Extended Mathematics
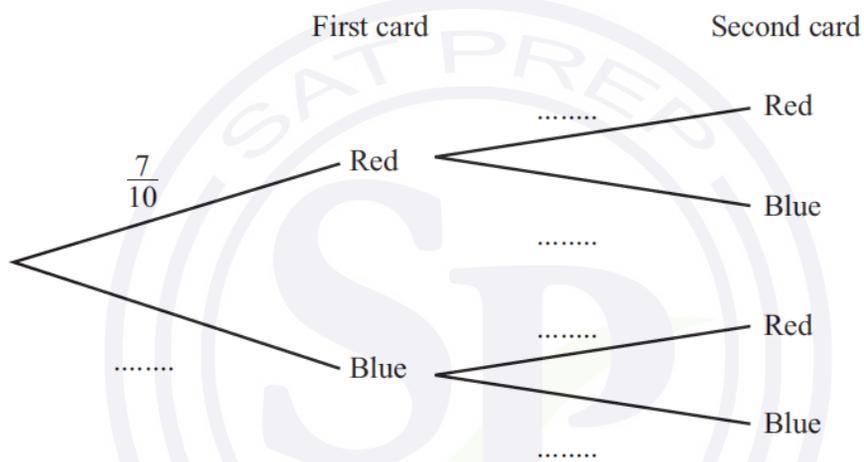**Topic :Probability**
Year :May 2013 -May 2024
Paper -4
Questions Booklet

Question 1

In a box there are 7 red cards and 3 blue cards.
A card is drawn at random from the box and is not replaced.
A second card is then drawn at random from the box.

(a) Complete this tree diagram.

First card   Second card

                                            .... — Red
            $\frac{7}{10}$ — Red
                                            ....
                                            .... — Blue

            .... — Blue
                                            .... — Red
                                            .... — Blue

[3]

(b) Work out the probability that the two cards are of different colours.
Give your answer as a fraction.

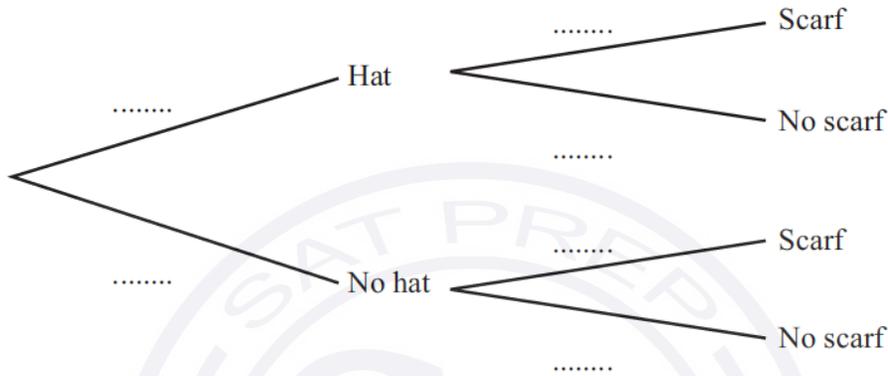*Answer(b)* .... [3]

Question 2

In this question, give all your answers as fractions.

When Ivan goes to school in winter, the probability that he wears a hat is $\frac{5}{8}$.

If he wears a hat, the probability that he wears a scarf is $\frac{2}{3}$.

If he does not wear a hat, the probability that he wears a scarf is $\frac{1}{6}$.

(a) Complete the tree diagram.

```
                              ........ ──────── Scarf
                      Hat ◄
        ........ ────/         ──────── No scarf
              /            ........
             ◄
        ........ \              ........ ──────── Scarf
                  No hat ◄
                              ──────── No scarf
                              ........
```

[3]

(b) Find the probability that Ivan

    (i) does not wear a hat and does not wear a scarf,

Answer(b)(i) .... [2]

    (ii) wears a hat but does not wear a scarf,

Answer(b)(ii) .... [2]

    (iii) wears a hat or a scarf but not both.

Answer(b)(iii) .... [2]

(c) If Ivan wears a hat and a scarf, the probability that he wears gloves is $\frac{7}{10}$.

Calculate the probability that Ivan does **not** wear all three of hat, scarf and gloves.

Answer(c) .... [3]

2

Question 3

A bag contains 7 white beads and 5 red beads.

(i) The mass of a red bead is 2.5 grams more than the mass of a white bead.
The total mass of all the 12 beads is 114.5 grams.

Find the mass of a white bead and the mass of a red bead.

Answer (i) White …………………..……. g

Red …………… ……….. g [5]

(ii) Two beads are taken out of the bag at random, without replacement.

Find the probability that

(a) they are both white,

Answer (ii) (a)…….. ………………..………[2]
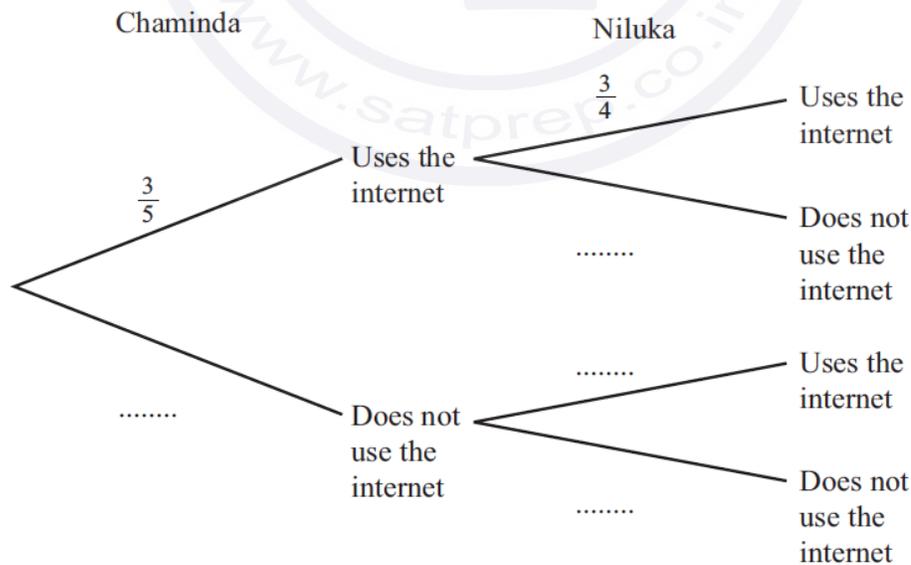
(b) one is white and one is red.

Answer (ii) (b)…….. ………………..………[3]

Question 4

The probability that Chaminda uses the internet on any day is $\frac{3}{5}$.

The probability that Niluka uses the internet on any day is $\frac{3}{4}$.

(i) Complete the tree diagram.

[2]

Continue on the next page…

(ii) Calculate the probability, that on any day, at least one of the two students uses the internet.

Answer (ii) …………….…..………………… [3]

(iii) Calculate the probability that Chaminda uses the internet on three consecutive days.

Answer (iii) …………….…..……………….... [2]

Question 5

| E | N | L | A | R | G | E | M | E | N | T |

Prettie picks a card at random from the 11 cards above and does not replace it.
She then picks a second card at random and does not replace it.

(a) Find the probability that she picks

    (i) the letter L and then the letter G,

Answer(a)(i) .... [2]

    (ii) the letter E twice,

Answer(a)(ii) .... [2]

    (iii) two letters that are the same.

