

Writing probabilities as fractions, decimals and percentages

Prob 1

A bag holds 3 red, 5 blue and 12 green counters. One counter is taken at random.

(a) Find $P(\text{red})$ as a fraction, a decimal and a percentage.

(b) Find $P(\text{not red})$.

Listing outcomes systematically

Prob 2

A café sells three sandwiches: cheese (C), ham (H) and tuna (T). It sells two drinks: juice (J) and water (W).

List all the meals of one sandwich and one drink.

Sample space diagrams

Prob 3

Spinner A is numbered 1, 2, 3. Spinner B is numbered 1, 2, 3, 4. Both spinners are spun and the scores are added.

Find the probability that the total is 5.

Expected results

Prob 4

The probability that a spinner lands on red is 0.35. The spinner is spun 200 times.

(a) How many times would you expect it to land on red?

(b) Will it land on red exactly this many times?

Experimental probability

Prob 5

A dice is rolled 50 times.

Score	1	2	3	4	5	6
Frequency	6	8	7	9	5	15

(a) Find the relative frequency of a 6.

(b) Is the dice fair? Explain.

Completing a frequency tree

Prob 6

60 pupils were asked whether they have a pet. 35 of them are boys. 20 of the boys have a pet. 12 of the girls have a pet.

Complete the frequency tree.

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graph LR; 60 --> Boys; 60 --> Girls; Boys --> Pet1[ ]; Boys --> NoPet1[ ]; Girls --> Pet2[ ]; Girls --> NoPet2[ ]
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Probabilities from a frequency tree

Prob 7

80 pupils took a test. One pupil is chosen at random.

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graph LR; 80 --> Revised; 80 --> DidNotRevise; Revised --> Pass1[ ]; Revised --> Fail1[ ]; DidNotRevise --> Pass2[ ]; DidNotRevise --> Fail2[ ]
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(a) Find $P(\text{pass})$.

(b) Find $P(\text{pass})$, given that the pupil revised.

Completing a Venn diagram

Prob 8

In a class of 30 pupils, 17 play football, 13 play tennis, and 5 play both.

Draw a Venn diagram. Find the probability that a pupil chosen at random plays neither sport.

Venn diagram notation

Prob 9

A number from 1 to 12 is chosen at random. A is the multiples of 2 and B is the multiples of 3.

Find $P(A \cap B)$, $P(A \cup B)$ and $P(A')$.

Conditional probability

Prob 10

40 people were asked whether they own a cat (C) or a dog (D).

A dog owner is chosen at random. Find the probability that they also own a cat.

Answer

Prob 4

Expected frequency = probability $\times$ number of trials

$0.35 \times 200 = 70$

(a) 70 times

(b) Not necessarily: each spin is random, so 70 is an estimate, not a certainty.

Remember: Probability times the number of goes.

Answer

Prob 3

spinner B

+	1	2	3	4
1	2	3	4	5
2	3	4	5	6
3	4	5	6	7

A

All $3 \times 4 = 12$ outcomes; 3 of them total 5:

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

Remember: Fix one, change the other, work in order, systematically.

Answer

Prob 2

C J C W (cheese first)

H J H W (ham first)

T J T W (tuna first)

$3 \times 2 = 6$ meals (this checks that none are missing)

Remember: Fix one, change the other, work in order, systematically.

Answer

Prob 1

Probability = number of ways it can happen $\div$ total number of possible outcomes

$3 + 5 + 12 = 20$ counters

$P(\text{red}) = \frac{3}{20} = 0.15 = 15\%$

Probability it does not happen = $1 -$ probability it does happen

$P(\text{not red}) = 1 - \frac{3}{20} = \frac{17}{20}$

Remember: Always between 0 and 1: 0 is impossible, 1 is certain.

Answer

Prob 8

Overlap 5, football only $17 - 5 = 12$, tennis only $13 - 5 = 8$, outside $30 - 12 - 5 - 8 = 5$

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

Remember: Fill the overlap first, then the rest, then outside.

Answer

Prob 7

(a) $35 + 12 = 47$ passed, out of 80:

$P(\text{pass}) = \frac{47}{80}$

(b) Given they revised: only look at the 50 pupils who revised. 35 of them passed:

$P(\text{pass}) = \frac{35}{50} = \frac{7}{10}$

Remember: ‘Given’ shrinks your total to just that group.

Answer

Prob 6

Girls: $60 - 35 = 25$

Boys with no pet: $35 - 20 = 15$

Girls with no pet: $25 - 12 = 13$

Remember: Branches add back up to the number before.

Answer

Prob 5

Relative frequency = number of times it happened $\div$ total number of trials

(a) $\frac{15}{50} = 0.3$

(b) A fair dice has $P(6) = \frac{1}{6} \approx 0.17$, about 8 sixes in 50 rolls. 15 sixes is far more than this, so the dice may be biased. More rolls would make us more sure.

Remember: More trials, more trust.

Answer

Prob 10

Given they own a dog: only look inside the dog circle.

$P(\text{cat}) = \frac{6}{6 + 15} = \frac{6}{21} = \frac{2}{7}$

($\frac{6}{40}$ is $P(\text{cat and dog})$, which is a different question)

Remember: ‘Given’ shrinks your total to just that group.

Answer

Prob 9

$A \cap B$ (A and B) is the overlap.

$A \cup B$ (A or B or both) is inside the circles.

A' (not A) is outside circle A.

$A \cap B$ is 6, 12:

$P(A \cap B) = \frac{2}{12} = \frac{1}{6}$

$A \cup B$ is 2, 3, 4, 6, 8, 9, 10, 12:

$P(A \cup B) = \frac{8}{12} = \frac{2}{3}$

A' is 1, 3, 5, 7, 9, 11:

$P(A') = \frac{6}{12} = \frac{1}{2}$