Probability - basics (preDP2) [104 marks]

1. [Maximum mark: 4]

Events A and B are such that $P(A) = 0.7$, $P(B) = 0.75$ and $P(A \cap B) = 0.55$.

(a) Find $P(A \cup B)$. [2]

(b) Hence, otherwise find $P(A\prime \cap B\prime)$. [2]

2. [Maximum mark: 5]

Events A and B are such that $P(A) = 0.4, P(A|B) = 0.25$ and $P(A \cup B) = 0.55$.

Find $P(B)$. [5]

3. [Maximum mark: 6]

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.
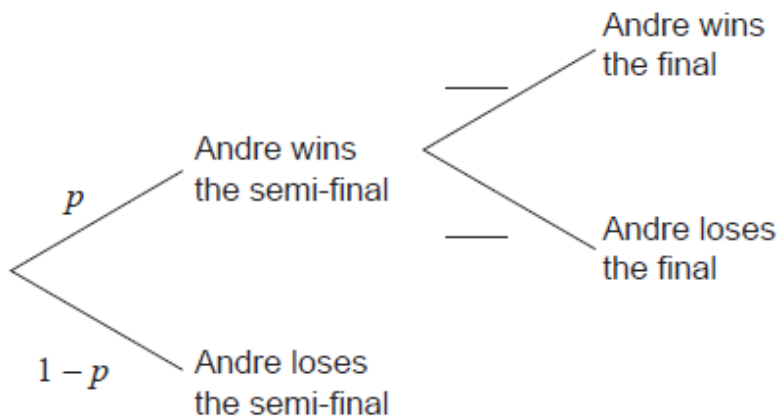
[1]

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
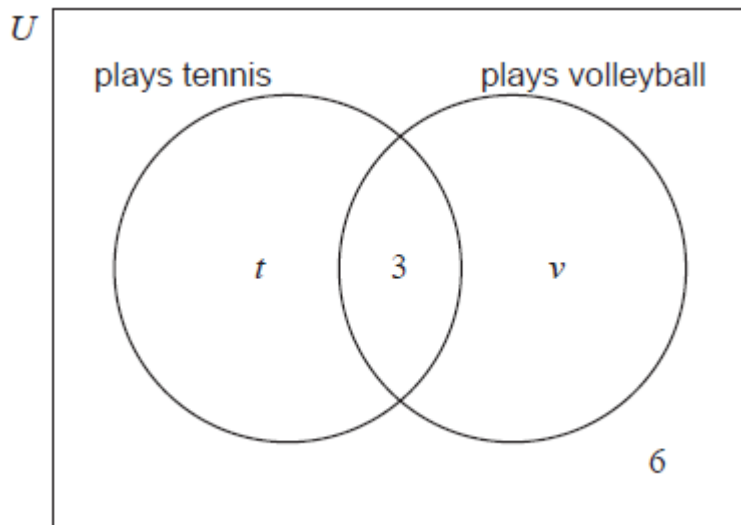   probability that he lost in the semi-final.   [3]

4. [Maximum mark: 6]

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]

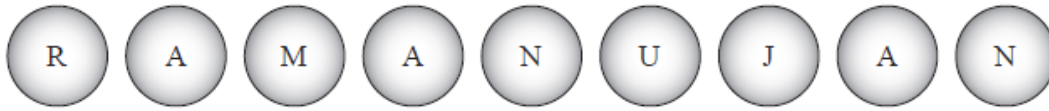(a.ii) Find the value of v.   [2]

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

5. [Maximum mark: 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]

6. [Maximum mark: 6]

