

Summary of key points

- 1** $P(\text{event } A \text{ or event } B \text{ or both}) = P(A \cup B)$
 $P(\text{both events } A \text{ and } B) = P(A \cap B)$
 $P(\text{ not event } A) = P(A')$

2 Complementary probability

$$P(A') = 1 - P(A)$$

3 Addition rule

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

4 Conditional probability

$$P(A \text{ given } B) = P(A|B) = \frac{P(A \cap B)}{P(B)}$$

5 Multiplication rule

$$P(A \cap B) = P(A|B) \times P(B) \text{ or } P(B|A) \times P(A)$$

6 A and B are **independent** if

$$P(A|B) = P(A) \text{ or } P(B|A) = P(B) \text{ or } P(A \cap B) = P(A) \times P(B)$$

7 A and B are **mutually exclusive** if

$$P(A \cap B) = 0$$

- 1** The events A and B are such that $P(A) = \frac{1}{3}$, $P(B) = \frac{1}{4}$ and $P(A \cup B) = \frac{1}{2}$.
- Show that A and B are independent.
 - Represent these probabilities in a Venn diagram.
 - Find $P(A|B')$.
- 2** A computer game has three levels and one of the objectives of every level is to collect a diamond. The probability of a randomly chosen player collecting a diamond on the first level is $\frac{4}{5}$, the second level is $\frac{2}{3}$ and the third level is $\frac{1}{2}$. The events are independent.
- Draw a tree diagram to represent collecting diamonds on the three levels of the game. Find the probability that a randomly chosen player
 - collects all three diamonds,
 - collects only one diamond.
- 3** An online readers' club has 50 members. Glasses are worn by 15 members, 18 are left handed and 21 are female. There are four females who are left handed, three females who wear glasses and five members who wear glasses and are left handed. Only one member wears glasses, is left handed and female.
- Draw a Venn diagram to represent these data.
- A member is selected at random. Find the probability that the member
- is female, does not wear glasses and is not left handed,
 - is male, does not wear glasses and is not left handed,
 - wears glasses given that she is left handed and female.
- 4** For the events J and K ,
- $$P(J \cup K) = 0.5, P(J' \cap K) = 0.2, P(J \cap K') = 0.25.$$
- Draw a Venn diagram to represent the events J and K and the sample space S . Find
 - $P(J)$,
 - $P(K)$,
 - $P(J|K)$.
 - Determine whether or not J and K are independent.
- 5** There are 15 coloured beads in a bag; seven beads are red, three are blue and five are green. Three beads are selected at random from the bag and not replaced. Find the probability that
- the first and second beads chosen are red and the third bead is blue or green,
 - one red, one blue and one green bead are chosen.
- 6** A survey of a group of students revealed that 85% have a mobile phone, 60% have an MP3 player and 5% have neither phone nor MP3 player.
- Find the proportion of students who have both gadgets.
 - Draw a Venn diagram to represent this information.
- Given that a randomly selected student has a phone or an MP3 player,
- find the probability that the student has a mobile phone.

- 7** In a factory, machines *A*, *B* and *C* produce electronic components. Machine *A* produces 16% of the components, machine *B* produces 50% of the components and machine *C* produces the rest. Some of the components are defective. Machine *A* produces 4%, machine *B* 3% and machine *C* 7% defective components.

a Draw a tree diagram to represent this information.

Find the probability that a randomly selected component is

- b** produced by machine *B* and is defective,
c defective.

Given that a randomly selected component is defective,

- d** find the probability that it was produced by machine *B*.

- 8** A garage sells three types of fuel; U95, U98 and diesel. In a survey of 200 motorists buying fuel at the garage, 80 are female and the rest are male. Of the 90 motorists buying 'U95' fuel, 50 were female and of the 70 motorists buying diesel, 60 were male. A motorist does not buy more than one type of fuel.

Find the probability that a randomly chosen motorist

- a** buys U98 fuel,
b is male, given that the motorist buys U98 fuel.

Garage records indicate that 10% of the motorists buying U95 fuel, 30% of the motorists buying U98 fuel and 40% of the motorists buying diesel have their car serviced by the garage.

A motorist is chosen at random.

- c** Find the probability that this motorist has his or her car serviced by the garage.
d Given the motorist has his or her car serviced by the garage, find the probability that the motorist buys diesel fuel.

- 9** A study was made of a group of 150 children to determine which of three cartoons they watch on television. The following results were obtained:

35 watch Toontime
54 watch Porky
62 watch Skellingtons
9 watch Toontime and Porky
14 watch Porky and Skellingtons
12 watch Toontime and Skellingtons
4 watch Toontime, Porky and Skellingtons

- a** Draw a Venn diagram to represent these data.

Find the probability that a randomly selected child from the study watches

- b** none of the three cartoons,
c no more than one of the cartoons.

A child selected at random from the study only watches one of the cartoons.

- d** Find the probability that it was Skellingtons.

Two different children are selected at random from the study.

- e** Find the probability that they both watch Skellingtons.

- 10** The members of a wine tasting club are married couples. For any married couple in the club, the probability that the husband is retired is 0.7 and the probability that the wife is retired 0.4. Given that the wife is retired, the probability that the husband is retired is 0.8.

For a randomly chosen married couple who are members of the club, find the probability that

- a** both of them are retired,
- b** only one of them is retired,
- c** neither of them is retired.

Two married couples are chosen at random.

- d** Find the probability that only one of the two husbands and only one of the two wives is retired.