LEVEL 1

1. Let P(A) = 0.5, P(B) = 0.6 and P($A \cup B$) = 0.8.

(a) Find P($A \cap B$).

(2)

(b) Find P($A | B$).

(2)

(c) Decide whether A and B are independent events. Give a reason for your answer.

(2)
(Total 6 marks)

2. A survey was carried out in a group of 200 people. They were asked whether they smoke or not. The collected information was organized in the following table.

	Smoker	**Non-smoker**
Male	60	40
Female	30	70

One person from this group is chosen at random.

(a) Write down the probability that this person is a smoker.

(2)

(b) Write down the probability that this person is male given that they are a smoker.

(2)

(c) Find the probability that this person is a smoker or is male.

(2)
(Total 6 marks)

3. 100 students are asked what they had for breakfast on a particular morning. There were three choices: cereal (X), bread (Y) and fruit (Z). It is found that

10 students had all three
17 students had bread and fruit only
15 students had cereal and fruit only
12 students had cereal and bread only
13 students had only bread
8 students had only cereal
9 students had only fruit

(a) Represent this information on a Venn diagram.

(4)

(b) Find the number of students who had none of the three choices for breakfast.

(2)

(c) Write down the percentage of students who had fruit for breakfast.

(2)

(d) Describe in words what the students in the set $X \cap Y'$ had for breakfast.

(2)

(e) Find the probability that a student had **at least** two of the three choices for breakfast.

(2)

(f) Two students are chosen at random. Find the probability that both students had all three choices for breakfast.

(3)
(Total 15 marks)

4. For events A and B, the probabilities are $P(A) = \frac{4}{13}$ and $P(B) = \frac{5}{13}$.

(a) If events A and B are mutually exclusive, write down the value of $P(A \cap B)$.

(1)

(b) If events A and B are independent, find the value of $P(A \cap B)$.

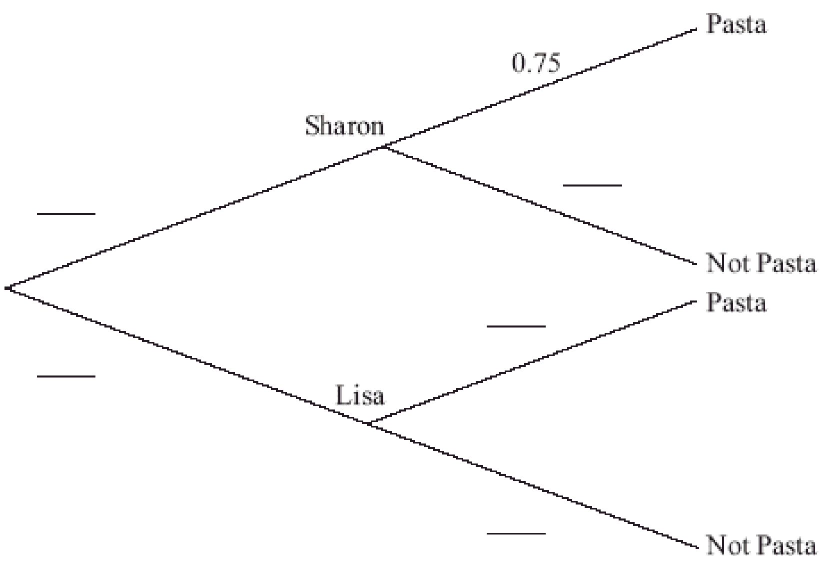
(2)

(c) If $P(A \cup B) = \frac{7}{13}$, find the value of $P(A \cap B)$.

(3)
(Total 6 marks)

5. Sharon and Lisa share a flat. Sharon cooks dinner three nights out of ten.
If Sharon does not cook dinner, then Lisa does. If Sharon cooks dinner the probability that they have pasta is 0.75. If Lisa cooks dinner the probability that they have pasta is 0.12.

(a) **Copy and complete** the tree diagram to represent this information.



(3)

(b) Find the probability that Lisa cooks dinner and they do not have pasta.

(2)

(c) Find the probability that they do not have pasta.

(3)

(d) Given that they do not have pasta, find the probability that Lisa cooked dinner.

(3)
(Total 11 marks)

6. A survey of 100 families was carried out, asking about the pets they own.
The results are given below.

56 owned dogs (S)
38 owned cats (Q)
22 owned birds (R)
16 owned dogs and cats, but not birds
8 owned birds and cats, but not dogs
3 owned dogs and birds, but not cats
4 owned all three types of pets

(a) Draw a Venn diagram to represent this information.

(5)

(b) Find the number of families who own no pets.

(2)

(c) Find the percentage of families that own exactly one pet.