Answer(a)(iii) .... [2]

(b) Prettie now picks a third card at random.

    Find the probability that the three letters

    (i) are all the same,

Answer(b)(i) .... [2]

    (ii) **do not** include a letter E,

Answer(b)(ii) .... [2]

    (iii) include exactly two letters that are the same.

Answer(b)(iii) .... [5]

Question 6

In this question, give all your answers as fractions.

| N | A | T | I | O | N |

The letters of the word **NATION** are printed on 6 cards.

(a) A card is chosen at random.

Write down the probability that

(i) it has the letter **T** printed on it,

Answer(a)(i) .... [1]

(ii) it does not have the letter **N** printed on it,

Answer(a)(ii) .... [1]

(iii) the letter printed on it has no lines of symmetry.

Answer(a)(iii) .... [1]

(b) Lara chooses a card at random, replaces it, then chooses a card again.

Calculate the probability that only **one** of the cards she chooses has the letter **N** printed on it.

Answer(b) .... [3]

(c) Jacob chooses a card at random and does not replace it.
He continues until he chooses a card with the letter **N** printed on it.

Find the probability that this happens when he chooses the 4th card.

Answer(c) .... [3]

Question 7

If the weather is fine the probability that Carlos is late arriving at school is $\frac{1}{10}$.

If the weather is not fine the probability that he is late arriving at school is $\frac{1}{3}$.

The probability that the weather is fine on any day is $\frac{3}{4}$.

(a) Complete the tree diagram to show this information.

Weather   Arriving at school

$\frac{3}{4}$ Fine $\frac{1}{10}$ Late

Not late

....

.... Late

Not fine

.... Not late

....

[3]

(b) In a school term of 60 days, find the number of days the weather is expected to be fine.

Answer(b) .... [1]

(c) Find the probability that the weather is fine and Carlos is late arriving at school.

Answer(c) .... [2]

(d) Find the probability that Carlos is not late arriving at school.

(e) Find the probability that the weather is not fine on at least one day in a school week of 5 days.

Answer(e) .... [2]

Question 8

(a) A square spinner is biased.
The probabilities of obtaining the scores 1, 2, 3 and 4 when it is spun are given in the table.

Score	1	2	3	4
Probability	0.1	0.2	0.4	0.3

(i) Work out the probability that on one spin the score is 2 or 3.

Answer(a)(i) .... [2]

(ii) In 5000 spins, how many times would you expect to score 4 with this spinner?

Answer(a)(ii) .... [1]

(iii) Work out the probability of scoring 1 on the first spin and 4 on the second spin.

Answer(a)(iii) .... [2]

(b) In a bag there are 7 red discs and 5 blue discs.
From the bag a disc is chosen at random and not replaced.
A second disc is then chosen at random.

Work out the probability that at least one of the discs is red.
Give your answer as a fraction.

Answer(b) .... [3]

Question 9

Yeung and Ariven compete in a triathlon race.

The probability that Yeung finishes this race is $\frac{3}{5}$.

The probability that Ariven finishes this race is $\frac{2}{3}$.

(a) (i) Which of them is more likely to finish this race?
Give a reason for your answer.

Answer(a)(i) .... because ....

.... [1]

(ii) Find the probability that they both finish this race.

Answer(a)(ii) .... [2]

(iii) Find the probability that only one of them finishes this race.

Answer(a)(iii) .... [3]

(b) After the first race, **Yeung** competes in two further triathlon races.

(i) Complete the tree diagram.

First race   Second race   Third race

[3]
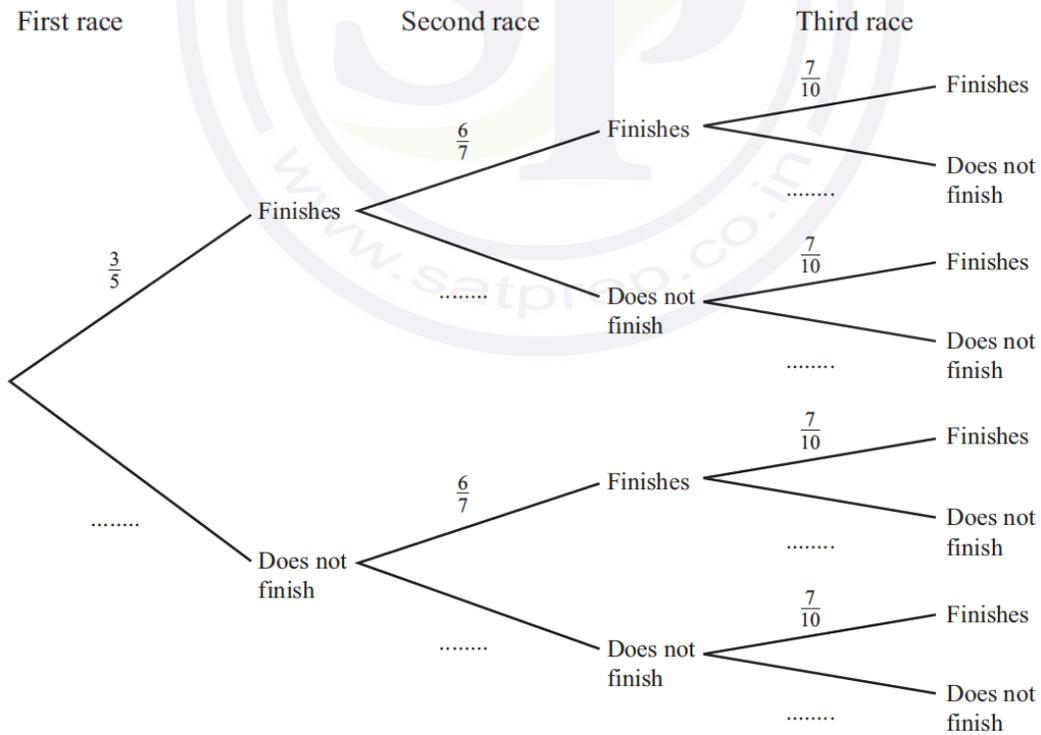
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(ii) Calculate the probability that Yeung finishes all three of his races.

Answer(b)(ii) .... [2]

(iii) Calculate the probability that Yeung finishes at least one of his races.

Answer(b)(iii) .... [3]

Question 10

Kenwyn plays a board game.
Two cubes (dice) each have faces numbered 1, 2, 3, 4, 5 and 6.
In the game, a **throw** is rolling the **two** fair 6-sided dice and then adding the numbers on their top faces.
This total is the number of spaces to move on the board.
For example, if the numbers are 4 and 3, he moves 7 spaces.

(a) Giving each of your answers as a fraction in its simplest form, find the probability that he moves

    (i) two spaces with his next throw,

Answer(a)(i) .... [2]

    (ii) ten spaces with his next throw.

Answer(a)(ii) .... [3]

(b) What is the most likely number of spaces that Kenwyn will move with his next throw?
Explain your answer.

Answer(b) .... because ....

.... [2]

(c)

95	96	97	98	99	100
				Go back 3 spaces	WIN

To win the game he must move **exactly** to the 100th space.
Kenwyn is on the 97th space.
If his next throw takes him to 99, he has to move back to 96.
If his next throw takes him over 100, he stays on 97.

Find the probability that he reaches 100 in either of his next two throws.

