



- 1 A bag contains 4 red counters and 6 blue counters.

Two counters are taken from the bag at random, without replacement.

Work out the probability that the two counters are different colours.

(3 marks)

Different colours can occur in two separate orders: red then blue, or blue then red.

Multiply the conditional probabilities along each order, then add because these outcomes cannot happen together

$$P(\text{red then blue}) = \frac{4}{10} \times \frac{6}{9} = \frac{24}{90}$$

$$P(\text{blue then red}) = \frac{6}{10} \times \frac{4}{9} = \frac{24}{90}$$

$$P(\text{different colours}) = \frac{24}{90} + \frac{24}{90} = \frac{48}{90} = \frac{8}{15}$$

$$\boxed{\frac{8}{15}}$$

2

A bag contains 3 red counters and 5 blue counters. Two counters are taken at random without replacement.

- Write down the probability that the first counter is red, and the probability that the second is blue given that the first was red.
- Work out the probability that the first is red and the second is blue.
- Work out the probability that both counters are blue.

(3 marks)

a) 8 counters, 3 red

$$P(\text{red first}) = \frac{3}{8}$$

7 left, 5 blue

$$P(\text{blue second} \mid \text{red first}) = \frac{5}{7}$$

b) Multiply along the branches

$$\frac{3}{8} \times \frac{5}{7} = \frac{15}{56}$$

$$\boxed{\frac{15}{56}}$$

c) Blue then blue

$$\frac{5}{8} \times \frac{4}{7} = \frac{20}{56} = \frac{5}{14}$$

$$\boxed{\frac{5}{14}}$$

3

Five cards are numbered 1, 2, 3, 4 and 5.

Two cards are taken at random, without replacement.

The two numbers are multiplied together.

Work out the probability that the product is even.

(3 marks)

The product is odd only if both cards are odd. The odd cards are 1, 3 and 5

$$P(\text{both odd}) = \frac{3}{5} \times \frac{2}{4} = \frac{6}{20} = \frac{3}{10}$$

$$P(\text{product even}) = 1 - \frac{3}{10} = \frac{7}{10}$$

$$\boxed{\frac{7}{10}}$$

4

A box contains 5 green pegs and 3 white pegs.

Two pegs are taken from the box at random, without replacement.

Work out the probability that both pegs are green.

(3 marks)

$$P(\text{first peg green}) = \frac{5}{8}$$

After one green peg is removed, 4 green pegs remain out of 7

$$P(\text{both green}) = \frac{5}{8} \times \frac{4}{7} = \frac{20}{56} = \frac{5}{14}$$

$$\boxed{\frac{5}{14}}$$

5

A bag contains 6 red counters and 4 blue counters. Two counters are taken at random without replacement.

a. Given that the first counter is red, write down the probability that the second counter is blue.

b. Work out the probability that the two counters are the same colour.

(4 marks)

a) 9 counters left, 4 blue

$$\boxed{\frac{4}{9}}$$

b) Same colour means RR or BB

$$P(RR) = \frac{6}{10} \times \frac{5}{9} = \frac{30}{90}$$

$$P(BB) = \frac{4}{10} \times \frac{3}{9} = \frac{12}{90}$$

$$\frac{30}{90} + \frac{12}{90} = \frac{42}{90}$$

$$\boxed{\frac{7}{15}}$$

6

A box contains 12 chocolates: 5 dark and 7 milk. Ravi takes two chocolates at random without replacement.

Work out the probability that at least one of the chocolates is dark.

(3 marks)

At least one dark = $1 - P(\text{none dark})$

$$P(\text{both milk}) = \frac{7}{12} \times \frac{6}{11} = \frac{42}{132}$$

$$\frac{42}{132} = \frac{7}{22}$$

$$1 - \frac{7}{22} = \frac{15}{22}$$

$$\boxed{\frac{15}{22}}$$

7

A bag contains 7 red beads and 5 blue beads.

Two beads are taken from the bag at random, without replacement.

Work out the probability that exactly one of the beads is red.

(4 marks)

$$P(\text{red then blue}) = \frac{7}{12} \times \frac{5}{11} = \frac{35}{132}$$

$$P(\text{blue then red}) = \frac{5}{12} \times \frac{7}{11} = \frac{35}{132}$$

$$P(\text{exactly one red}) = \frac{35}{132} + \frac{35}{132} = \frac{70}{132} = \frac{35}{66}$$

$$\boxed{\frac{35}{66}}$$

8

A packet contains 9 mints and 5 toffees. Chloe takes two sweets at random without replacement.

Work out the probability that the second sweet is a toffee.

(3 marks)

$$P(M, T) = \frac{9}{14} \times \frac{5}{13} = \frac{45}{182}$$

$$P(T, T) = \frac{5}{14} \times \frac{4}{13} = \frac{20}{182}$$

$$\frac{45}{182} + \frac{20}{182} = \frac{65}{182}$$

$$\boxed{\frac{5}{14}}$$

9

The probability that Ravi cycles to work on Monday is 0.7.

If he cycles on Monday, the probability that he cycles on Tuesday is 0.9.

If he does not cycle on Monday, the probability that he cycles on Tuesday is 0.4.

Work out the probability that Ravi cycles to work on Tuesday.

