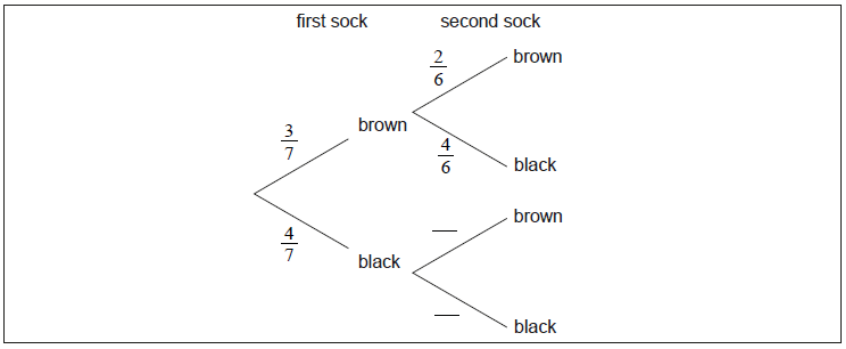
Basic probability [72 marks]

1. [Maximum mark: 6] 22M.1.SL.TZ1.10

Karl has three brown socks and four black socks in his drawer. He takes two socks at random from the drawer.

(a) Complete the tree diagram.



[1]

(b) Find the probability that Karl takes two socks of the same colour. [2]

(c) Given that Karl has two socks of the same colour find the probability that he has two brown socks. [3]

2. [Maximum mark: 6] 22M.1.SL.TZ2.2

A group of 130 applicants applied for admission into either the Arts programme or the Sciences programme at a university. The outcomes of their applications are shown in the following table.

	Accepted	Rejected
Arts programme	17	24
Sciences programme	25	64

(a) Find the probability that a randomly chosen applicant from this group was accepted by the university. [1]

An applicant is chosen at random from this group. It is found that they were accepted into the programme of their choice.

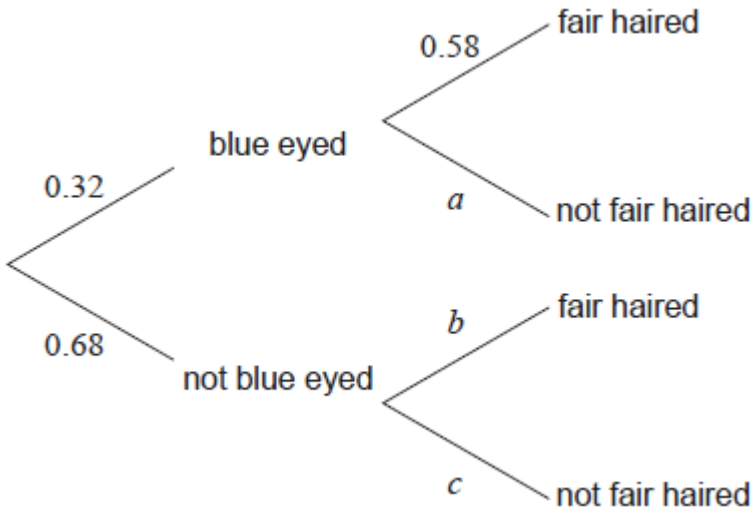
(b) Find the probability that the applicant applied for the Arts programme. [2]

(c) Two different applicants are chosen at random from the original group.

Find the probability that both applicants applied to the Arts programme. [3]

3. [Maximum mark: 5] 21N.1.SL.TZ0.11

In a city, 32% of people have blue eyes. If someone has blue eyes, the probability that they also have fair hair is 58%. This information is represented in the following tree diagram.



(a) Write down the value of a. [1]

(b) Find an expression, in terms of b, for the probability of a person not having blue eyes **and** having fair hair. [1]

It is known that 41% of people in this city have fair hair.

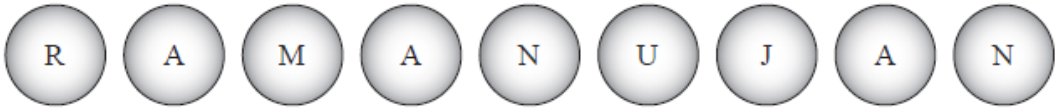
Calculate the value of

(c.i) b. [2]

(c.ii) c. [1]

4. [Maximum mark: 6] 20N.1.SL.TZ0.T_6

Srinivasa places the nine labelled balls shown below into a box.



Srinivasa then chooses two balls at random, one at a time, from the box. The first ball is **not replaced** before he chooses the second.

