Name Date

13.3 Experiments and expected results — worked answers

Find experimental probabilities from trials, calculate expected numbers, and compare experimental results with theory. · 41 questions

A · Fluency — Expected numbers and experimental probabilities.

1 A fair spinner has 6 equal sectors. It is spun 60 times. How many times would you **expect** each number?

Answer: 10
Each sector has probability 1/6, so expect 60 ÷ 6 = 10.

2 A fair spinner has 4 equal sectors. It is spun 100 times. How many times would you **expect** each number?

Answer: 25
Each sector has probability 1/4, so expect 100 ÷ 4 = 25.

3 A fair spinner has 8 equal sectors. It is spun 80 times. How many times would you **expect** each number?

Answer: 10
Each sector has probability 1/8, so expect 80 ÷ 8 = 10.

4 A fair spinner has 5 equal sectors. It is spun 50 times. How many times would you **expect** each number?

Answer: 10
Each sector has probability 1/5, so expect 50 ÷ 5 = 10.

5 A fair spinner has 3 equal sectors. It is spun 120 times. How many times would you **expect** each number?

Answer: 40
Each sector has probability 1/3, so expect 120 ÷ 3 = 40.

6 A fair spinner has 10 equal sectors. It is spun 200 times. How many times would you **expect** each number?

Answer: 20
Each sector has probability 1/10, so expect 200 ÷ 10 = 20.

7 A fair spinner has 6 equal sectors. It is spun 90 times. How many times would you **expect** each number?

Answer: 15
Each sector has probability 1/6, so expect 90 ÷ 6 = 15.

8 A fair spinner has 4 equal sectors. It is spun 40 times. How many times would you **expect** each number?

Answer: 10

Each sector has probability 1/4, so expect 40 ÷ 4 = 10.

9 In 60 trials an event happened 12 times. What is the **experimental probability**?

Answer: 1/5

Experimental probability is successes ÷ trials: 12/60 = 1/5.

10 In 100 trials an event happened 30 times. What is the **experimental probability**?

Answer: 3/10

Experimental probability is successes ÷ trials: 30/100 = 3/10.

11 In 90 trials an event happened 18 times. What is the **experimental probability**?

Answer: 1/5

Experimental probability is successes ÷ trials: 18/90 = 1/5.

12 In 50 trials an event happened 7 times. What is the **experimental probability**?

Answer: 7/50

Experimental probability is successes ÷ trials: 7/50 = 7/50.

13 In 200 trials an event happened 25 times. What is the **experimental probability**?

Answer: 1/8

Experimental probability is successes ÷ trials: 25/200 = 1/8.

14 In 45 trials an event happened 9 times. What is the **experimental probability**?

Answer: 1/5

Experimental probability is successes ÷ trials: 9/45 = 1/5.

15 An event has probability ¹$_2$. In 40 trials, how many times would you expect it?

Answer: 20

Expected number = probability × trials = 1/2 × 40 = 20.

16 An event has probability ¹$_4$. In 80 trials, how many times would you expect it?

Answer: 20

Expected number = probability × trials = 1/4 × 80 = 20.

17 An event has probability ¹$_6$. In 60 trials, how many times would you expect it?

Answer: 10

Expected number = probability × trials = 1/6 × 60 = 10.

18 An event has probability ³$_5$. In 100 trials, how many times would you expect it?

Answer: 60

Expected number = probability × trials = 3/5 × 100 = 60.

19 An event has probability ²$_3$. In 90 trials, how many times would you expect it?

Answer: 60

Expected number = probability × trials = 2/3 × 90 = 60.

20 An event has probability ¹$_5$. In 75 trials, how many times would you expect it?

Answer: 15

Expected number = probability × trials = 1/5 × 75 = 15.

B · Reasoning — Theory against experiment.

21 What is **experimental probability**?

☐ A guess
☐ Successes divided by the number of trials
☐ The same as theoretical probability
☐ Always 1/2

Answer: Successes divided by the number of trials

It is what actually happened, not what should happen.