Answer(c) .... [5]

Question 11

Navpreet has 15 cards with a shape drawn on each card.
5 cards have a square, 6 cards have a triangle and 4 cards have a circle drawn on them.

(a) Navpreet selects a card at random.

Write down the probability that the card has a circle drawn on it.

Answer(a) .... [1]

(b) Navpreet selects a card at random and replaces it.
She does this 300 times.

Calculate the number of times she expects to select a card with a circle drawn on it.

Answer(b) .... [1]

(c) Navpreet selects a card at random, replaces it and then selects another card.

Calculate the probability that

(i) one card has a square drawn on it and the other has a circle drawn on it,

Answer(c)(i) .... [3]

(ii) neither card has a circle drawn on it.

Answer(c)(ii) .... [3]

(d) Navpreet selects two cards at random, without replacement.

Calculate the probability that

(i) only one card has a triangle drawn on it,

Answer(d)(i) .... [3]

(ii) the two cards have different shapes drawn on them.

Answer(d)(ii) .... [4]

Question 12

| A | A | A | A | B | B | C |

(a) One of these 7 cards is chosen at random.

Write down the probability that the card

    (i) shows the letter A,

Answer(a)(i) .... [1]

    (ii) shows the letter A or B,

Answer(a)(ii) .... [1]

    (iii) does not show the letter B.

Answer(a)(iii) .... [1]

(b) Two of the cards are chosen at random, without replacement.

Find the probability that

    (i) both show the letter A,

Answer(b)(i) .... [2]

    (ii) the two letters are different.

Answer(b)(ii) .... [3]

(c) Three of the cards are chosen at random, without replacement.

Find the probability that the cards do not show the letter C.

Answer(c) .... [2]

Question 13

Gareth has 8 sweets in a bag.
4 sweets are orange flavoured, 3 are lemon flavoured and 1 is strawberry flavoured.

(a) He chooses two of the sweets at random.

Find the probability that the two sweets have different flavours.

Answer(a) .... [4]

(b) Gareth now chooses a third sweet.

Find the probability that **none** of the three sweets is lemon flavoured.

Answer(b) .... [2]

Question 14

Coins are put into a machine to pay for parking cars.
The probability that the machine rejects a coin is 0.05 .

(a) Adhira puts 2 coins into the machine.

(i) Calculate the probability that the machine rejects **both** coins.

.... [2]

(ii) Calculate the probability that the machine accepts at **least one** coin.

.... [1]

(b) Raj puts 4 coins into the machine.

Calculate the probability that the machine rejects **exactly one** coin.

.... [3]

Question 15

Kiah plays a game.
The game involves throwing a coin onto a circular board.
Points are scored for where the coin lands on the board.
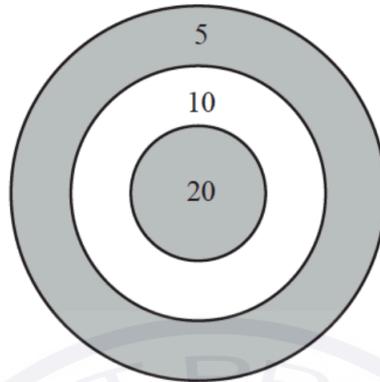
If the coin lands on part of a line or misses the board then 0 points are scored.
The table shows the probabilities of Kiah scoring points on the board with one throw.

Points scored	20	10	5	0
Probability	x	0.2	0.3	0.45

(a) Find the value of x.

$x =$ .... [2]

Continue on the next page...

(b) Kiah throws a coin fifty times.

Work out the expected number of times she scores 5 points.

.... [1]

(c) Kiah throws a coin two times.

Calculate the probability that

    (i) she scores either 5 or 0 with her first throw,

.... [2]

    (ii) she scores 0 with her first throw and 5 with her second throw,

   (iii) she scores a total of 15 points with her two throws.

.... [3]

(d) Kiah throws a coin three times.

Calculate the probability that she scores a total of 10 points with her three throws.

....……………..…………… [5]

Question 16

Sandra has a fair eight-sided spinner.
The numbers on the spinner are 3, 4, 4, 4, 5, 5, 6 and 8.
Sandra spins the spinner twice and records each number it lands on.
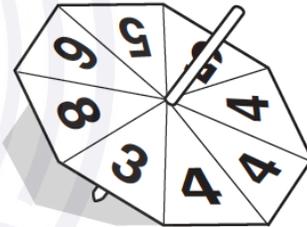
Find the probability that

(a) both numbers are 8,

.... [2]

(b) the two numbers are not both 8,

.... [1]

(c) one number is odd and one number is even,

.... [2]

(d) the total of the two numbers is at least 13,

.... [3]

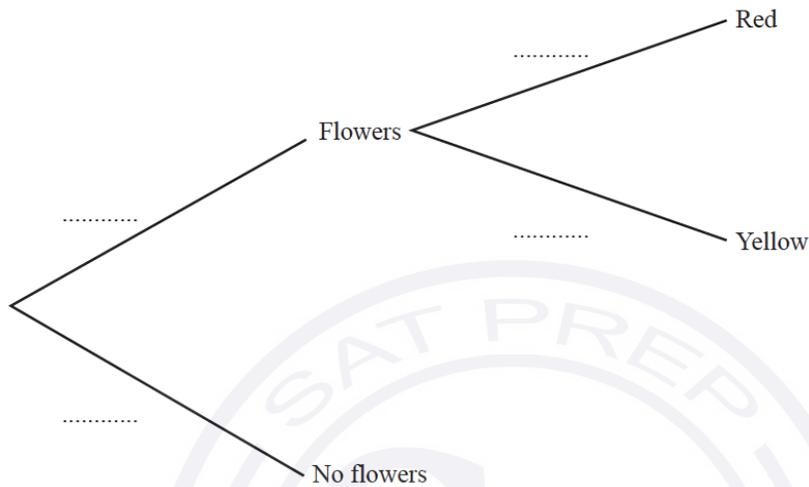 **(e)** the second number is bigger than the first number.

…………………………………[3]

Question 17

The probability that a plant will produce flowers is $\frac{7}{8}$.
The flowers are either red or yellow.
If the plant produces flowers, the probability that the flowers are red is $\frac{3}{4}$.

(a) (i) Complete the tree diagram by writing a probability beside each branch.


```
                                        .......... ┌─ Red
                              Flowers ─<
                       ..........          .......... └─ Yellow
              ┌────────
         ..........
              └──── No flowers
```

[2]

(ii) Calculate the probability that a plant, chosen at random, will produce red flowers.

[2]

(iii) Two plants are chosen at random.

Calculate the probability that both will produce red flowers.

.... [2]

(b) Alphonse buys 200 of these plants.

Calculate the number of plants that are expected to produce flowers.

.... [2]

(c) Gabriel has 1575 plants with red flowers.

Estimate the total number of plants that Gabriel has.

.... [2]

Question 18

A train stops at station A and then at station B.
If the train is late at station A, the probability that it is late at station B is 0.9 .
If the train is not late at station A, the probability that it is late at station B is 0.2 .
The probability that the train is late at station A is 0.3 .

(a) Complete the tree diagram.