The following Venn diagram shows the events A and B, where $\mathrm{P}(A) = 0.3$.
The values shown are probabilities.
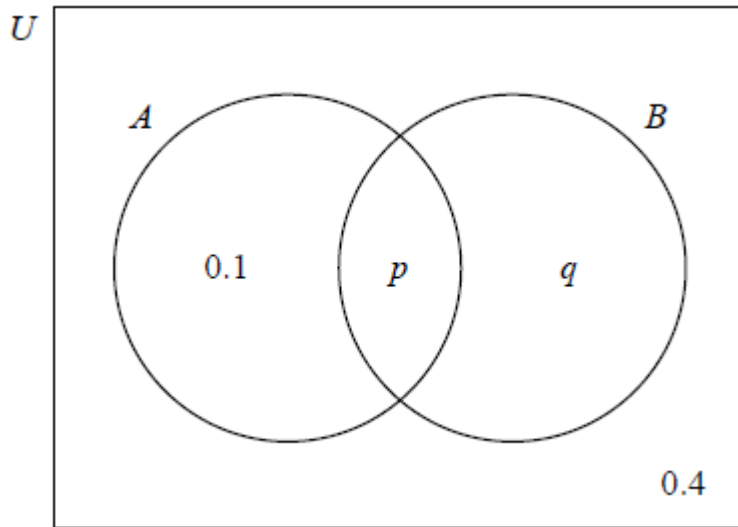
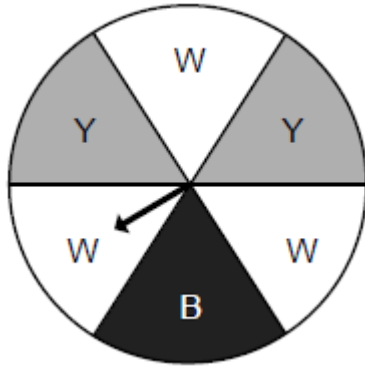(a) Find the value of p. [2]

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

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

7.   [Maximum mark: 6]
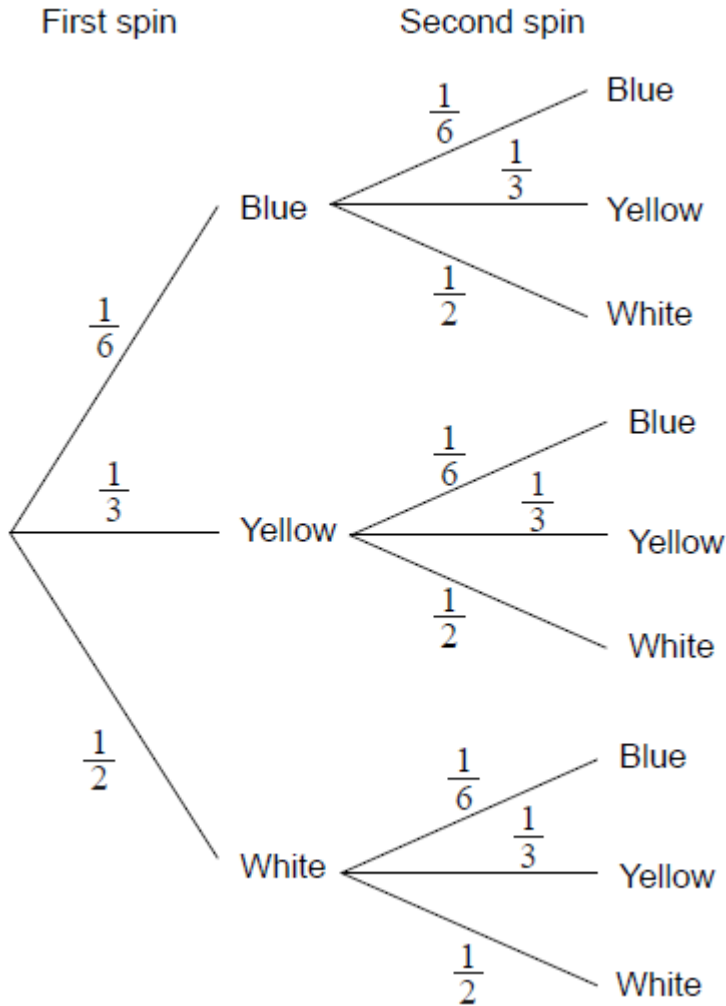
The diagram shows a circular horizontal board divided into six equal sectors. The sectors are labelled white (W), yellow (Y) and blue (B).

A pointer is pinned to the centre of the board. The pointer is to be spun and when it stops the colour of the sector on which the pointer stops is recorded. The pointer is equally likely to stop on any of the six sectors.