(a.i) Find the probability that the first ball chosen is labelled A. [1]

(a.ii) Find the probability that the first ball chosen is labelled A or labelled N. [1]

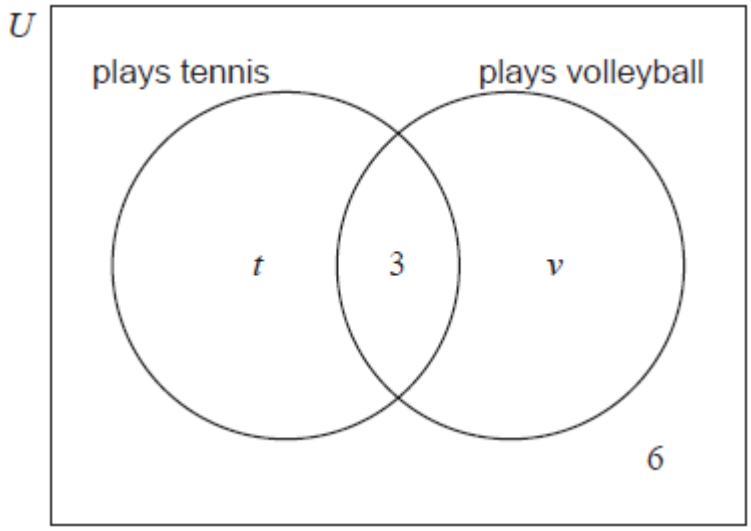
(b) Find the probability that the second ball chosen is labelled A, given that the first ball chosen was labelled N. [2]

(c) Find the probability that both balls chosen are labelled N. [2]

5. [Maximum mark: 6] 20N.1.SL.TZ0.S_1

In a class of 30 students, 19 play tennis, 3 play both tennis and volleyball, and 6 do not play either sport.

The following Venn diagram shows the events "plays tennis" and "plays volleyball". The values t and v represent numbers of students.



(a.i) Find the value of t. [2]

(a.ii) Find the value of v. [2]

(b) Find the probability that a randomly selected student from the class plays tennis or volleyball, but not both. [2]

6. [Maximum mark: 6] 20N.1.SL.TZ0.T_14

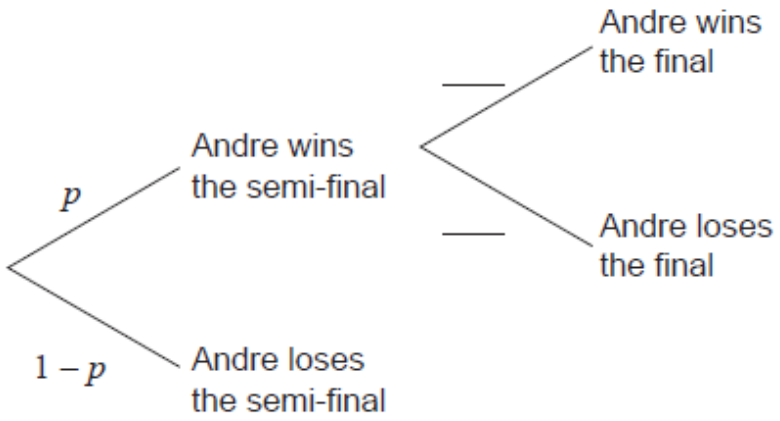
Andre will play in the semi-final of a tennis tournament.

If Andre wins the semi-final he will progress to the final. If Andre loses the semi-final, he will **not** progress to the final.

If Andre wins the final, he will be the champion.

The probability that Andre will win the semi-final is p. If Andre wins the semi-final, then the probability he will be the champion is 0.6.

(a) Complete the values in the tree diagram.



[1]

The probability that Andre will not be the champion is 0.58.

(b) Find the value of p. [2]

(c) Given that Andre did not become the champion, find the probability that he lost in the semi-final. [3]