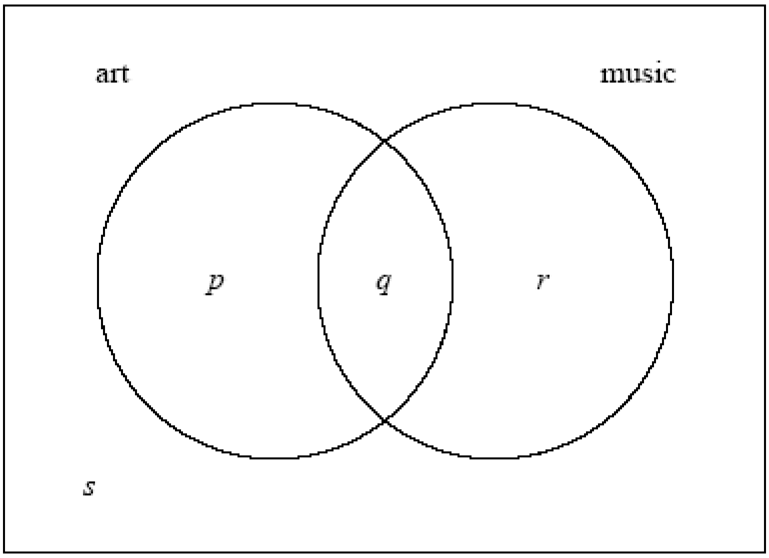
(3)

(d) A family is chosen at random. Find the probability that they own a cat, given that they own a bird.

(2)
(Total 12 marks)

LEVEL 2

1. In a group of 16 students, 12 take art and 8 take music. One student takes neither art nor music. The Venn diagram below shows the events art and music. The values *p*, *q*, *r* and *s* represent numbers of students.



(a) (i) Write down the value of *s*.

(ii) Find the value of *q*.

(iii) Write down the value of *p* and of *r*.

(5)

(b) (i) A student is selected at random. Given that the student takes music, write down the probability the student takes art.

(ii) **Hence**, show that taking music and taking art are **not** independent events.

(4)

(c) Two students are selected at random, one after the other. Find the probability that the first student takes **only** music and the second student takes **only** art.

(4)
(Total 13 marks)

2. A company uses two machines, A and B, to make boxes. Machine A makes 60 % of the boxes.

80 % of the boxes made by machine A pass inspection.
90 % of the boxes made by machine B pass inspection.

A box is selected at random.

(a) Find the probability that it passes inspection.

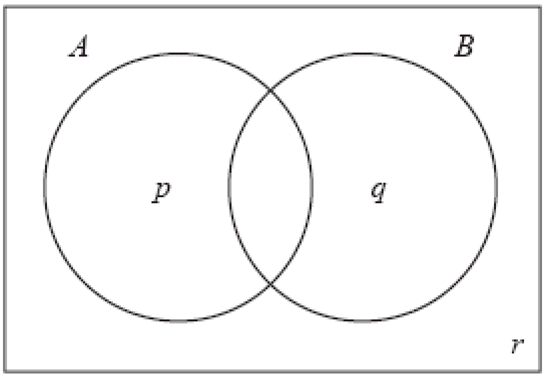
(3)

(b) The company would like the probability that a box passes inspection to be 0.87.
Find the percentage of boxes that should be made by machine B to achieve this.

(4)
(Total 7 marks)

3. Consider the events A and B, where $P(A) = 0.5$, $P(B) = 0.7$ and $P(A \cap B) = 0.3$.

The Venn diagram below shows the events A and B, and the probabilities p, q and r.



(a) Write down the value of

(i) p;

(ii) q;

(iii) r.

(3)

(b) Find the value of $P(A \mid B')$.

(2)

(c) Hence, or otherwise, show that the events A and B are **not** independent.

(1)
(Total 6 marks)

4. In any given season, a soccer team plays 65 % of their games at home.
When the team plays at home, they win 83 % of their games.
When they play away from home, they win 26 % of their games.

The team plays one game.

(a) Find the probability that the team wins the game.

(4)

(b) If the team does not win the game, find the probability that the game was played at home.

(4)
(Total 8 marks)

5. In a class of 100 boys, 55 boys play football and 75 boys play rugby. Each boy must play at least one sport from football and rugby.

(a) (i) Find the number of boys who play both sports.

(ii) Write down the number of boys who play only rugby.

(3)

(b) One boy is selected at random.

(i) Find the probability that he plays only one sport.

(ii) Given that the boy selected plays only one sport, find the probability that he plays rugby.

(4)

Let A be the event that a boy plays football and B be the event that a boy plays rugby.

(c) Explain why A and B are **not** mutually exclusive.

(2)

(d) Show that A and B are **not** independent.

(3)
(Total 12 marks)

6. Consider the independent events A and B. Given that $P(B) = 2P(A)$, and $P(A \cup B) = 0.52$, find $P(B)$.

(Total 7 marks)

7. There are 20 students in a classroom. Each student plays only one sport. The table below gives their sport and gender.

