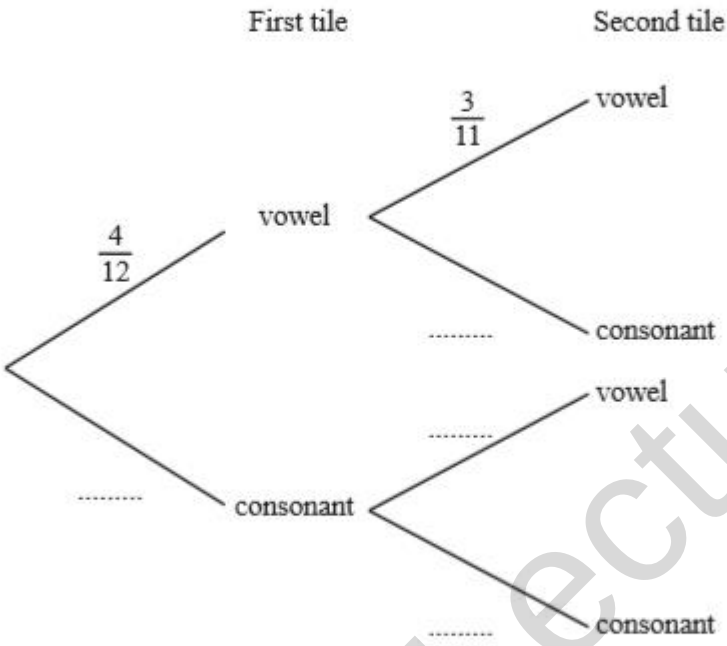
Answer ..... [2]

(c) Vowels are the letters A, E, I, O and U.
All other letters are consonants.
All the twelve tiles are placed back in the bag and two tiles are taken at random, without replacement.

(i) Complete the tree diagram.



[2]

(ii) Find the probability that the tiles both show vowels.

Answer ..... [1]

Answer:

4(a)	$\frac{1}{6}$ cao	**1**	
4(b)	$\frac{1}{660}$ oe	**2**	**M1** for $\frac{1}{12}\times\frac{1}{11}\times\frac{2}{10}$ oe or **SC1** for $\frac{1}{12}\times\frac{1}{12}\times\frac{2}{12}$ or answer $\frac{1}{864}$ or $\frac{1}{12},\frac{1}{11},\frac{2}{10}$
4(c)(i)	$\frac{8}{12},\frac{8}{11},\frac{4}{11},\frac{7}{11}$ oe correctly placed	**2**	**B1** for two correct
4(c)(ii)	$\frac{1}{11}$ oe	**1**	
4(c)(iii)	$\frac{16}{33}$ oe	**2**	**M1** for $\frac{4}{12}\times\frac{8}{11}$ or $\frac{8}{12}\times\frac{4}{11}$ oe

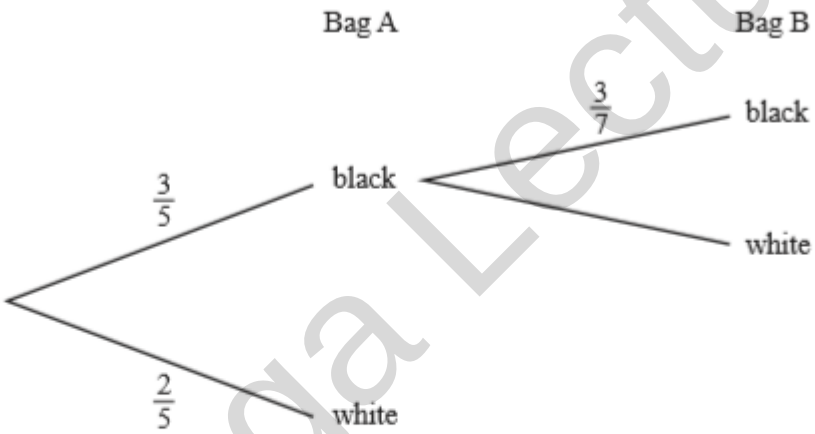
17

Bag A Bag B

Bag A contains 3 black and 2 white beads.
Bag B contains 2 black and 4 white beads.

A bead is chosen, at random, from Bag A and placed in Bag B.
A bead is then chosen, at random, from Bag B.

(a) Complete the tree diagram.



[2]

(b) Find the probability that a black bead is taken from Bag B.