(4 marks)

$$P(\text{cycles Monday and Tuesday}) = 0.7 \times 0.9 = 0.63$$

$$P(\text{does not cycle Monday but cycles Tuesday}) = 0.3 \times 0.4 = 0.12$$

$$P(\text{cycles Tuesday}) = 0.63 + 0.12 = 0.75$$

0.75

10

A drawer contains 8 black socks and 6 white socks. Two socks are taken at random without replacement.

Given that the two socks are the same colour, work out the probability that they are both white.

(4 marks)

$$P(WW) = \frac{6}{14} \times \frac{5}{13} = \frac{30}{182}$$

$$P(BB) = \frac{8}{14} \times \frac{7}{13} = \frac{56}{182}$$

$$P(\text{same}) = \frac{86}{182}$$

Only the same-colour outcomes are possible now

$$P(WW \mid \text{same}) = \frac{30}{86}$$

$\frac{15}{43}$

- 11 Six cards are numbered 1, 2, 3, 4, 5 and 6.

Two cards are taken at random, without replacement.

The two numbers are added together.

Work out the probability that the sum is even.

(4 marks)

The sum is even only when both numbers are odd or both are even

There are 3 odd cards and 3 even cards

$$P(\text{both odd}) = \frac{3}{6} \times \frac{2}{5} = \frac{6}{30}, \text{ and } P(\text{both even}) = \frac{3}{6} \times \frac{2}{5} = \frac{6}{30}$$

$$P(\text{sum even}) = \frac{6}{30} + \frac{6}{30} = \frac{12}{30} = \frac{2}{5}$$

$$\frac{2}{5}$$

- 12 A tin contains 12 chocolates. 5 are dark chocolate and 7 are milk chocolate.

Nina takes two chocolates at random, without replacement.

Work out the probability that she takes at least one dark chocolate.

(4 marks)

$$P(\text{no dark chocolates}) = P(\text{both milk}) = \frac{7}{12} \times \frac{6}{11} = \frac{42}{132} = \frac{7}{22}$$

$$P(\text{at least one dark}) = 1 - \frac{7}{22} = \frac{15}{22}$$

$$\frac{15}{22}$$

- 13 A bag contains 5 blue counters and 7 white counters.

Tom takes 3 counters from the bag at random, one at a time, without replacement.

He takes 2 blue counters and 1 white counter.

- Write down the number of blue counters left in the bag.
- Tom now takes two more counters at random, without replacement. Work out the probability that both of these counters are white.

(5 marks)

Blue counters left = $5 - 2 = 3$, and white counters left = $7 - 1 = 6$, so 9 counters remain

$$P(\text{first counter white}) = \frac{6}{9}$$

$$P(\text{second counter white}) = \frac{5}{8}$$

$$P(\text{both white}) = \frac{6}{9} \times \frac{5}{8} = \frac{30}{72} = \frac{5}{12}$$

14

A bag contains 4 red discs and 8 blue discs.

Meg takes two discs from the bag at random, without replacement.

Meg says,

"The probability that both discs are blue is more than three times the probability that both discs are red."

Is Meg correct? You must show your working.

(5 marks)

$$P(\text{both blue}) = \frac{8}{12} \times \frac{7}{11} = \frac{56}{132}$$

$$P(\text{both red}) = \frac{4}{12} \times \frac{3}{11} = \frac{12}{132}$$

$$\text{Three times } P(\text{both red}) = \frac{36}{132}$$

$$\frac{56}{132} > \frac{36}{132}, \text{ so the claim is true: Meg is correct}$$

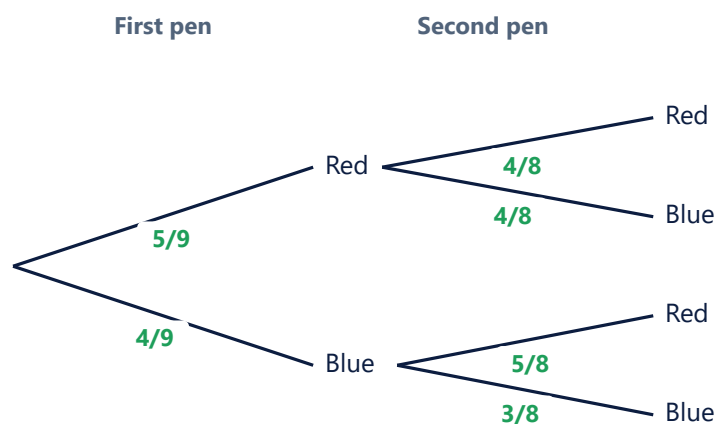
15

A box contains 5 red pens and 4 blue pens.

Milo takes a pen at random and does **not** replace it.

He then takes a second pen at random.

- Complete the probability tree diagram.
- Work out the probability that Milo takes at least one red pen.



(5 marks)

First pick

$$P(\text{red}) = \frac{5}{9}, P(\text{blue}) = \frac{4}{9}$$

The pen is not replaced, so 8 pens remain

after a red, $P(\text{red}) = \frac{4}{8}$ and $P(\text{blue}) = \frac{4}{8}$; after a blue,

$$P(\text{red}) = \frac{5}{8} \text{ and } P(\text{blue}) = \frac{3}{8}$$

$$P(\text{no red pens}) = P(\text{blue, blue}) = \frac{4}{9} \times \frac{3}{8} = \frac{12}{72} = \frac{1}{6}$$

$$P(\text{at least one red}) = 1 - \frac{1}{6} = \frac{5}{6}$$