GCSE Maths: Relative frequency, expected outcomes and fairness (Higher): answers

GCSE Maths - Probability - Higher - Lesson 23.3

Answers. Final answers to the worksheet questions. Full step-by-step solutions for every question are free at **websink.site/gcse/maths/ch23-probability/higher/relative-frequency-expected-outcomes-and-fairness/**

Exercise 23C Relative frequency (Non-calculator)

1 Write down the relative frequency of the event. Give each answer as a fraction in its simplest form.

(a) The event happened 9 times in 30 trials

Answer: $\frac{3}{10}$

(b) The event happened 24 times in 80 trials

Answer: $\frac{3}{10}$

(c) The event happened 15 times in 60 trials

Answer: $\frac{1}{4}$

(d) The event happened 35 times in 140 trials

Answer: $\frac{1}{4}$

2 Work out the relative frequency of each event as a decimal.

(a) 6 out of 20 trials

Answer: 0.3

(b) 27 out of 60 trials

Answer: 0.45

(c) 13 out of 25 trials

Answer: 0.52

(d) 7 out of 8 trials

Answer: 0.875

3 Tom spins a spinner 80 times. The table shows his results. Find the relative frequency of each colour, as a fraction in its simplest form.

Colour	Red	Blue	Green
Frequency	24	31	25

(a) Red

Answer: $\frac{3}{10}$

(b) Blue

Answer: $\frac{31}{80}$

(c) Green

Answer: $\frac{5}{16}$

(d) Add the three relative frequencies

Answer: 1

4 **A coin is tossed several times. The table shows the number of heads after different numbers of tosses. Work out the relative frequency of heads each time, as a decimal.**

Number of tosses	**20**	**50**	**100**	**200**
Number of heads	12	27	52	98

(a) After 20 tosses

Answer: 0.6

(b) After 50 tosses

Answer: 0.54

(c) After 100 tosses

Answer: 0.52

(d) After 200 tosses

Answer: 0.49

(e) Which result is the best estimate of P(heads)? Explain.

Answer: After 200 tosses

5 **In a survey 200 students were asked how they travel to school. 38 walk, 62 take the bus, 70 come by car and the rest cycle. A student is chosen at random from the 200. Estimate the probability that the student...**

(a) walks

Answer: $\frac{19}{100}$

(b) cycles

Answer: $\frac{3}{20}$

6 **Tom tosses a coin 10 times and gets 7 heads. He says: "P(heads) must be 0.7." Explain why Tom may be wrong.**

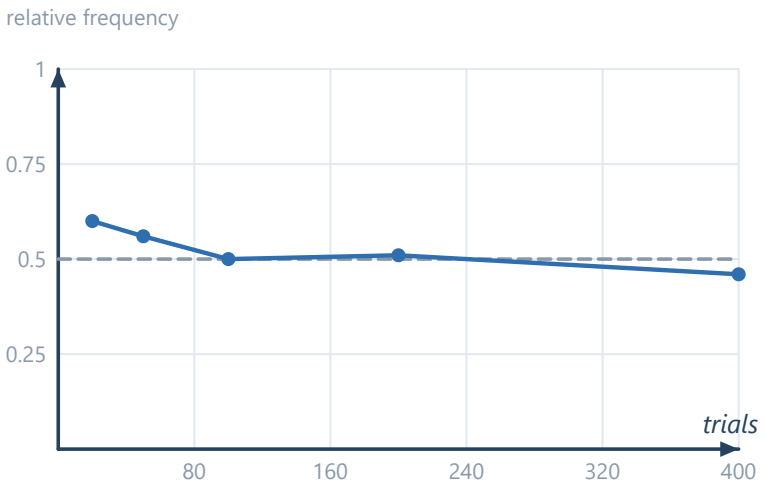
Answer: Only 10 trials

7 **Ella spun a spinner 20 times and landed on red 6 times. Raj spun the same spinner 200 times and landed on red 58 times. Who has the better estimate of P(red)? Give a reason, and write both estimates as decimals.**

Answer: Raj's, 0.29 (Ella: 0.3)

8 A fair coin was tossed 400 times by a computer. The table gives the number of heads after 20, 50, 100, 200 and 400 tosses and the graph shows the relative frequency of heads.

Number of tosses	20	50	100	200	400
Heads	12	28	50	102	184



(a) Work out the relative frequency of heads after 50 tosses, as a decimal.

Answer: 0.56

(b) Work out the relative frequency of heads after 400 tosses, as a decimal.

Answer: 0.46

(c)

The theoretical probability of heads is 0.5. Which is closer to 0.5: the result after 20 tosses or after 400 tosses?

Answer: 400 tosses

9 A bag contains 20 counters that are red or blue. Sam picks a counter, records its colour and puts it back. He does this 150 times and gets red 93 times. Use his results to estimate the number of red counters in the bag.

Answer: 12

Exercise 23D Expected outcomes, fair and biased Calculator allowed

1 A fair six-sided die is rolled. How many times would you expect to roll...

(a) a 3 in 60 rolls

Answer: 10

(b) an even number in 120 rolls

Answer: 60

(c) a number bigger than 4 in 300 rolls

Answer: 100

(d) a 6 in 450 rolls

Answer: 75

2 **Work out the expected number of times that each event happens.**

(a) A fair coin is tossed 500 times: heads

Answer: 250

(b) A spinner has P(red) = 3/8 and is spun 200 times: red

Answer: 75

(c) The probability of rain on a day is 0.2: rainy days in 365 days

Answer: 73

(d) P(a part is faulty) = 2%: faulty parts in 5000

Answer: 100

3 **A drawing pin is dropped 60 times and lands point up 24 times. Use his results to answer the questions.**

(a) Relative frequency of point up

Answer: $\frac{2}{5}$

(b) Estimate for 150 drops

Answer: 60

4 **At a fair, a game costs £2 to play. The probability of winning is $\frac{1}{12}$ and a win pays £10 prize money. In one day the game is played 300 times. Work out the expected profit for the fair.**

Answer: £350

5 **Maria rolls a die 120 times. The table shows her results.**

Score	1	2	3	4	5	6
Frequency	17	23	19	25	16	20

(a) How many times would you expect each score if the die is fair?

Answer: 20

(b) Which score is furthest from the expected number?

Answer: 4 (it came up 25 times)

(c) Is there evidence that the die is biased? Give a reason.

Answer: No

6 **Maya tosses a fair coin and gets heads 5 times in a row. She says: "Tails is more likely next time, to even things out." Is Maya correct? Explain.**

Answer: No

7 **Die A is rolled 30 times and shows a 6 on 5 rolls. Die B is rolled 300 times and shows a 6 on 70 rolls. Which die is more likely to be biased? Show your working.**

Answer: Die B

8 **The probability that Ben wins a game is 0.15. Work out the least number of games Ben must play to expect to win at least 12 games.**

> **Answer:** 80

9 **Explain why an expected number of wins does not have to be a whole number, and why it does not tell us exactly how many wins there will be.**

> **Answer:** It is an average

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