Eva will spin the pointer twice. The following tree diagram shows all the possible outcomes.

First spin

Second spin

Blue

$\frac{1}{6}$ Blue

$\frac{1}{6}$ Blue

$\frac{1}{3}$ Yellow

$\frac{1}{2}$ White

$\frac{1}{3}$ Yellow

$\frac{1}{6}$ Blue

$\frac{1}{3}$ Yellow

$\frac{1}{2}$ White

$\frac{1}{2}$ White

$\frac{1}{6}$ Blue

$\frac{1}{3}$ Yellow

$\frac{1}{2}$ White

(a)   Find the probability that both spins are yellow.   [2]

(b)   Find the probability that at least one of the spins is yellow.   [3]

(c)   Write down the probability that the second spin is yellow, given that the first spin is blue.   [1]

8. [Maximum mark: 6]

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.

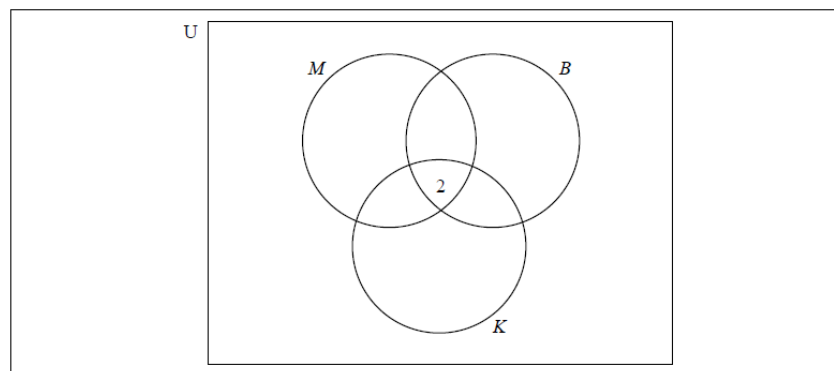35 students liked mango, 37 liked banana, and 26 liked kiwi fruit

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]
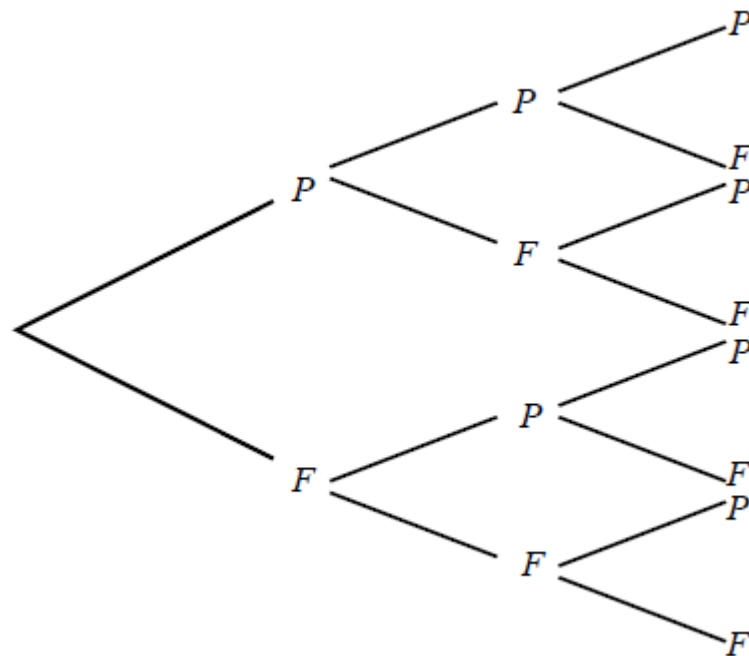
9. [Maximum mark: 8]

Iqbal attempts three practice papers in mathematics. The probability that he passes the first paper is 0.6. Whenever he gains a pass in a paper, his confidence increases so that the probability of him passing the next paper increases by 0.1. Whenever he fails a paper the probability of him passing the next paper is 0.6.

(a) Complete the given probability tree diagram for Iqbal's three attempts, labelling each branch with the correct probability.