[2]
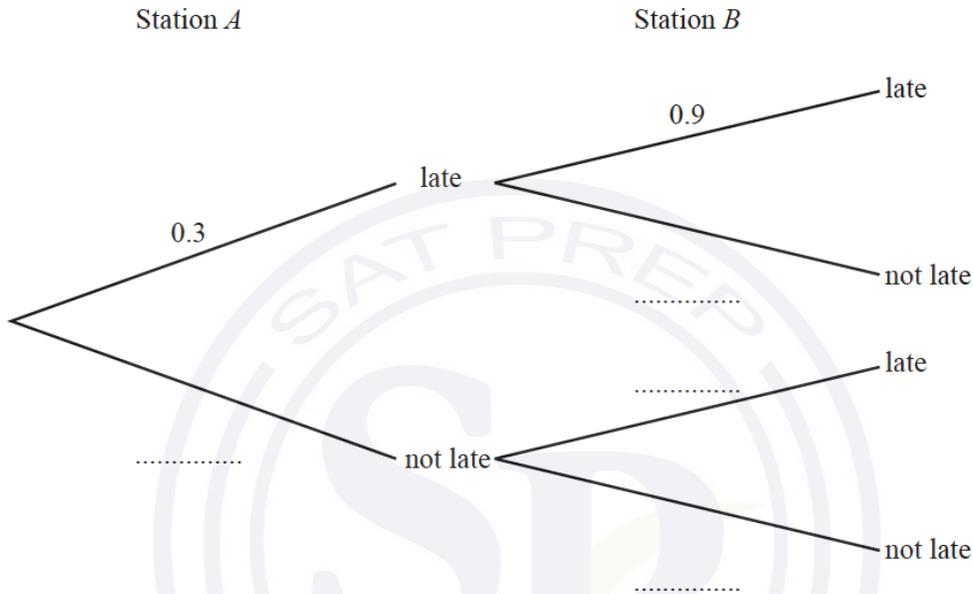
(b) (i) Find the probability that the train is late at one or both of the stations.

.... [3]

(ii) This train makes 250 journeys.

Find the number of journeys that the train is expected to be late at one or both of the stations.

.... [1]

(c) The train continues to station C.
The probability that it is late at all 3 stations is 0.27 .

Describe briefly what this probability shows.

....

.... [1]

Question 19

Ravi spins a biased 5-sided spinner, numbered 1 to 5.
The probability of each number is shown in the table.

Number	1	2	3	4	5
Probability	$\frac{1}{6}$	$\frac{1}{4}$	$\frac{1}{3}$	x	x

(a) Find the value of x.

$x =$ .... [3]

(b) Ravi spins the spinner once.

Find the probability that the number is 2 or 3.

.... [2]

(c) Ravi spins the spinner twice.

Find the probability that

(i) the number is 2 both times,

.... [2]

(ii) the sum of the numbers is 3.

.... [3]

(d) Ravi spins the spinner 72 times.

Calculate how many times he expects the number 1.

.... [1]

Question 20

Each morning the probability that it rains is $\frac{2}{3}$.

If it rains, the probability that Asha walks to school is $\frac{1}{7}$.

If it does not rain, the probability that Asha walks to school is $\frac{4}{7}$.

(a) Complete the tree diagram.
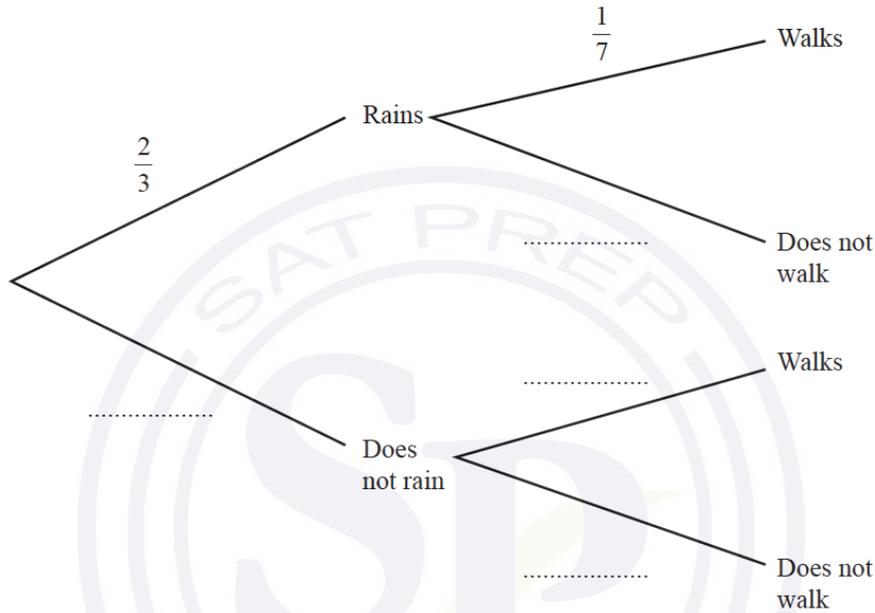
[2]

(b) Find the probability that it rains and Asha walks to school.

.... [2]

(c) (i) Find the probability that Asha does not walk to school.

.... [3]

(ii) Find the expected number of days Asha does not walk to school in a term of 70 days.

.... [2]

(d) Find the probability that it rains on exactly one morning in a school week of 5 days.

.... [2]

Question 21

A   B
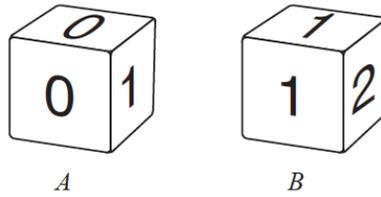
The diagram shows two fair dice.
The numbers on dice A are 0, 0, 1, 1, 1, 3.
The numbers on dice B are 1, 1, 2, 2, 2, 3.
When a dice is rolled, the score is the number on the top face.

(a) Dice A is rolled once.

Find the probability that the score is not 3.

.... [1]

(b) Dice A is rolled twice.

Find the probability that the score is 0 both times.

.... [2]

(c) Dice A is rolled 60 times.

Calculate an estimate of the number of times the score is 0.

.... [1]

(d) Dice A and dice B are each rolled once.
The product of the scores is recorded.

  (i) Complete the possibility diagram.

Dice B	0	0	1	1	1	3
3	0	0				
2	0	0				
2	0	0				
2	0	0				
1	0	0				
1	0	0	1	1	1	3

Dice A

[2]

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(ii) Find the probability that the product of the scores is

    (a) 2,

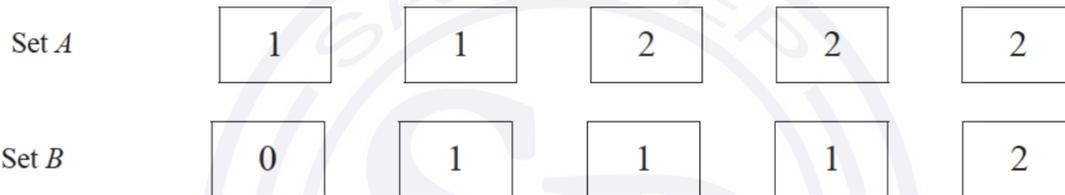.. [1]

    (b) greater than 3.

....[1]

(e) Eva keeps rolling dice *B* until 1 is scored.

Find the probability that this happens on the 5th roll.

.... [2]

Question 22

(a) The diagram shows two sets of cards.

Set *A* | 1 | 1 | 2 | 2 | 2 |

Set *B* | 0 | 1 | 1 | 1 | 2 |

    (i) Jojo chooses two cards at random from Set *A* without replacement.

