Conditional probability

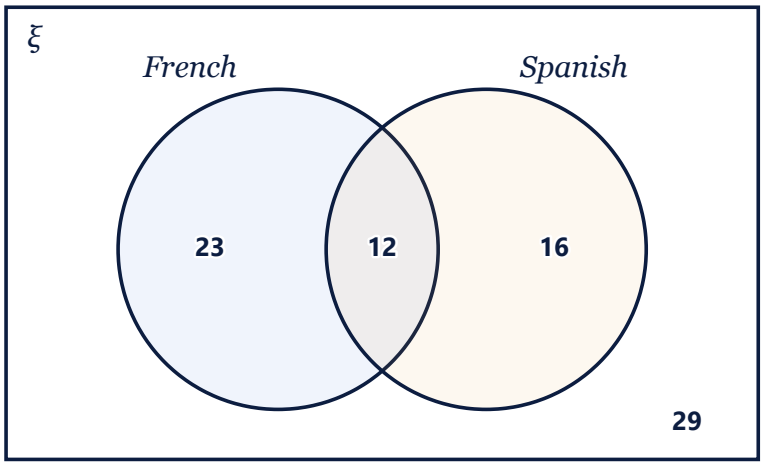
Grade 6 | Worked solutions

GCSE Statistics topic practice

1 The Venn diagram shows information about the 80 students in Year 10 at a school. It shows how many study French and how many study Spanish.

a. One of the 80 students is chosen at random. Write down the probability that this student studies both French and Spanish. (1)

b. One of the students who studies French is chosen at random. Work out the probability that this student also studies Spanish. (2)



(3 marks)

a)

12 of the 80 students study both

$P = \frac{12}{80}$

$= \frac{3}{20}$

b)

Only look at the students who study French

$23 + 12 = 35$

12 of these 35 also study Spanish

$P = \frac{12}{35}$

a) $\frac{3}{20}$ b) $\frac{12}{35}$

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2 A sports club has 150 members. Each member chose one activity for an open day, swimming or the gym. The two-way table shows some information about their choices.

	Swimming	Gym	Total
Adult	38		90
Junior		18	
Total	80		150

a. Complete the two-way table. (2)

b. One of the members who chose swimming is picked at random. Work out the probability that this member is a junior. (2)

(4 marks)

a)

Adult gym = 90 − 38

= 52

Junior swimming = 80 − 38

= 42

Junior total = 42 + 18

= 60

Gym total = 52 + 18

= 70

Check the totals

90 + 60 = 150

b)

Only look at the 80 members who chose swimming

42 of these 80 are juniors

$P = \frac{42}{80}$

$= \frac{21}{40}$

a) 52, 42, 60, 70 b) $\frac{21}{40}$

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3 120 patients took part in a trial of a new hay fever drug. Each patient was given either the new drug or a placebo. The two-way table shows whether their symptoms improved.

	Improved	Did not improve	Total
New drug	49	21	70
Placebo	25	25	50
Total	74	46	120

a. One of the patients who took the new drug is chosen at random. Write down the probability that this patient's symptoms improved. (1)

b. One of the patients whose symptoms improved is chosen at random. Work out the probability that this patient took the new drug. (2)

c. Does the trial suggest that the new drug works? Use probabilities to support your answer. (2)

(5 marks)

a)

70 patients took the new drug and 49 improved

$$p = \frac{49}{70}$$

$$= \frac{7}{10}$$

b)

74 patients improved and 49 of them took the new drug

$$p = \frac{49}{74}$$

c)

Compare the two groups of patients

$$P(\text{improved given new drug}) = 0.7$$

$$P(\text{improved given placebo}) = \frac{25}{50}$$

$$= 0.5$$

$0.7 > 0.5$

Patients on the new drug were more likely to improve, so yes it suggests the drug works.

a) $\frac{7}{10}$ b) $\frac{49}{74}$ c) yes, $0.7 > 0.5$

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4 A vet surveys the households in a village. The probability that a household owns a dog is 0.4. The probability that a household owns a cat is 0.3. The probability that a household owns both a dog and a cat is 0.15.

a. A household that owns a dog is chosen at random. Work out the probability that this household also owns a cat. (2)

b. Are owning a dog and owning a cat independent events? Give a reason for your answer. (2)

(4 marks)

a)

P(cat given dog) = P(dog and cat) ÷ P(dog)

0.15 ÷ 0.4 = 0.375

b)

If independent, owning a dog would not change the probability of owning a cat.

P(cat given dog) = 0.375

P(cat) = 0.3

These are not equal.

So the events are not independent.

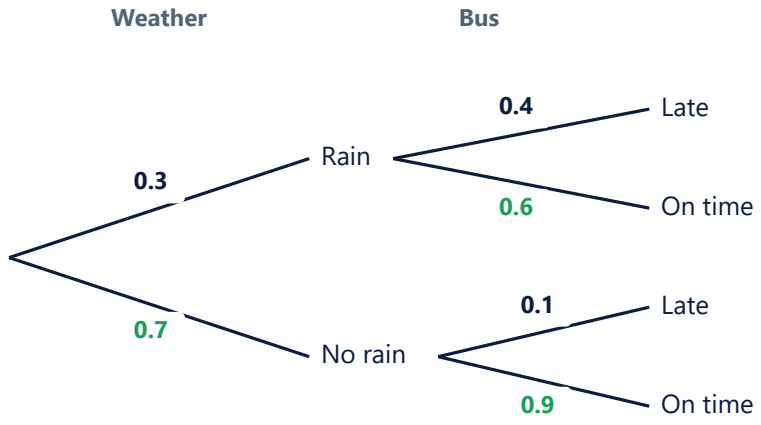
a) 0.375 b) not independent, 0.375 is not 0.3

5 Maya catches a bus to work. On any day the probability that it rains is 0.3. When it rains, the probability that her bus is late is 0.4. When it does not rain, the probability that her bus is late is 0.1.

a. Complete the probability tree diagram. (1)

b. Work out the probability that her bus is late on a day chosen at random. (2)

c. On one day her bus is late. Work out the probability that it rained that day. (2)



(5 marks)

a)

1 - 0.3 = 0.7

1 - 0.4 = 0.6

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$1 - 0.1 = 0.9$

b)

$$P(\text{rain and late}) = 0.3 \times 0.4$$
$$= 0.12$$
$$P(\text{no rain and late}) = 0.7 \times 0.1$$
$$= 0.07$$
$$P(\text{late}) = 0.12 + 0.07$$
$$= 0.19$$

c)

$P(\text{rain given late}) = P(\text{rain and late}) \div P(\text{late})$

$$0.12 \div 0.19 = \frac{12}{19}$$
$$\frac{12}{19} = 0.632$$

a) 0.7, 0.6, 0.9 b) 0.19 c) $\frac{12}{19}$

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