[3]

(b) Calculate the probability that Iqbal passes at least two of the papers he attempts. [2]

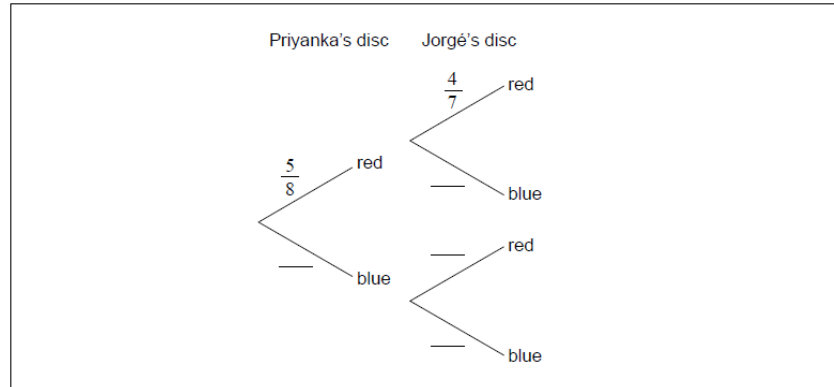(c) Find the probability that Iqbal passes his third paper, given that he passed only one previous paper. [3]

10.   [Maximum mark: 6]

A bag contains 5 red and 3 blue discs, all identical except for the colour. First, Priyanka takes a disc at random from the bag and then Jorgé takes a disc at random from the bag.

(a)   Complete the tree diagram.

[3]

(b)   Find the probability that Jorgé chooses a red disc.   [3]

11. [Maximum mark: 14]

160 students attend a dual language school in which the students are taught only in Spanish or taught only in English.

A survey was conducted in order to analyse the number of students studying Biology or Mathematics. The results are shown in the Venn diagram.

Set S represents those students who are **taught** in Spanish.

Set B represents those students who **study** Biology.

Set M represents those students who **study** Mathematics.
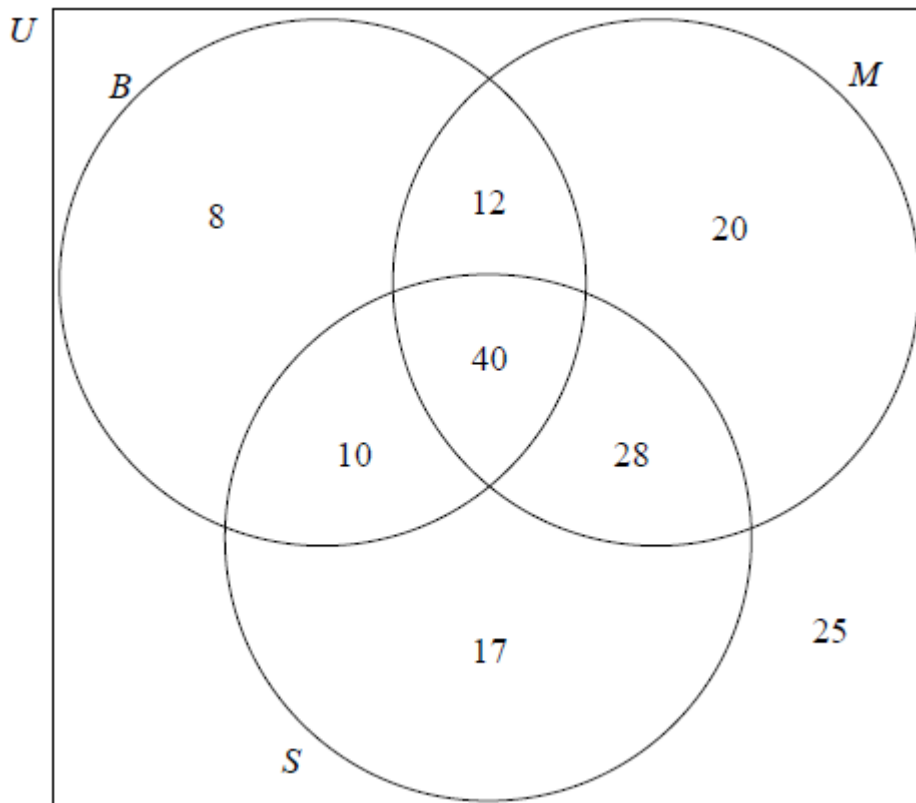
(a.i) Find the number of students in the school that are taught in Spanish. [2]

(a.ii)   Find the number of students in the school that study
         Mathematics in English.   [2]

(a.iii) Find the number of students in the school that study both
         Biology and Mathematics.   [2]

(b.i)   Write down $n\left(S \cap (M \cup B)\right)$.   [1]

(b.ii)   Write down $n\left(B \cap M \cap S'\right)$.   [1]

A student from the school is chosen at random.