    Find the probability that the two cards have the same number.

.... [3]

    (ii) Jojo replaces the two cards.
    Kylie then chooses one card at random from Set *A* and one card at random from Set *B*.

    Find the probability that the two cards have the same number.

.... [3]

    (iii) Who is the most likely to choose two cards that have the same number?
    Show all your working.

....[1]

(b)

Set *C* | 4 | 4 | 5 | 5 | 5 |

Lena chooses three cards at random from Set *C* without replacement.

Find the probability that the third card chosen is numbered 4.

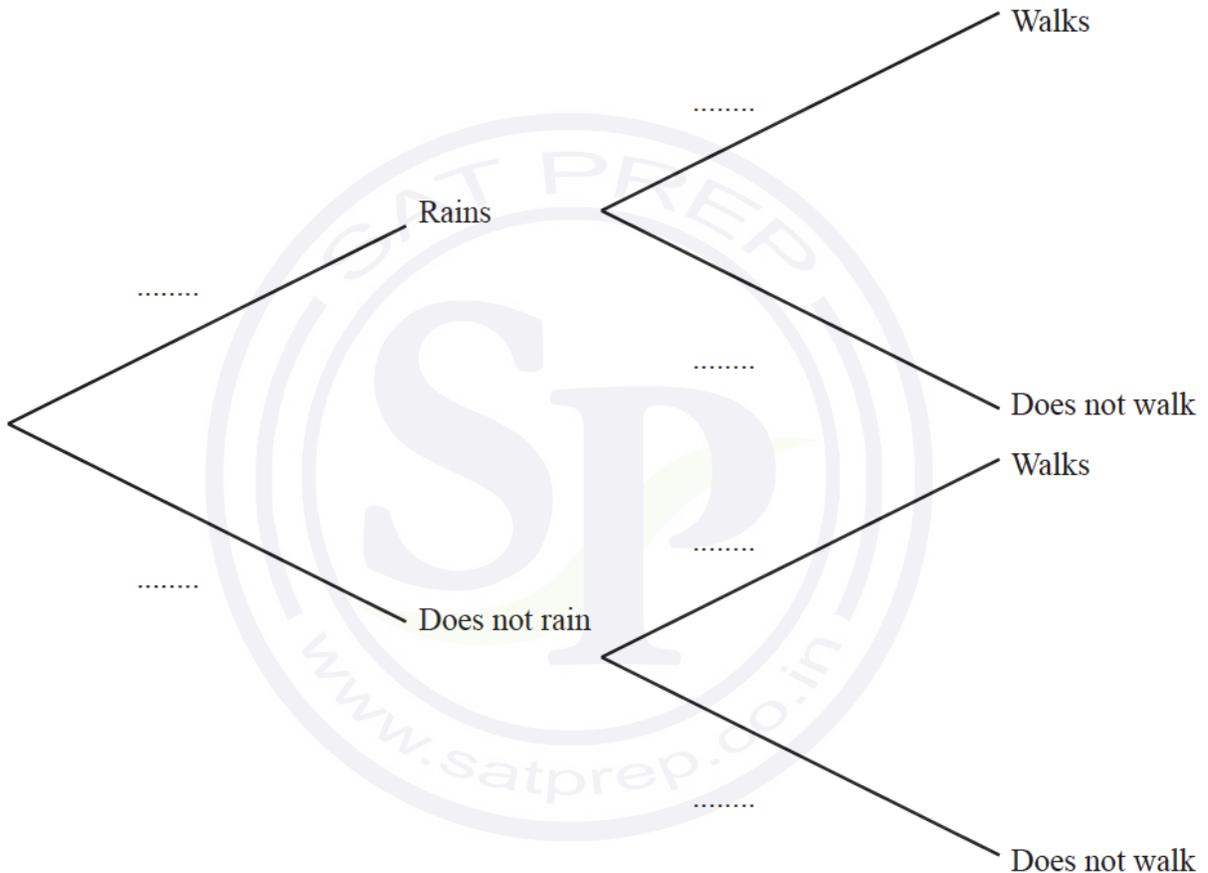................................[3]

Question 23

The probability that it will rain tomorrow is $\frac{5}{8}$.

If it rains, the probability that Rafael walks to school is $\frac{1}{6}$.

If it does not rain, the probability that Rafael walks to school is $\frac{7}{10}$.

(a) Complete the tree diagram.

[3]

(b) Calculate the probability that it will rain tomorrow and Rafael walks to school.

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

(c) Calculate the probability that Rafael does not walk to school.

....[3]

Question 24

A box contains 20 packets of potato chips.

6 packets contain barbecue flavoured chips.
10 packets contain salt flavoured chips.
4 packets contain chicken flavoured chips.

(a) Maria takes two packets at random **without replacement**.

(i) Show that the probability that she takes two packets of salt flavoured chips is $\frac{9}{38}$.

[2]

(ii) Find the probability that she takes two packets of different flavoured chips.

……………………………[4]

(b) Maria takes three packets at random, **without replacement**, from the 20 packets.

Find the probability that she takes **at least two** packets of chicken flavoured chips.

……………………….[3]

Question 25

Sushila, Ravi and Talika each have a bag of balls.
Each of the bags contains 10 red balls and 8 blue balls.

(a) Sushila takes one ball at random from her bag.

Find the probability that she takes a red ball.

………………………..[1]

(b) Ravi takes two balls at random from his bag, without replacement.

Find the probability that one ball is red and one ball is blue.

………………………..[3]

(c) Talika takes three balls at random from her bag, without replacement.

Calculate the probability that the three balls are the same colour.

…………………………..[4]

Question 26

The probability that Andrei cycles to school is r.

(a) Write down, in terms of r, the probability that Andrei **does not** cycle to school.

.... [1]

(b) The probability that Benoit **does not** cycle to school is $1.3 - r$.
The probability that both Andrei and Benoit **do not** cycle to school is 0.4 .

(i) Complete the equation in terms of r.

(........................) × (........................) = 0.4   [1]

(ii) Show that this equation simplifies to $10r^2 - 23r + 9 = 0$.

[3]

(iii) Solve by factorisation $10r^2 - 23r + 9 = 0$.

$r = $ .... or $r = $ .... [3]

(iv) Find the probability that Benoit **does not** cycle to school.

……………………………….[1]

Question 27

(a) A bag contains 4 red marbles and 2 yellow marbles.
Behnaz picks two marbles at random without replacement.

Find the probability that

(i) the marbles are both red,

.... [2]

(ii) the marbles are not both red.

.... [1]

(b) Another bag contains 5 blue marbles and 2 green marbles.
Bryn picks one marble at random without replacement.
If this marble is not green, he picks another marble at random without replacement.
He continues until he picks a green marble.

Find the probability that he picks a green marble on his first, second or third attempt.

.... [4]

Question 28

| • • • | | • • | | • • • • | | • • | | • • |

The diagram shows 5 cards.

(a) Donald chooses a card at random.

    (i) Write down the probability that the number of dots on this card is an even number.

                      .... [1]

    (ii) Write down the probability that the number of dots on this card is a prime number.

                      .... [1]

(b) Donald chooses two of the five cards at random, without replacement.
He works out the total number of dots on these two cards.

    (i) Find the probability that the total number of dots is 5.

                      .... [3]

    (ii) Find the probability that the total number of dots is an odd number.