Answer ..... [2]

Answer:

17(a)	$\frac{4}{7}$	**1**	
	$\frac{2}{7}$ (black) **and** $\frac{5}{7}$ (white) with two branches and both labels	**1**	
17(b)	$\frac{13}{35}$ oe	**2**	**FT** $\frac{3}{5}\times\frac{3}{7}+\frac{2}{5}\times(their\ \frac{2}{7})$ or **M1** for $\frac{3}{5}\times\frac{3}{7}$; or for $\frac{2}{5}\times(their\ \frac{2}{7})$

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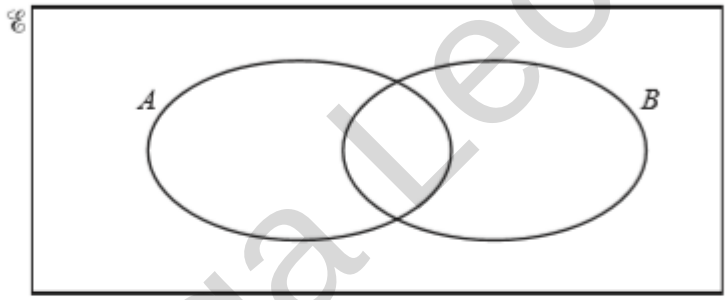
4 **(a)** $\mathscr{E} = \{x : x \text{ is an integer } 1 \leqslant x \leqslant 10\}$
$A = \{x : x \text{ is a factor of } 20\}$
$B = \{x : x \text{ is a multiple of } 4\}$

(i) Complete the Venn diagram.



[2]

(ii) State $n(A \cup B)$.

Answer ..... [1]

(iii) Describe in words the set $A \cap B'$.

Answer ..... [1]

(b) 30 people are asked what type of fruit they like.
Of these people,

- 5 say they like both oranges and bananas
- 12 say they like oranges
- 8 say they like neither oranges nor bananas.

(i) By drawing a Venn diagram, or otherwise, find the number of people who like bananas but not oranges.

Answer ..... [2]

(ii) Two of the 30 people are selected at random.

Find the probability that they both like oranges but not bananas.

Answer ..... [2]

Answer:

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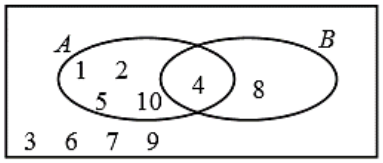
4(a)(i)		2	**B1** for 8 or 9 numbers correctly placed or for 1, 2, 4, 5, 8, 10 correctly placed with no numbers placed incorrectly
4(a)(ii)	6	1	**FT** n($A \cup B$) from *their* Venn diagram
4(a)(iii)	Factors of 10 **oe**	1	
4(b)(i)	10	2	**B1** for Venn diagram with at least 3 numbers correct Or **M1** for $30 = 8 + 12 + x$ **oe**
4(b)(ii)	$\frac{42}{870}$ or $\frac{7}{145}$ **oe**	2	**M1** for $\frac{their\,7}{30} \times \frac{their\,6}{29}$ [×2] or **SC1** for answer $\frac{49}{900}$ **oe**, FT their Venn diagram

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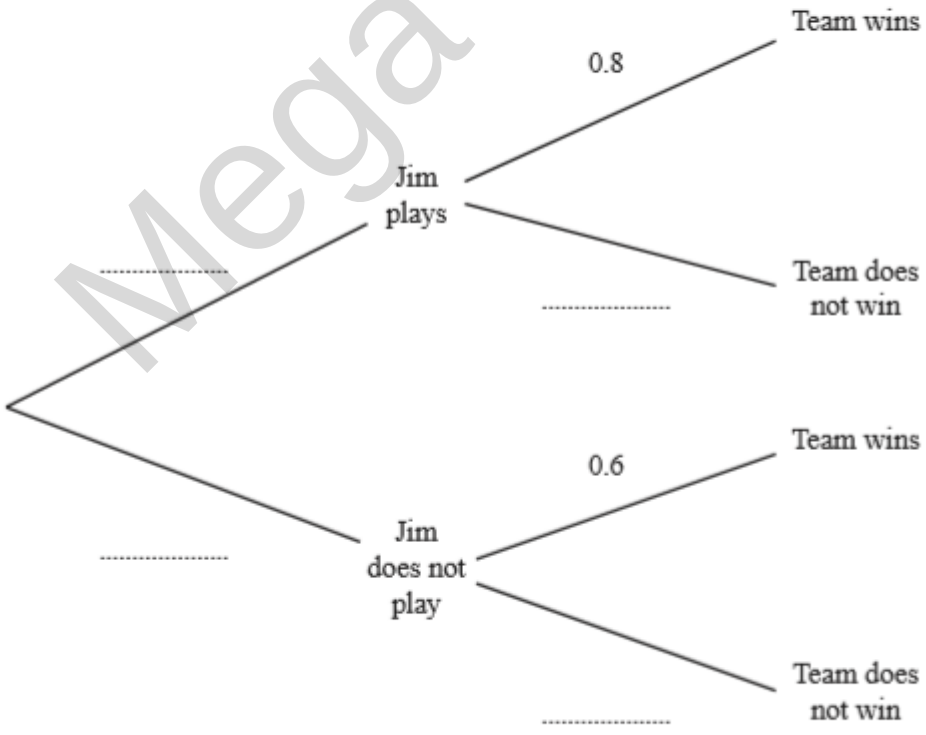
18 Jim plays for his local football team.
The probability that Jim plays in the next match is 0.7.

