

Experimental probability and expectation

About 50 minutes No calculator 38 marks



Hints online, answers free with an account:
mathswariz.uk/worksheets/gcse-experimental-probability-and-expectation/

Date _____

A Do Now

The first question is what today's lesson needs. The others bring back earlier topics.

- A1** Needed today [2 marks]

A bag holds 21 red counters and some blue counters. The probability of taking a red counter is $\frac{3}{7}$. How many blue counters are in the bag?

A2 From chapter 9 [2 marks]

A trapezium has the same area as a square of side 7 cm. The parallel sides of the trapezium are 2 cm and 5 cm. Find its height.

Answer

Answer

- A3** From chapter 3 [2 marks]

Some people were asked how many books they read last month. The answers 1, 2, 3, 4 have frequencies 3, 5, 9, 3 in that order. Work out the mean.

A4 From chapter 8 [2 marks]

Make x the subject of $3x + 5y = x - 11$.

Answer

Answer

B Example, then your turn

Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1

A spinner is spun 160 times. It lands on blue 52 times. Estimate the probability that it lands on blue.

Hint Relative frequency = number of times it happened ÷ number of trials.

- B1** A paper cup lands on its side 78 times in 120 drops. Estimate, as a decimal, the probability that it lands on its side. [2 marks]

Answer

EXAMPLE 2

The probability that a seed grows is 0.85. 260 seeds are planted. Work out the expected number of seeds that grow.

Hint Expected number = probability $\times$ number of trials.

B2 A biased coin lands on heads with probability 0.36. It is thrown 225 times. Work out the expected number of heads. [2 marks]

Answer

C Practice

C1 Ali gets red 9 times in 30 spins. [2 marks]
Bea gets red 25 times in 70 spins of the same spinner. Use all the results to estimate $P(\text{red})$.

Answer

C2 A dice lands on 2 in 93 of 420 throws. How many 2s would a fair dice be expected to give? Is the dice likely to be biased? [2 marks]

Answer biased?

C3 $P(\text{a battery fails in its first year}) = 0.02$. 18 batteries failed, the expected number. How many batteries were sold? [2 marks]

Answer

C4 A spinner lands on A, B or C. [2 marks]
 $P(A) = 0.45$ and $P(B) = 0.3$. In 80 spins, how many Cs are expected?

Answer

C5 A game at a fair costs £3 a go. [3 marks]
The probability of winning is 0.2, and a winner is paid £8. 150 people play. Work out the expected profit for the stall.

Answer

D Exam-style questions

D1 Sara throws a coin 10 times and gets 7 heads. She says, "The coin must be biased, because a fair coin would give 5 heads." [2 marks]

Explain why Sara is wrong.

- D2** A bag holds 60 beads, each red, white or blue. Leah takes a bead at random, notes its colour and puts it back, 300 times. She gets red 55 times, white 125 times and blue 120 times.
- (a) Estimate the number of blue beads in the bag. [2 marks]

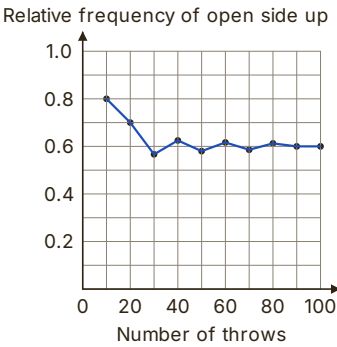
Answer

- (b) Leah takes a bead 240 more times. Estimate how many times she gets a red bead. [2 marks]

Answer

Total for D2: 4 marks

- D3** Kai throws a bottle top 100 times and records whether it lands open side up. After every 10 throws he works out the relative frequency of open side up so far. The graph shows his results.



- (a) How many times did the bottle top land open side up in the first 20 throws? [1 mark]

Answer

- (b) Use the graph to give the best estimate of the probability that the bottle top lands open side up. Give a reason for your choice. [2 marks]

Answer reason

- (c) Kai throws the bottle top another 450 times. Estimate how many of these throws land open side up. [2 marks]

Answer

Total for D3: 5 marks

E Extension

No route is given. The hints are at the end of the sheet. Use one at a time.

- E1** A bag holds only red and green counters. A counter is taken at random and put back 400 times: red comes up 160 times. Then 10 green counters are added. In 300 more picks, red comes up 90 times. Estimate the number of red counters. [4 marks]

Answer

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** Estimate the fraction of red counters before and after.
Hint 2 With n counters at first, red $\approx 0.4n$ and also $0.3(n + 10)$.
Hint 3 $0.4n = 0.3n + 3$, so $n = 30$ and red $= 0.4 \times 30 = 12$.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

I can estimate a probability from an experiment or a relative frequency graph, and judge whether it is fair.



I can work out an expected number, and work back from one.