(c.i)   Find the probability that this student studies Mathematics. [2]

(c.ii)   Find the probability that this student studies neither Biology
         nor Mathematics.   [2]

(c.iii) Find the probability that this student is taught in Spanish, given
         that the student studies Biology.   [2]

12. [Maximum mark: 6]

In an international competition, participants can answer questions in **only one** of the three following languages: Portuguese, Mandarin or Hindi. 80 participants took part in the competition. The number of participants answering in Portuguese, Mandarin or Hindi is shown in the table.

		Languages			
		Portuguese	Mandarin	Hindi	**Total**
Participants	Boys	20	18	5	43
	Girls	18	7	12	37
	Total	**38**	**25**	**17**	**80**

(a) State the number of boys who answered questions in Portuguese. [1]

A boy is chosen at random.

(b) Find the probability that the boy answered questions in Hindi. [2]

(c) Two girls are selected at random.

Calculate the probability that one girl answered questions in Mandarin and the other answered questions in Hindi. [3]
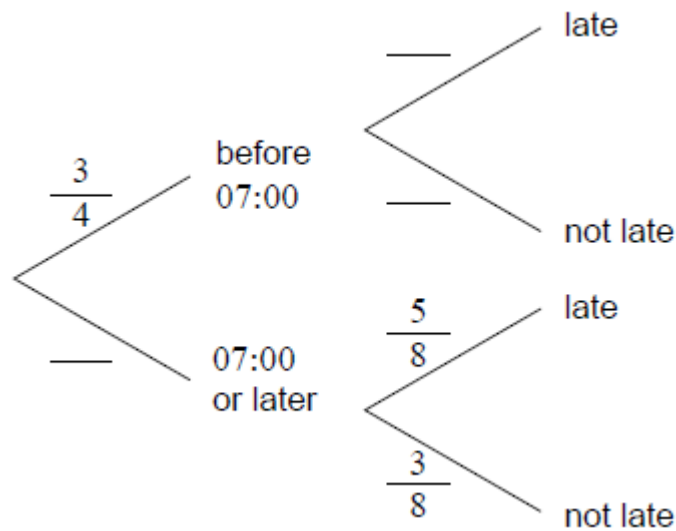
13. [Maximum mark: 14]

Pablo drives to work. The probability that he leaves home before 07:00 is $\frac{3}{4}$.

If he leaves home before 07:00 the probability he will be late for work is $\frac{1}{8}$.

If he leaves home at 07:00 or later the probability he will be late for work is $\frac{5}{8}$.

(a) **Copy** and complete the following tree diagram.

[3]

(b) Find the probability that Pablo leaves home before 07:00 and is late for work. [2]

(c) Find the probability that Pablo is late for work. [3]

(d) Given that Pablo is late for work, find the probability that he left home before 07:00. [3]

(e) Two days next week Pablo will drive to work. Find the probability that he will be late at least once. [3]

14. [Maximum mark: 6]

A junior baseball team consists of six boys and three girls.

The team members are to be placed in a line to have their photograph taken.

(a) In how many ways can the team members be placed if

(a.i) there are no restrictions. [1]

(a.ii) the girls must be placed next to each other. [2]

(b) Five members of the team are selected to attend a baseball summer camp. Find the number of possible selections that contain at least two girls. [3]

15. [Maximum mark: 5]

A team of four is to be chosen from a group of four boys and four girls.

(a) Find the number of different possible teams that could be chosen. [3]

(b) Find the number of different possible teams that could be chosen, given that the team must include at least one girl and at least one boy. [2]