Probability

Worked solutions

KS3 Maths topic practice

This topic online

1 Ruby rolls a fair six-sided dice once.

a. Choose a word from the box to describe each probability.

impossible	unlikely	even chance	likely	certain

i. She rolls an even number.

ii. She rolls a 7.

iii. She rolls a number less than 6.

b. The probability that it rains tomorrow is 0.35. Work out the probability that it does not rain tomorrow.

(4 marks)

a) i) 2, 4, 6 are even: 3 out of 6

even chance

ii) no 7 on the dice

impossible

iii) 1, 2, 3, 4, 5: 5 out of 6

likely

b) probabilities add up to 1

$1 - 0.35 = 0.65$

0.65

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2 Write down whether each type of data is **discrete** or **continuous**.

a. The number of pupils in a class

b. The mass of an apple

c. The time taken to run 100 m

d. The number of goals scored in a football match

(2 marks)

counted = discrete, measured = continuous

a) counted

discrete

b) measured

continuous

c) measured

continuous

d) counted

discrete

3 A spinner can land on red, blue, green or yellow.

The table shows the probabilities for three of the colours.

Colour	red	blue	green	yellow
Probability	0.2	0.35	0.1	

Work out the probability that the spinner lands on yellow.

(2 marks)

The four probabilities must add up to 1

$0.2 + 0.35 + 0.1 = 0.65$

$P(\text{yellow}) = 1 - 0.65 = 0.35$

0.35

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4 Tom thinks his dice might be biased. He rolls it 60 times and gets a six 22 times.

a. Work out the relative frequency of rolling a six.

b. Tom says, "My dice is not fair." Do the results support what Tom says? Give a reason for your answer.

c. Tom rolls the dice another 300 times. Use his results to estimate the number of sixes he will get. (4 marks)

a) sixes ÷ rolls

$$RF = \frac{22}{60} = \frac{11}{30}$$

$\frac{11}{30}$

b) a fair dice: $P(six) = \frac{1}{6}$

$$60 \times \frac{1}{6} = 10$$

22 is much more than 10

Yes, the dice looks biased

c)

$$300 \times \frac{22}{60} = 110$$

110 sixes

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5 Spinner A has sections numbered 1, 2 and 3. Spinner B has sections numbered 1, 2, 3 and 4. Both spinners are fair.

Mo spins both spinners and adds the two numbers to get a total.

+	1	2	3	4
1	2	3		
2	3			6
3			6	

a. Complete the sample space diagram. Spinner A is down the side and spinner B is across the top.

b. Work out the probability that the total is 5.

c. Work out the probability that the total is an even number.

(4 marks)

a) add the two numbers

row 1: 2, 3, 4, 5

row 2: 3, 4, 5, 6

row 3: 4, 5, 6, 7

b) 3 x 4 = 12 outcomes, three 5s

$$P(5) = \frac{3}{12} = \frac{1}{4}$$

$\frac{1}{4}$

c) even totals: 2, 4, 4, 6, 4, 6

$$P(\text{even}) = \frac{6}{12} = \frac{1}{2}$$

$\frac{1}{2}$

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6 There are 60 students in Year 10 and Year 11 at a small school.

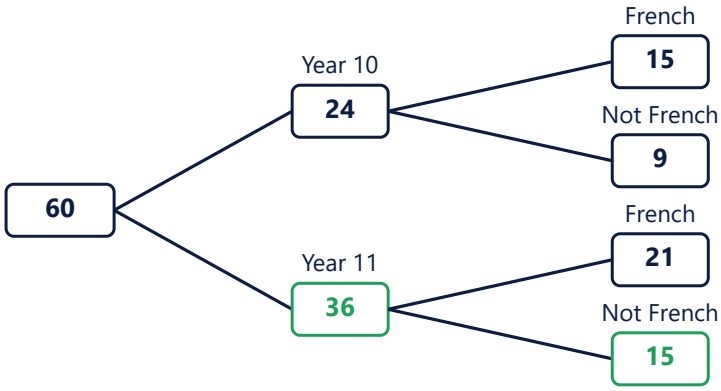
24 of the students are in Year 10 and the rest are in Year 11.

Of the Year 10 students, 15 study French and 9 do not.

Of the Year 11 students, 21 study French.

a. Work out the number of students in Year 11.

b. Work out the number of Year 11 students who do not study French.



(3 marks)

A frequency tree counts people, rather than showing probabilities. The two branches leaving each group must add to the number in that group

Number in Year 11 = 60 − 24 = 36

Year 11 students not studying French = 36 − 21 = 15

Check

15 + 9 = 24 and 21 + 15 = 36, so every branch adds up correctly

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7 A spinner can land on red, blue, green or yellow. The table shows the probabilities.