If Jim plays in the match, the probability of his team winning is 0.8.
If Jim does not play in the match, the probability of his team winning is 0.6.

(a) Complete the tree diagram.



[2]

(b) Calculate the probability that Jim's team wins their next match.

..... [2]

Answer:

18(a)	[0].7, [0].3, [0].2, [0].4 correctly placed	**2**	**M1** for two or three correct
18(b)	[0].74 oe	**2**	**M1** for 0.7 × 0.8 or 0.3 × 0.6 oe

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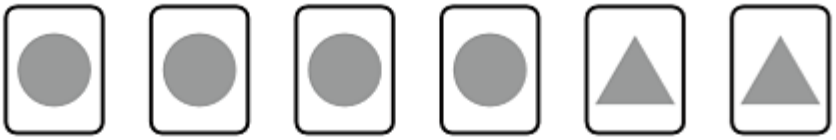
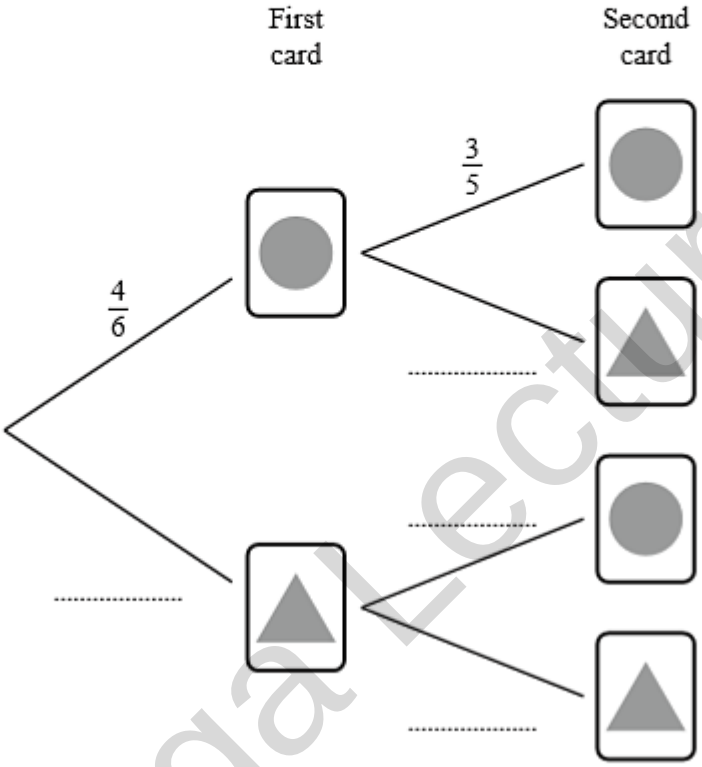
17



Nima has these six cards. Each card has a shape on it.
She takes two cards at random without replacement.

(a) Complete the tree diagram.



[2]

(b) Find the probability that the shapes on Nima's two cards are the same.
Give your answer as a fraction.

..... [2]

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Answer:

17(a)	$\frac{2}{6}$ on first branch $\frac{2}{5}, \frac{4}{5}, \frac{1}{5}$ on second set	**2**	**B1** for two or three completed correctly
17(b)	$\frac{14}{30}$ oe	**2**	**M1** for $\frac{4}{6}\times\frac{3}{5}$ oe **or** *their* $\frac{2}{6}\times$ *their* $\frac{1}{5}$ oe

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