                      .... [3]

Question 29

  (a) Two students are chosen at random.
      Calculate the probability that they both have travelled only by plane.
                    .... [2]

  (b) Two students are chosen at random from those who have travelled by train.
      Calculate the probability that they both have also travelled by plane.

                    .... [2]

Question 30

Suleika has six cards numbered 1 to 6.

| 1 | 2 | 3 | 4 | 5 | 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]

(ii) Suleika does this 300 times.

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

.... [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.

.... [3]

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

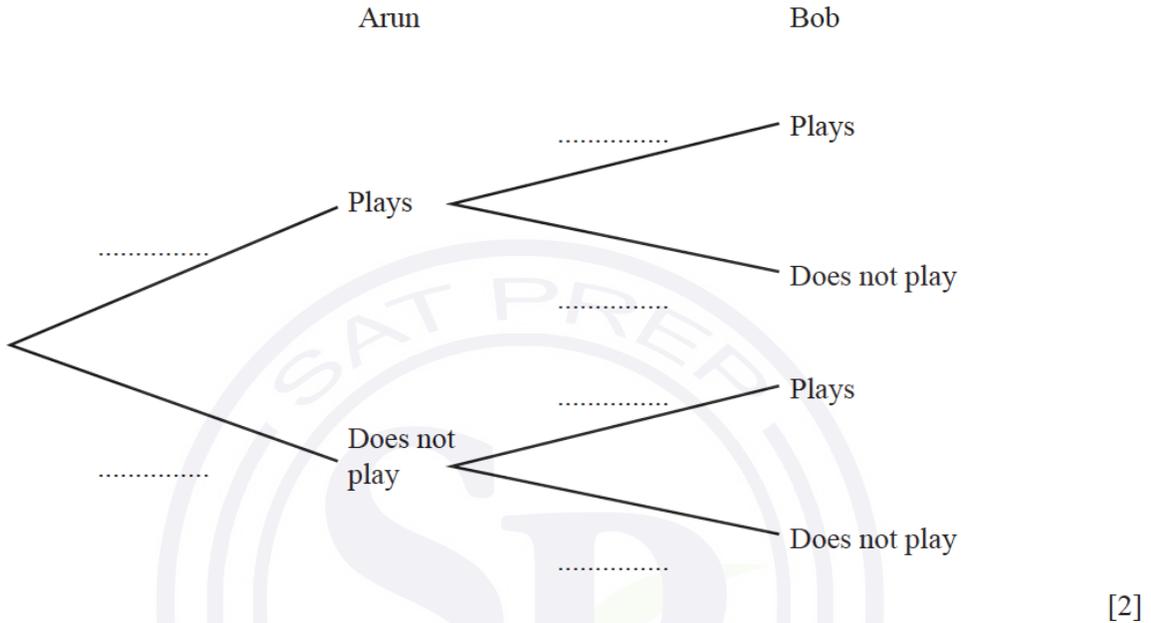.. [1]

Question 31

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

Plays .... Plays

.... Plays .... Does not play

Does not .... Plays
play
.... Does not play
....

[2]

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

.... [2]

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

.... [3]

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

.... [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.

.... [2]

Question 32

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.

.... [1]

(b) (i) Complete the tree diagram.

```
           Produces                    Colour
           flowers
                                              Red
                          ............
                  Yes
                          ............      Yellow
           0.8
                          ............      Other
                                            colours
                  No
     ............
```

[2]

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

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

(iii) Tanya chooses a seed at random.

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

.... [3]

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

Find the probability that one produces flowers and one does not produce flowers.

.... [3]

Question 33

| 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,

   .... [1]

   (ii) the letter B then the letter Y,

   .... [2]

(iii)   two letters that are the same.

   .... [3]

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

   Find the probability that

   (i)   all three letters are the same,

   .... [2]

   (ii) exactly two of the three letters are the same,

   .... [5]

(iii)   all three letters are different.

   .... [2]

Question 34

(4) Red   (6) Yellow   (3) Blue   (4) Blue   (2) Yellow   (3) Blue
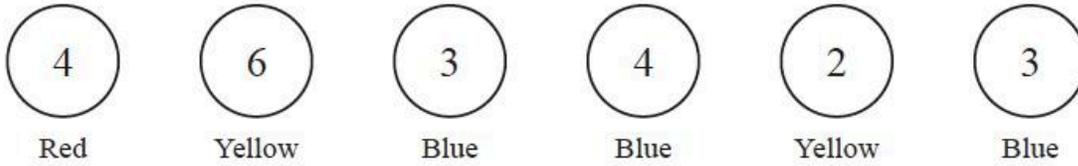
The diagram shows six discs.
Each disc has a colour and a number.

(a) One disc is picked at random.

Write down the probability that

   (i) the disc has the number 4,

            .... [1]

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

            .... [1]

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

            .... [1]

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

Find the probability that

   (i) both discs have the number 3,

            .... [2]

   (ii) both discs have the same colour.

            .... [3]

(c) Two of the six discs are picked at random **with** replacement.

Find the probability that both discs have the same colour.

            .... [3]

30

Question 35

(a) There are 32 students in a class.

    5 do not study any languages.
    15 study German (*G*).
    18 study Spanish (*S*).
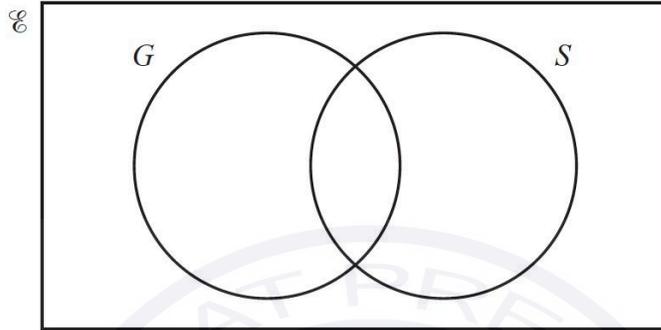
(i) Complete the Venn diagram to show this information.   [2]

(ii) A student is chosen at random.

    Find the probability that the student studies Spanish but not German.

    .... [1]

(iii) A student who studies German is chosen at random.

    Find the probability that this student also studies Spanish.

(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.

    .... [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.

    Continue on the next page…

.... [2]

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

.... [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.

.... [3]

Question 36

(a) A shop gives each of 1000 people a voucher.
    28 people use their voucher.
    The shop now gives each of 16 500 people a voucher.

    Calculate how many of these 16 500 people are expected to use their voucher.

.... [1]

(b) In a class activity, all the 15 students wear hats.
    7 students wear red hats, 6 students wear green hats and 2 students wear white hats.

    (i) One of these students is picked at random.

        Find the probability that this student wears a red hat.

.... [1]

    (ii) Two of the 15 students are picked at random.

        Show that the probability that these two students wear hats of the same colour is $\frac{37}{105}$.

[3]

    (iii) Three of the 15 students are picked at random.

        Find the probability that at least two of these three students wear red hats.

.... [4]

Question 37

In a class of 24 students, 18 students like homework (H), 15 students like tests (T) and 1 student does not like homework and does not like tests.