Colour	red	blue	green	yellow
Probability	x	$2x$	0.25	0.15

a. Work out the value of x.

b. The spinner is spun 150 times. Work out an estimate for the number of times it lands on blue. (3 marks)

a) probabilities add up to 1

$$x + 2x + 0.25 + 0.15 = 1$$
$$3x + 0.4 = 1$$
$$3x = 0.6$$
$$x = 0.2$$

÷3 ÷3

$x = 0.2$

b) P(blue) = $2x$

$2 \times 0.2 = 0.4$

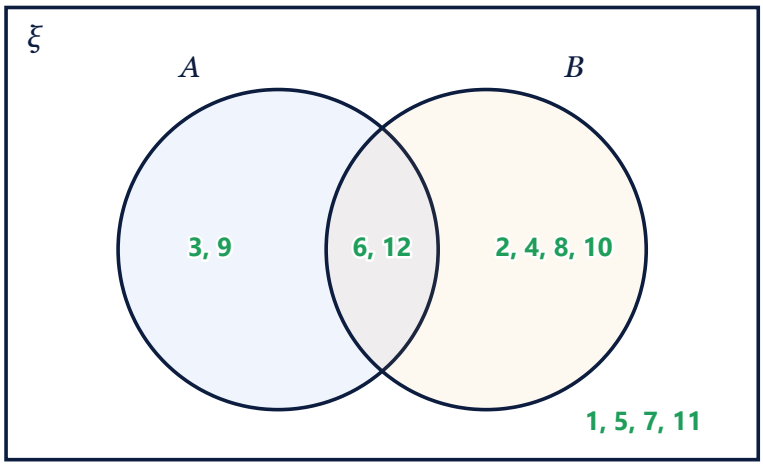
$150 \times 0.4 = 60$

60 times

8 $\xi = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$

A = {multiples of 3} B = {even numbers}

Complete the Venn diagram.



(3 marks)

A = {3, 6, 9, 12} and B = {2, 4, 6, 8, 10, 12}

Numbers in both sets: 6 and 12 go in the intersection

A only: 3 and 9. B only: 2, 4, 8, 10

The remaining numbers 1, 5, 7, 11 go outside both circles

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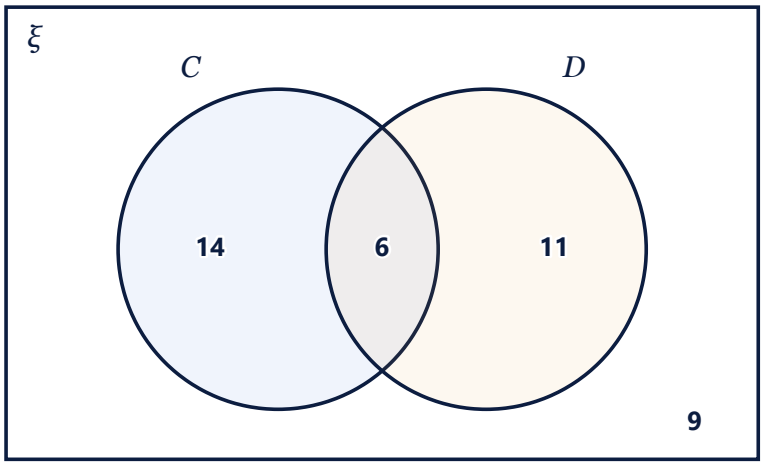
9 40 people were asked whether they drink coffee (C) and whether they drink tea (D).

14 drink coffee only, 6 drink both, 11 drink tea only and 9 drink neither.

One of the 40 people is chosen at random.

a. Find the probability that this person drinks both coffee and tea.

b. Find the probability that this person drinks coffee or tea or both.



(3 marks)

$P(\text{both}) = \frac{6}{40} = \frac{3}{20}$

Number who drink coffee or tea or both $= 14 + 6 + 11 = 31$

$P(\text{coffee or tea or both}) = \frac{31}{40}$

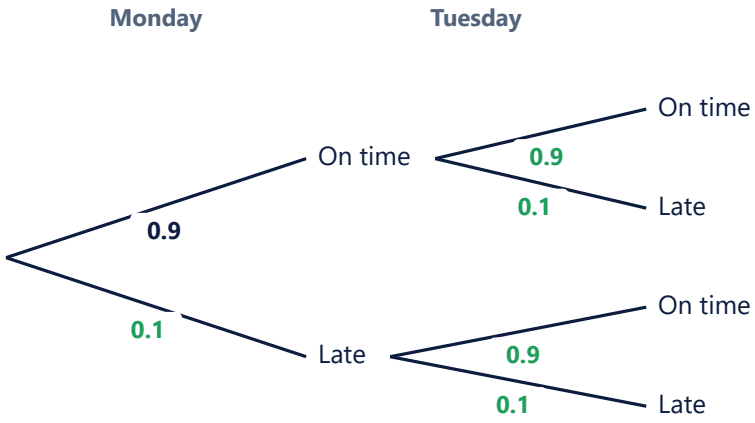
10 The probability that Jon's bus is on time on any day is 0.9.

