Expected outcome

Use Expected value $= n \times p$ to predict how many times an event will occur over n trials.

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Show your method

Expected value $= n \times p$, where n is the number of trials and p is the theoretical probability. This is a prediction, not a guaranteed result.

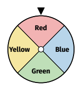
Worked example A biased coin has $P(\text{heads}) = 0.4$. It is flipped 80 times. Find the expected number of heads.

Expected value $= n \times p$.
$= 80 \times 0.4 = 32$

1. A fair die is rolled 90 times. How many times would you expect a 5?

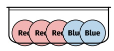
Solution
$90 \times \frac{1}{6} = 15$

2. This spinner is spun 60 times. How many times would you expect blue?



Solution
$60 \times \frac{1}{4} = 15$

3. Drawn (and replaced) 40 times. How many reds expected?



Solution
$40 \times \frac{3}{5} = 24$

4. $P(\text{rain tomorrow}) = 0.3$. Over 20 similar days, how many rainy days expected?

Solution
$20 \times 0.3 = 6$

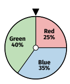
5. 20% of emails are spam. In an inbox of 150 emails, how many expected to be spam?

Solution
$150 \times 0.2 = 30$

6. What does the expected value of an event tell you?

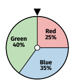
Solution
A prediction of how many times it will occur over n trials – not a guaranteed result.

7. Spun 120 times. Find the expected number of Blue.



Solution
$120 \times 0.35 = 42$

8. Using the same spinner, find the expected number of Green.



Solution
$120 \times 0.40 = 48$

9. A spinner lands on yellow with probability 0.05. If 4 yellows are expected, how many times was it spun?

Solution
$4 \div 0.05 = 80$

Expected outcome (continued)

Read a probability table, then work backwards for n or p.

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10. 250 trials. Find the expected frequency of Green.

Colour	Red	Blue	Green
Probability	0.2	0.5	0.3

Solution

$250 \times 0.3 = 75$

11. Using the same table, find the expected frequency of Red OR Blue combined.

Colour	Red	Blue	Green
Probability	0.2	0.5	0.3

Solution

$250 \times (0.2 + 0.5) = 175$

12. A die is rolled 48 times, expecting 8 sixes. What probability of a six does this imply?

Solution

$8 \div 48 = \frac{1}{6}$

13. A weighted coin has $P(\text{heads}) = 0.65$. Flipped n times, 130 heads are expected. Find n.

Solution

$130 \div 0.65 = 200$

14. A frequency tree shows 54 of 90 sport-players also play an instrument (LO2). At this rate, how many of a new group of 60 sport-players would you expect to?

Solution

$54/90 = 0.6$

$60 \times 0.6 = 36$

15. Explain why the actual sixes rolled in 60 rolls of a fair die might not be exactly 10, even though 10 is expected.

Solution

It's a prediction/average – ordinary random variation means a real trial often differs.

16. A game has an independent $P(\text{win}) = 0.12$ each play. Over 500 plays, how many wins are expected?

Solution

$500 \times 0.12 = 60$

17. A sample of 25 sweets contains 6 red. The maker claims 20% are red. Show the expected number for comparison, and say if 6 is roughly consistent.

Solution

Expected $= 25 \times 0.2 = 5$.

6 is close to 5 – roughly consistent.

18. A spinner is spun 50 times and a colour occurs 10 times (its expected count). Find the new expected count if spun 500 times.

Solution

$p = 10/50 = 0.2$

$500 \times 0.2 = 100$