	Football	**Tennis**	**Hockey**
Female	5	3	3
Male	4	2	3

(a) One student is selected at random.

(i) Calculate the probability that the student is a male or is a tennis player.

(ii) Given that the student selected is female, calculate the probability that the student does not play football.

(4)

(b) Two students are selected at random. Calculate the probability that neither student plays football.

(3)
(Total 7 marks)

8. Let A and B be independent events, where $P(A) = 0.6$ and $P(B) = x$.

(a) Write down an expression for $P(A \cap B)$.

(1)

(b) Given that $P(A \cup B) = 0.8$,

(i) find x;

(ii) find $P(A \cap B)$.

(4)

(c) **Hence**, explain why A and B are **not** mutually exclusive.

(1)
(Total 6 marks)

9. Consider the events A and B, where $P(A) = \frac{2}{5}$, $P(B') = \frac{1}{4}$ and $P(A \cup B) = \frac{7}{8}$.

(a) Write down $P(B)$.

(b) Find $P(A \cap B)$.

(c) Find $P(A \mid B)$.

(Total 6 marks)

10. The eye colour of 97 students is recorded in the chart below.

	Brown	Blue	Green
Male	21	16	9
Female	19	19	13

One student is selected at random.

(a) Write down the probability that the student is a male.

(b) Write down the probability that the student has green eyes, given that the student is a female.

(c) Find the probability that the student has green eyes or is male.

(Total 6 marks)

LEVEL 3

1. Events A and B are such that $P(A) = 0.3$ and $P(B) = 0.4$.

(a) Find the value of $P(A \cup B)$ when

(i) A and B are mutually exclusive;

(ii) A and B are independent.

(4)

(b) Given that $P(A \cup B) = 0.6$, find $P(A \mid B)$.

(3)
(Total 7 marks)

2. In a population of rabbits, 1 % are known to have a particular disease. A test is developed for the disease that gives a positive result for a rabbit that **does** have the disease in 99 % of cases. It is also known that the test gives a positive result for a rabbit that **does not** have the disease in 0.1 % of cases. A rabbit is chosen at random from the population.

(a) Find the probability that the rabbit tests positive for the disease.

(2)

(b) Given that the rabbit tests positive for the disease, show that the probability that the rabbit does not have the disease is less than 10 %.

(3)
(Total 5 marks)

3. Two players, A and B, alternately throw a fair six–sided dice, with A starting, until one of them obtains a six. Find the probability that A obtains the first six.

(Total 7 marks)

4. Jenny goes to school by bus every day. When it is not raining, the probability that the bus is late is $\frac{3}{20}$. When it is raining, the probability that the bus is late is $\frac{7}{20}$. The probability that it rains on a particular day is $\frac{9}{20}$. On one particular day the bus is late. Find the probability that it is not raining on that day.

(Total 5 marks)

5. In a class of 20 students, 12 study Biology, 15 study History and 2 students study neither Biology nor History.

(a) Illustrate this information on a Venn diagram.

(2)

(b) Find the probability that a randomly selected student from this class is studying both Biology and History.

(1)

(c) Given that a randomly selected student studies Biology, find the probability that this student also studies History.

(1)
(Total 4 marks)

6. An influenza virus is spreading through a city. A vaccination is available to protect against the virus. If a person has had the vaccination, the probability of catching the virus is 0.1; without the vaccination, the probability is 0.3. The probability of a randomly selected person catching the virus is 0.22.

(a) Find the percentage of the population that has been vaccinated.

(3)

(b) A randomly chosen person catches the virus. Find the probability that this person has been vaccinated.

(2)
(Total 5 marks)

7. Let A and B be events such that $\mathrm{P}(A) = 0.6$, $\mathrm{P}(A \cup B) = 0.8$ and $\mathrm{P}(A \mid B) = 0.6$.

Find $\mathrm{P}(B)$.

(Total 6 marks)

8. If $\mathrm{P}(A) = \frac{1}{6}$, $\mathrm{P}(B) = \frac{1}{3}$, and $\mathrm{P}(A \cup B) = \frac{5}{12}$, what is $\mathrm{P}(A' / B')$?

(Total 6 marks)

9. Bag A contains 2 red and 3 green balls.

(a) Two balls are chosen at random from the bag without replacement. Find the probability that 2 red balls are chosen.

(2)

Bag B contains 4 red and n green balls.

(b) Two balls are chosen without replacement from this bag. If the probability that two red balls are chosen is $\frac{2}{15}$, show that $n = 6$.

(4)

A standard die with six faces is rolled. If a 1 or 6 is obtained, two balls are chosen from bag A, otherwise two balls are chosen from bag B.

(c) Calculate the probability that two red balls are chosen.

(3)

(d) Given that two red balls are chosen, find the probability that a 1 or a 6 was obtained on the die.

(4)
(Total 13 marks)