2.4) Probability formulae

Worked example

Two events A and B are independent.

$$P(A) = \frac{1}{5}$$

$$P(B) = \frac{1}{6}$$

Find:

a) $P(A \cap B)$

b) $P(B|A)$

c) $P(A \cup B)$

Your turn

Two events A and B are independent.

$$P(A) = \frac{1}{3}$$

$$P(B) = \frac{1}{4}$$

Find:

a) $P(A \cap B)$

b) $P(A|B)$

c) $P(A \cup B)$

a) $\frac{1}{12}$

b) $\frac{1}{3}$

c) $\frac{1}{2}$

Worked example

A and B are two events such that

$$P(A) = 0.3$$
$$P(B) = 0.4$$
$$P(A|B) = 0.2$$

Find:

a) $P(A \cap B)$

b) $P(B|A)$

c) $P(A \cup B)$

Your turn

C and D are two events such that

$$P(C) = 0.2$$
$$P(D) = 0.6$$
$$P(C|D) = 0.3$$

Find:

a) $P(C \cap D)$

b) $P(D|C)$

c) $P(C \cup D)$

a) 0.18

b) 0.9

c) 0.62

Worked example

C and D are two independent events such that

$$P(C) = \frac{1}{3}$$

$$P(C \cup D) = \frac{3}{5}$$

Find:

a) $P(D)$

b) $P(C' \cap D)$

c) $P(D'|C)$

Your turn

A and B are two independent events such that

$$P(A) = \frac{1}{4}$$

$$P(A \cup B) = \frac{2}{3}$$

Find:

a) $P(B)$

b) $P(A' \cap B)$

c) $P(B'|A)$

a) $\frac{5}{9}$

b) $\frac{5}{12}$

c) $\frac{4}{9}$

Worked example

There are three events: A, B and C.
A and C are mutually exclusive.
A and B are independent.

$$P(A) = 0.4$$
$$P(C) = 0.3$$
$$P(A \cup B) = 0.6$$

Find:

a) $P(A|B)$
b) $P(A \cup C)$
c) $P(B)$

Your turn

There are three events: A, B and C.
A and B are mutually exclusive.
A and C are independent.

$$P(A) = 0.2$$
$$P(B) = 0.4$$
$$P(A \cup C) = 0.7$$

Find:

a) $P(A|C)$
b) $P(A \cup B)$
c) $P(C)$

a) 0.2
b) 0.6
c) 0.625

Worked example

Write out the law for conditional probability:

"Given John runs to school, find the probability that he's not late…"

"Given an even number is rolled on a die, find the probability that the number is prime…"

Your turn

Write out the law for conditional probability:

"Given Bob walks to school, find the probability that he's not late…"

$$P(L'|W) = \frac{P(L' \cap W)}{P(W)} = \cdots$$

Worked example

Write out the relevant probability laws:

- C and D are independent events.

- C and D are mutually exclusive events.

Your turn

Write out the law for independent events:

- A and B are independent events.

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

- C and D are mutually exclusive events.

$$P(C \cap D) = 0$$
$$P(C \cup D) = P(C) + P(D)$$