22 What is **theoretical probability**?

☐ What actually happened
☐ What should happen, worked out from the outcomes
☐ A guess
☐ The average

Answer: What should happen, worked out from the outcomes

Favourable ÷ total, when outcomes are equally likely.

23 A fair coin is tossed 10 times and gives 7 heads. Is the coin unfair?

☐ Yes, definitely
☐ Not necessarily — 10 trials is far too few to tell
☐ Yes, because 7 > 5
☐ It cannot be decided ever

Answer: Not necessarily — 10 trials is far too few to tell

Short runs vary a lot. This is exactly the sample-size idea from Unit 6.

24 What happens to experimental probability as the number of trials increases?

☐ It gets further from the theoretical value
☐ It usually gets closer to the theoretical value
☐ It stays the same
☐ It becomes exact

Answer: It usually gets closer to the theoretical value

More trials means less influence from any single unusual run.

25 How do you find the **expected number** of successes?

☐ Divide the trials by the probability
☐ Multiply the probability by the number of trials
☐ Add them
☐ Subtract them

Answer: Multiply the probability by the number of trials

$1/6 \times 60 = 10$.

26 Will the expected number always be exactly what happens?

☐ Yes
☐ No

Answer: No

It is what you would expect on average, not a promise. Expecting 10 sixes in 60 rolls and getting 8 is entirely normal.

27 You want to know the probability of a drawing pin landing point-up. What should you do?

☐ Use favourable ÷ total
☐ Carry out many trials and use the experimental probability
☐ Guess 1/2
☐ It cannot be found

Answer: Carry out many trials and use the experimental probability
The two outcomes are not equally likely, so the formula does not apply.

28 Experimental and theoretical probability differ for a fair dice. What is the most likely reason?

☐ The dice is loaded
☐ Ordinary variation in a limited number of trials
☐ The maths is wrong
☐ The dice has 7 faces

Answer: Ordinary variation in a limited number of trials
Difference is expected; a large and persistent difference is what would suggest bias.

C · Challenge — Comparing the two, and spotting bias.

29 A dice is rolled 300 times. How many sixes would you expect?

Answer: 50
1/6 × 300 = 50.

30 A spinner gives a 3 on 24 of 80 spins. What is the experimental probability as a percentage?

Answer: 30
24 ÷ 80 = 0.3 = 30%.

31 A coin is tossed 500 times and gives 260 heads. How far is the experimental probability from 0.5, in percentage points?

Answer: 2
260 ÷ 500 = 0.52, which is 52%. That is 2 percentage points from 50%.

32 An event has probability 0.15. In 400 trials, how many times would you expect it?

Answer: 60
0.15 × 400 = 60.

33 A spinner is spun 200 times and lands on red 90 times. If it were fair with 4 equal sectors, how many reds would be expected?

Answer: 50
1/4 × 200 = 50. Getting 90 is a long way above that, which is evidence the spinner may not be fair.

D · Word problems — Factories, penalties and spinners.

34 A dice is rolled 120 times. How many even numbers would you expect?

Answer: 60
P(even) = 1/2, and 1/2 of 120 = 60.

35 A bag has 5 counters, 2 of them red. In 100 draws with replacement, how many reds would you expect?

Answer: 40
2/5 × 100 = 40.

36 A factory finds 3 faulty items in 150. What is the experimental probability as a percentage?

Answer: 2

3 ÷ 150 = 0.02 = 2%.

37 If 2% of items are faulty, how many faults would you expect in 5000 items?

Answer: 100

2% of 5000 = 100.

38 A coin is tossed 80 times. How many tails would you expect?

Answer: 40

1/2 × 80 = 40.

39 A spinner has 10 equal sectors. In 250 spins, how many times would you expect sector 7?

Answer: 25

1/10 × 250 = 25.

40 A survey finds 45 of 300 people cycle. What percentage is that?

Answer: 15

45 ÷ 300 = 0.15 = 15%.

41 A goalkeeper saves 18 of 45 penalties. What is the experimental probability as a percentage?

Answer: 40

18 ÷ 45 = 0.4 = 40%.