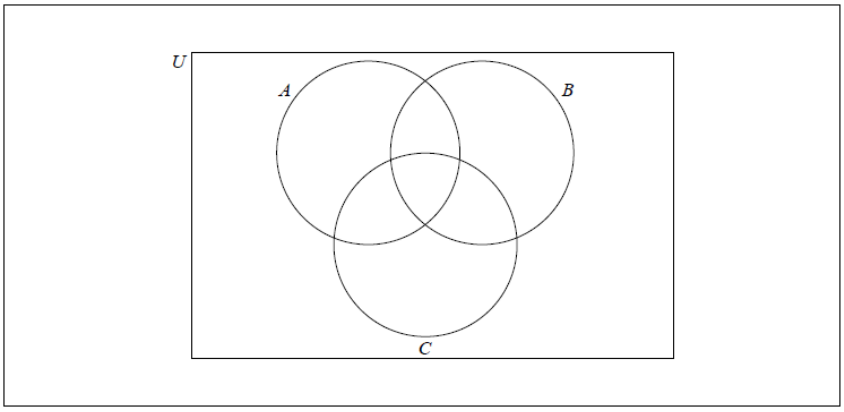
7. [Maximum mark: 6] 19N.1.SL.TZ0.T_4

Let the universal set, U, be the set of all integers x such that $1 \leq x < 11$.
A, B and C are subsets of U.

$$A = \{1, 2, 3, 4, 6, 8\}$$
$$B = \{2, 3, 5, 7\}$$
$$C = \{1, 3, 5, 7, 9\}$$

(a) Write down $n(B)$. [1]

(b) Complete the following Venn diagram using **all** elements of U.

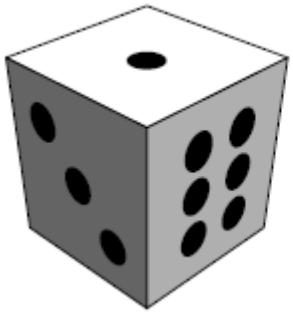


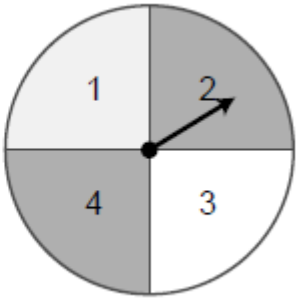
[4]

(c) Write down an element that belongs to $(A \cup B)' \cap C$. [1]

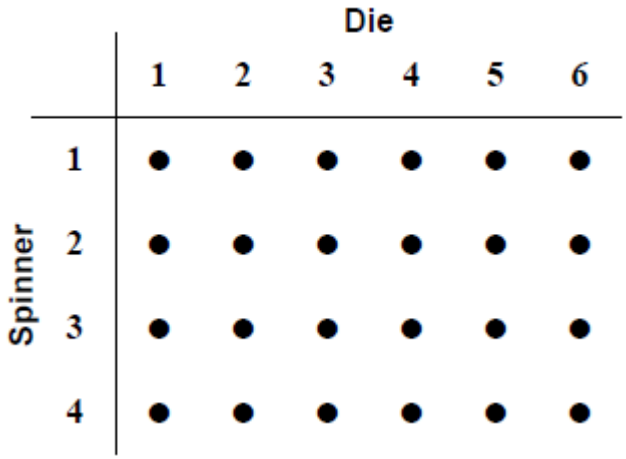
8. [Maximum mark: 6] 19N.1.SL.TZ0.T_9

Sungwon plays a game where she rolls a fair 6-sided die and spins a fair spinner with 4 equal sectors. During each turn in the game, the die is rolled once and the spinner is spun once. The **score** for each turn is the sum of the two results. For example, 1 on the die and 2 on the spinner would receive a score of 3.





The following diagram represents the sample space.



(a) Find the probability that Sungwon's score on her first turn is greater than 4. [2]

Sungwon takes a second turn.

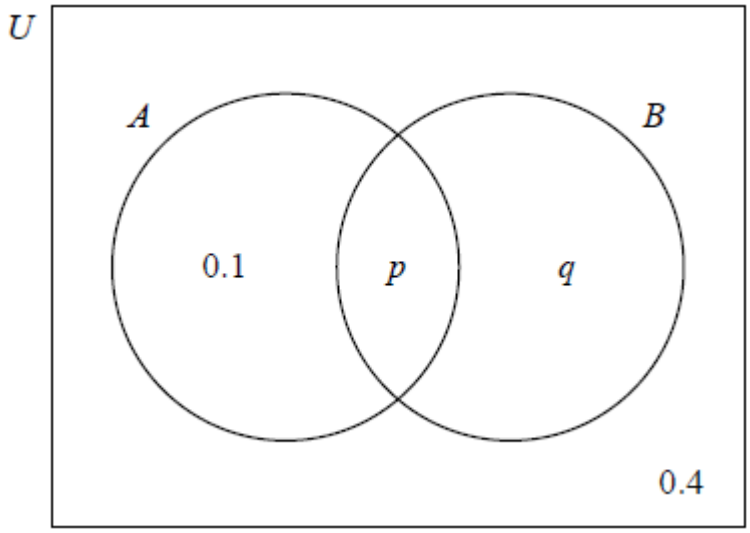
(b) Find the probability that Sungwon scores greater than 4 on both of her first two turns. [2]

(c) Sungwon will play the game for 11 turns.