(a) Complete the Venn diagram to show this information.
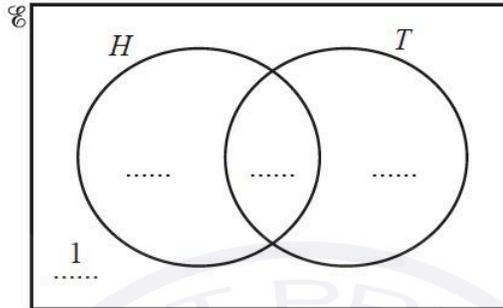
[2]

(b) Write down the number of students who like both homework and tests.

.... [1]

(c) Find $n(H' \cap T)$.

.... [1]

(d) A student is picked at random from the class.

Write down the probability that this student likes tests but does not like homework.

.... [1]

(e) Two students are picked at random from the class.

Find the probability that both students do not like homework and do not like tests.

.... [1]

(f) Two of the students who like homework are picked at random.

Find the probability that both students also like tests.

.... [3]

Question 38

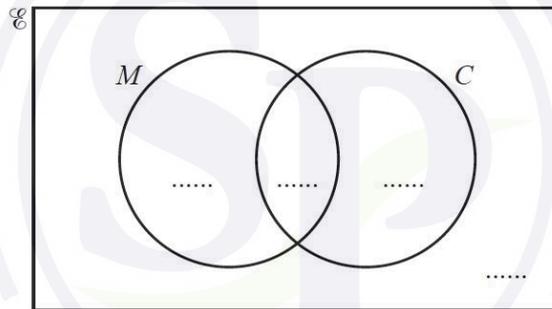(a) In the Venn diagram, shade the region $P' \cup Q$.
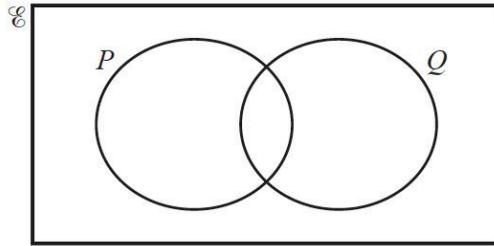
[1]

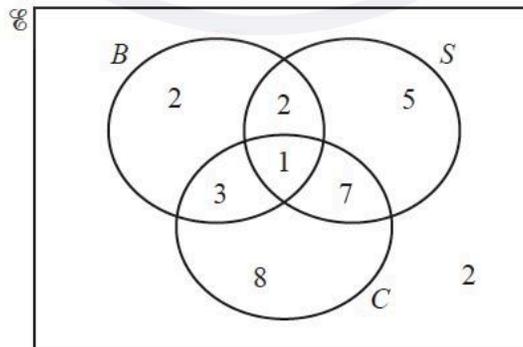(b) There are 50 students in a group.

34 have a mobile phone (M).
39 have a computer (C).
5 have no mobile phone and no computer.

Complete the Venn diagram to show this information.

[2]

(c) The Venn diagram shows the number of students in a group of 30 who have brothers (B), sisters (S) or cousins (C).

Continue on the next page…

(i) Write down the number of students who have brothers.

.... [1]

(ii) Write down the number of students who have cousins but do not have sisters.

.... [1]

(iii) Find $n(B \cup S \cup C)'$.

.... [1]

(iv) Use set notation to describe the set of students who have both cousins and sisters but do not have brothers.

.... [1]

(v) One student is picked at random from the 30 students.

Find the probability that this student has cousins.

.... [1]

(vi) Two students are picked at random from the students who have cousins.

Calculate the probability that both these students have brothers.

....[3]

(v) One student is picked at random from the 30 students.

Find the probability that this student has cousins.

.... [1]

(vi) Two students are picked at random from the students who have cousins.

Calculate the probability that both these students have brothers.

....[3]

(vii) One student is picked at random from the 30 students.

Event A This student has sisters.
Event B This student has cousins but does not have brothers.

Explain why event A and event B are equally likely.

....

.... [1]

35

Question 39

(a) Sarah spins a fair four-sided spinner numbered 0, 1, 1 and 3.

(i) What number is the spinner most likely to land on?

.... [1]

(ii) Sarah spins the spinner twice.

Find the probability that it lands on the number 1 both times.

.... [2]

(iii) Sarah spins the spinner until it lands on the number 3.

The probability that this happens on the nth spin is $\dfrac{729}{16384}$.

Find the value of n.

$n = $ .... [2]

(b) Scott takes an examination.
The examination is in two parts, a theory test and a practical test.
Both parts must be passed to pass the examination.

The probability that Scott passes the theory test is 0.9 .
The probability that Scott passes the practical test is 0.8 .
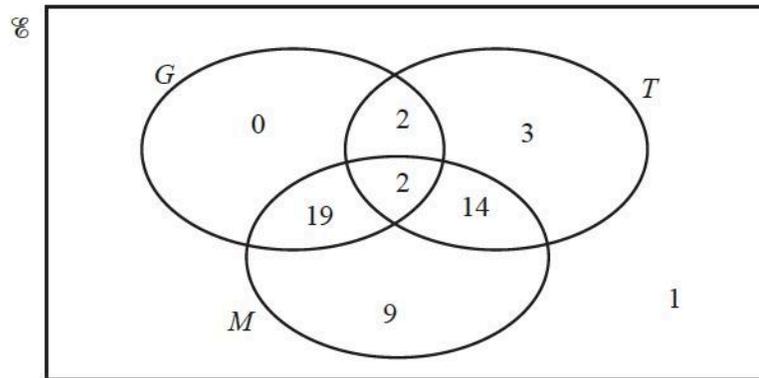
Find the probability that

(i) Scott passes the examination,

.... [2]

(ii) Scott passes the theory test or the practical test but not both.

.... [3]

Question 40

(a) The probability that Shalini is late for school on any day is $\frac{1}{6}$.

(i) Complete the tree diagram for Monday and Tuesday.

Monday   Tuesday

Late

.... → Late

.... → Not late

....

....

Not late

.... → Late

.... → Not late

[2]

(ii) Calculate the probability that Shalini is late on Monday but is not late on Tuesday.

.... [2]

Continue on the next page…

(b) The Venn diagram shows the number of students in a group of 50 students who wear glasses (G), who wear trainers (T) and who have a mobile phone (M).

(i) Use set notation to describe the region that contains only one student.

.... [1]

(ii) Find $n\left(T'\cap(G\cup M)\right)$.

.... [1]

(iii) One student is picked at random from the 50 students.

Find the probability that this student wears trainers but does not wear glasses.

.... [1]

(iv) Two students are picked at random from those wearing trainers.

Find the probability that both students have mobile phones.

.... [3]

Question 41

12 friends travel to the festival.
5 travel by car, 4 travel by bus and 3 travel by train.
Two people are chosen at random from the 12 friends.

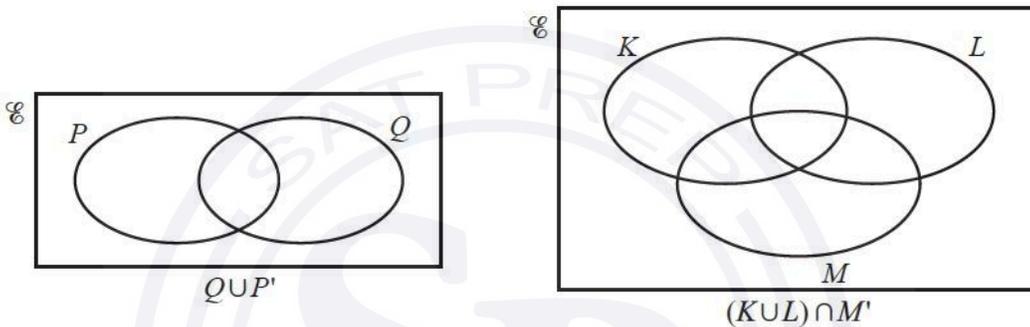Calculate the probability that they travel by different types of transport.