Whether the bus is on time on one day is independent of any other day.

Jon catches the bus on Monday and on Tuesday.

a. Complete the probability tree diagram.

b. Work out the probability that the bus is on time on both days.



(4 marks)

Each pair of branches sums to 1, so $P(\text{Late}) = 1 - 0.9 = 0.1$

$P(\text{on time both days}) = 0.9 \times 0.9 = 0.81$

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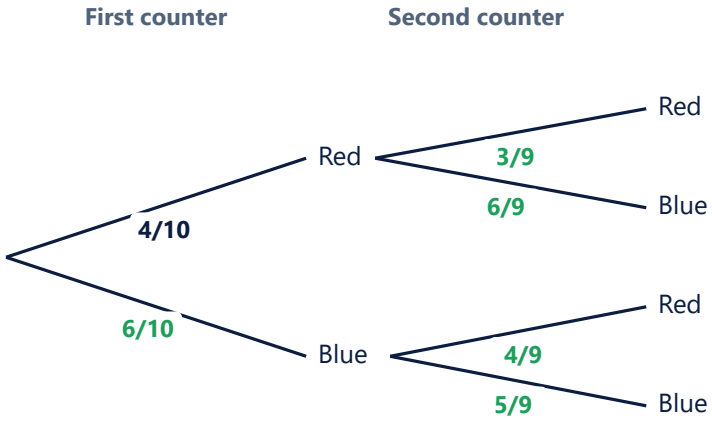
11 A bag contains 4 red counters and 6 blue counters. Isla takes a counter at random and does **not** put it back. She then takes a second counter at random.

a. Explain why the colour of the second counter is not independent of the colour of the first counter.

b. Complete the probability tree diagram.

c. Work out the probability that both counters are red.



(4 marks)

a) no replacement

the counters left depend on the first pick

dependent events

b) first pick out of 10

red $\frac{4}{10}$, blue $\frac{6}{10}$

after red: 3 red, 6 blue left

red $\frac{3}{9}$, blue $\frac{6}{9}$

after blue: 4 red, 5 blue left

red $\frac{4}{9}$, blue $\frac{5}{9}$

c) multiply along the branches

$P(R, R) = \frac{4}{10} \times \frac{3}{9}$

$P(R, R) = \frac{12}{90} = \frac{2}{15}$

$\frac{2}{15}$

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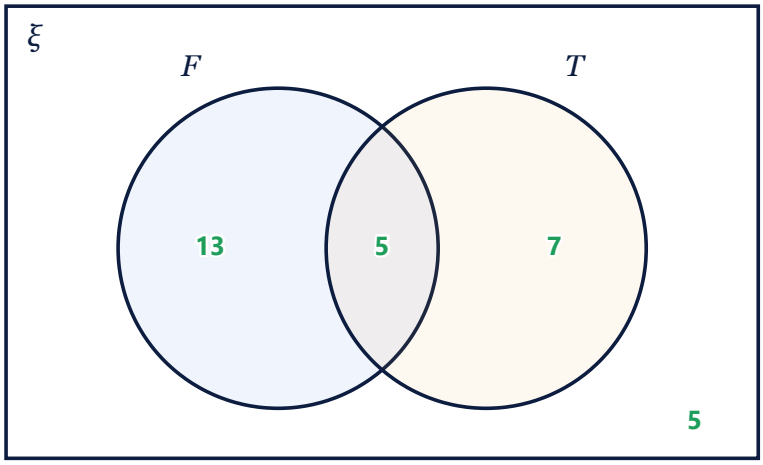
12 There are 30 pupils in a sports club. 18 play football (F). 12 play tennis (T). 5 play both football and tennis.

a. Complete the Venn diagram to show the number of pupils in each region.

b. One pupil is chosen at random. Work out the probability that this pupil plays neither sport.

c. A pupil who plays football is chosen at random. Work out the probability that this pupil also plays tennis.



(4 marks)

a) start with the overlap

F only = 18 - 5 = 13

T only = 12 - 5 = 7

13 + 5 + 7 = 25

neither = 30 - 25 = 5

13, 5, 7 and 5 outside

b)

$P(\text{neither}) = \frac{5}{30} = \frac{1}{6}$

$\frac{1}{6}$

c) only the 18 football players

$P = \frac{5}{18}$

$\frac{5}{18}$

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