Find the expected number of times the score on a turn is greater than 4. [2]

9. [Maximum mark: 6] 19M.1.SL.TZ1.S_1

The following Venn diagram shows the events A and B, where $\mathrm{P}(A) = 0.3$. The values shown are probabilities.



(a) Find the value of p. [2]

(b) Find the value of q. [2]

(c) Find $\mathrm{P}(A' \cup B)$. [2]

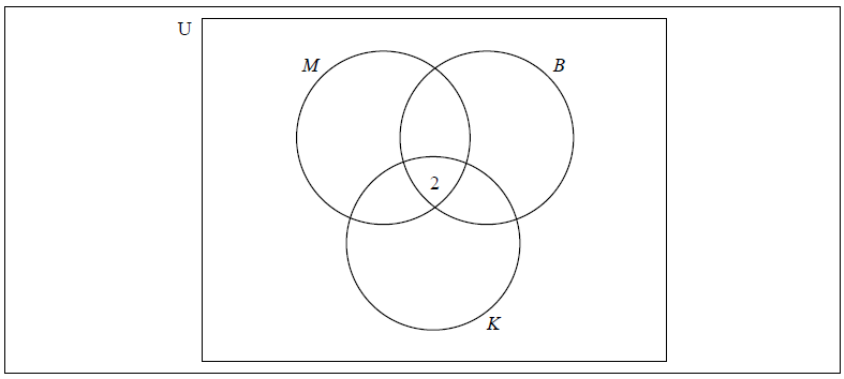
10. [Maximum mark: 6] 19M.1.SL.TZ2.T_5

A school café sells three flavours of smoothies: mango (M), kiwi fruit (K) and banana (B).

85 students were surveyed about which of these three flavours they like.

35 students liked mango, 37 liked banana, and 26 liked kiwi fruit
2 liked all three flavours
20 liked both mango and banana
14 liked mango and kiwi fruit
3 liked banana and kiwi fruit

(a) Using the given information, complete the following Venn diagram.



[2]

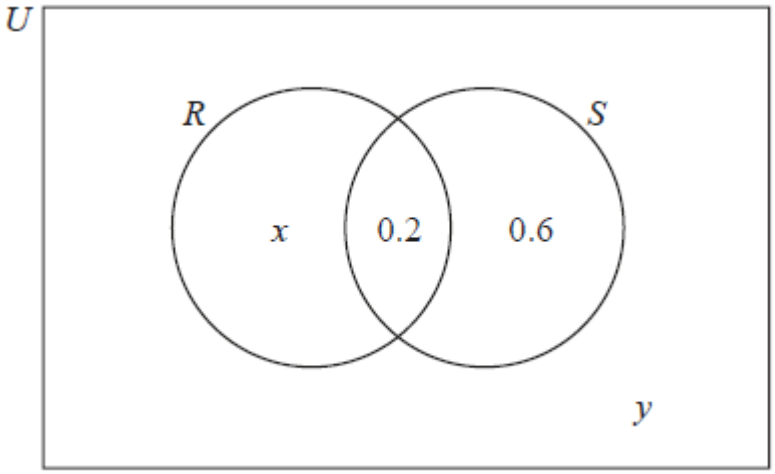
(b) Find the number of surveyed students who did not like any of the three flavours. [2]

(c) A student is chosen at random from the surveyed students.

Find the probability that this student likes kiwi fruit smoothies given that they like mango smoothies. [2]

11. [Maximum mark: 7] 23M.1.AHL.TZ2.3

The following Venn diagram shows two independent events, R and S. The values in the diagram represent probabilities.



(a) Find the value of x. [3]

(b) Find the value of y. [2]

(c) Find $\mathrm{P}(R' | S')$. [2]

12. [Maximum mark: 6] 18N.1.AHL.TZ0.H_1

Consider two events, A and B, such that $\mathrm{P}(A) = \mathrm{P}(A' \cap B) = 0.4$ and $\mathrm{P}(A \cap B) = 0.1$.

(a) By drawing a Venn diagram, or otherwise, find $\mathrm{P}(A \cup B)$. [3]

(b) Show that the events A and B are not independent. [3]