.... [4]

Question 42

(a) **(i)** Use set notation to describe the shaded region in the Venn diagram.
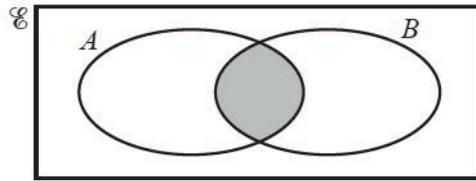
.... [1]

(ii) Shade the correct region in each Venn diagram.

$Q \cup P'$

$(K \cup L) \cap M'$

[2]

(b)

| V | E | N | N | D | I | A | G | R | A | M |

The diagram shows 11 cards.

(i) One of these cards is chosen at random.

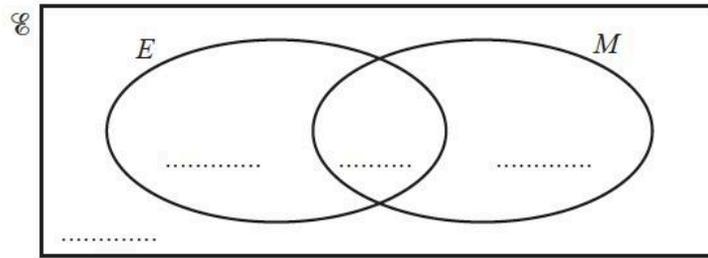Write down the probability that the letter on the card is **not** A.

.... [1]

(ii) A card is chosen at random from these 11 cards and then replaced.
A second card is then chosen at random.

Find the probability that exactly one card has the letter N.

.... [3]

Continue on the next page…

(c)

50 students are asked if they like English (*E*) and if they like mathematics (*M*).
3 say they do not like English and do not like mathematics.
33 say they like English.
42 say they like mathematics.

(i) Complete the Venn diagram. [2]

(ii) A student is chosen at random.

Find the probability that this student likes English and likes mathematics.

.... [1]

(iii) Two students are chosen at random.

Find the probability that they both like mathematics.

.... [2]

(iv) Two students who like English are chosen at random.

Find the probability that they both also like mathematics.

.... [2]

Question 43

Regan is playing a game with these six number cards.

| −3 | −2 | 2 | 3 | 5 | 7 |

(a) She takes two cards at random, without replacement, and **multiplies** the two numbers to give a score.

Find the probability that

(i) the score is 35

.... [3]

(ii) the score is a positive number.

.... [3]

(b) Regan now takes three cards at random from the six cards, without replacement, and **adds** the three numbers to give a total.

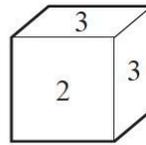Find the probability that her total is 5.

.... [4]

Question 44
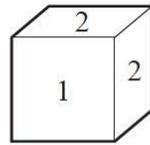
Dice A   Dice B

The diagram shows two fair dice.
Dice A is numbered   1, 2, 2, 2, 3, 6.
Dice B is numbered   2, 3, 3, 4, 4, 4.

(a) (i) Dice A is rolled once.

Write down the probability that it lands on the number 6.

.... [1]

(ii) Dice A is rolled 150 times.

Find the number of times it is expected to land on the number 6.

.... [1]

(b) Dice A and Dice B are each rolled once.

(i) Find the probability that the two numbers they land on have a total of 6.

.... [3]

(ii) Find the probability that when the two numbers they land on have a total of 6, both numbers are 3.

.... [2]

(c) Dice B is rolled n times.

The probability that on the nth roll it first lands on a number 3 is $\frac{32}{729}$.

Find the value of n.
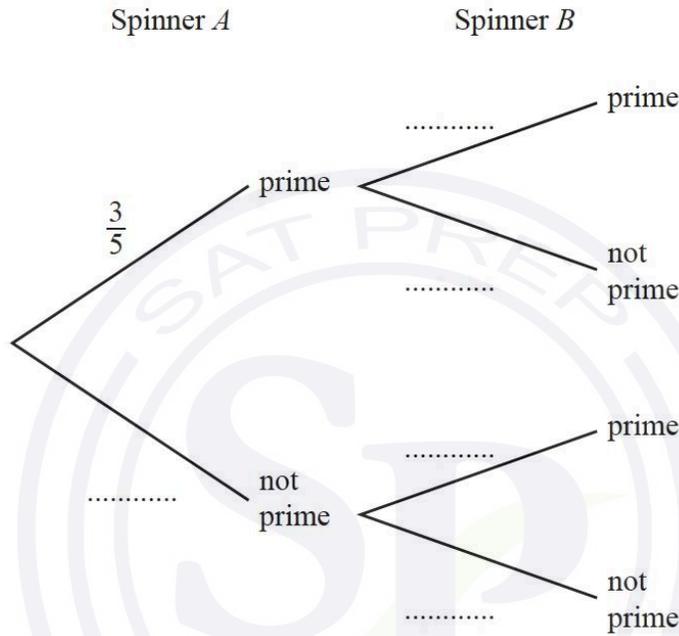
$n = $ .... [2]

Question 45

(a) Lucia has two fair spinners.
Spinner *A* is five-sided and is numbered 1, 2, 3, 4, 5.
Spinner *B* is nine-sided and is numbered 3, 3, 3, 4, 4, 4, 4, 5, 5.

Lucia spins the two spinners and records whether they land on a prime number.

(i) Complete the tree diagram.

Spinner *A*   Spinner *B*

.... prime

prime
$\frac{3}{5}$

.... not prime

.... prime

.... not prime

prime

.... not prime

[2]

(ii) Find the probability that

(a) the two numbers are both prime

.... [2]

(b) the two numbers are **not** both prime.

.... [1]

(b) Lucia spins Spinner *A* 120 times.

Find the expected number of times the spinner lands on a prime number.

.... [1]

(c) Lucia spins Spinner *B* twice.

Find the probability that the two numbers it lands on add up to 9 or more.

.... [3]

(d) Lucia keeps spinning Spinner *B* until it lands on a 4.

Find an expression, in terms of *n*, for the probability that this happens on the *n*th spin.

.... [2]

Question 46

| N | A | M | I | B | I | A |

The diagram shows 7 cards.

(a) Amir picks a card at random.

Find the probability that the card shows

   (i)   the letter H

.... [1]

   (ii)   the letter B.

.... [1]

(b) Fumika picks one of the 7 cards at random.
She replaces it and picks a second card at random.

Find the probability that both cards show the letter I.

.... [2]

(c) Marcos picks two of the 7 cards at random, **without** replacement.

   (i)   Find the probability that one card shows the letter I and the other card shows the letter N.

.... [3]

   (ii)   Find the probability that the two cards show different letters.

.... [3]

Continue on the next page…

(d) Nina picks one of the 7 cards at random without replacement.
She continues picking cards at random without replacement until she picks a card that shows the letter A.

The probability that this occurs when she picks the *n*th card is $\frac{4}{21}$.

Find the value of *n*.

$n =$ .... [2]