



Estimates of probability

Year 7 About 60 minutes No calculator 45 marks

Date _____

A Do Now

Quick questions to start.

- A1** Needed today [1 mark] **A2** Needed today [1 mark]
Write $\frac{9}{25}$ as a decimal. Work out 0.15×400 .

Answer

Answer

- A3** Last lesson [1 mark] **A4** From chapter 1 [1 mark]
Two fair coins are tossed. Find P(two tails). Find the LCM of 6 and 9.

Answer

Answer

B Example, then your turn

Year 7

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

EXAMPLE 1

A gardener plants 40 seeds and 34 of them grow. (a) Estimate the probability that a seed grows. (b) She plants 300 more seeds. How many would you expect to grow?

Hint An estimate of a probability is the number of times it happened divided by the number of trials.

- B1** A shop tests 60 batteries and 12 of them fail within a year. (i) Estimate the probability that a battery fails within a year. (ii) How many of 900 batteries would you expect to fail? [2 marks]

Answer (i) (ii)

EXAMPLE 2

A dice is rolled 150 times and lands on 6 a total of 33 times. (a) Estimate $P(6)$. (b) How many 6s do you expect in 600 rolls? (c) How many 6s would a fair dice give in 600 rolls?

Hint For a fair dice, $P(6) = \frac{1}{6}$.

- B2** A spinner has four equal sections numbered 1 to 4. In 200 spins it lands on 3 a total of 62 times. (i) Estimate $P(3)$. (ii) How many 3s do you expect in 1000 spins? (iii) How many 3s would a fair spinner give in 1000 spins? [3 marks]

Answer (i) (ii) (iii)

EXAMPLE 3

A vet records the injections given to animals over 5 days. (a) Estimate the probability that an animal needs no injection. (b) The vet works 220 days a year. Estimate how many animals in a year need more than one injection.

Injections	Animals
None	45
One	27
More than one	18

Hint For (b), 18 animals in 5 days is the same rate as $18 \div 5$ animals a day.

EXAMPLE 4

Ravi drops a paper cup and records how often it lands on its side. Complete the relative frequencies. Which is the best estimate of the probability that the cup lands on its side?

Drops	On its side	Rel. freq.
10	6	0.6
20	13	
50	31	
100	64	

Hint Relative frequency = number of times it happened $\div$ number of trials. More trials give a better estimate.

B3 A library records how 180 books were returned over 4 days. [3 marks]

(i) Estimate the probability that a book is returned on time. (ii) The library is open 300 days a year. Estimate how many books a year are returned over a week late.

Returned	Books
On time	120
Up to a week late	45
Over a week late	15

Answer (i) (ii)

B4 A machine makes items, and some are faulty. Complete the table. Then write down the best estimate of the probability that an item is faulty. [3 marks]

Items	Faulty	Rel. freq.
50	4	0.08
100	9	
200	14	
400	30	

Answer

- C1** A four-sided spinner is spun 80 times. It lands on 1, 2, 3 and 4 a total of 18, 22, 17 and 23 times. Kim says, "It is biased, because the numbers are not all 20." Is Kim right? Give a reason. [2 marks]
- C2** A bag holds 60 counters, each red or blue. Leah takes a counter, notes its colour and puts it back. She does this 40 times and gets red 14 times. Estimate how many red counters are in the bag. [2 marks]

Answer

- C3** After 20 games the relative frequency of Mia winning is 0.65. After 25 games it is 0.6. How many of the last 5 games did Mia win? [3 marks]
- C4** Three pupils do the same experiment. Ann gets 9 successes in 20 trials, Ben 22 in 50 and Cal 86 in 200. Whose results give the best estimate of $P(\text{success})$? Give it as a decimal. [2 marks]

Answer

Answer

D Exam-style questions

GCSE Foundation

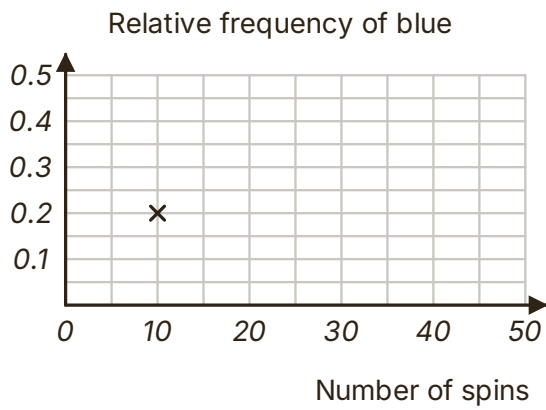
- D1** Jo throws a dice 30 times and gets 9 fives. She says, "So if I throw it 300 times, I will get exactly 90 fives." [3 marks]

Is Jo correct? Explain your answer. How could Jo get a better estimate of the probability of a five?

- D2** Ella spins a spinner. After 10, 20, 30, 40 and 50 spins it has landed on blue 2, 6, 9, 13 and 16 times.
- (a) The relative frequency of blue after 10 spins is 0.2. Work out the relative frequency after 20, 30, 40 and 50 spins. [2 marks]

(b) Plot the relative frequencies on the graph. The first one is done for you.

[2 marks]



(c) Write down the best estimate of the probability of blue.

[1 mark]

Answer

(d) Ella spins the spinner 400 times. Estimate how many times it lands on blue.

[1 mark]

Answer

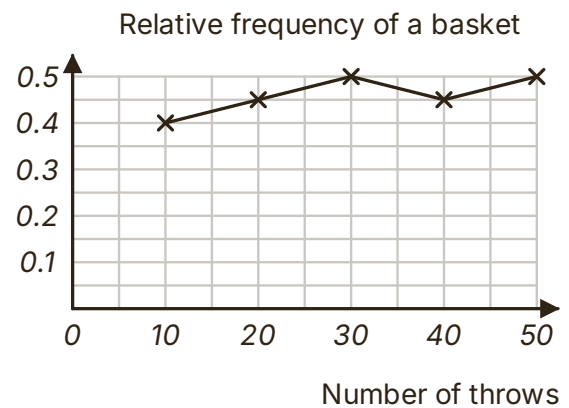
Total for D2: 6 marks

D3 Ali throws a ball at a basket. The graph shows the relative frequency of scoring a basket after every 10 throws.

(a) How many baskets did Ali score in his first 20 throws? [1 mark]

Answer

(b) How many baskets did he score from throw 21 to throw 40? [2 marks]



Answer

(c) Write down the best estimate of the probability that Ali scores a basket.

[1 mark]

Answer

Total for D3: 4 marks

- D4** A spinner has five equal sections numbered 1 to 5. It is spun 250 times. The table shows the results.
- (a) If the spinner is fair, how many times would you expect each number? [1 mark]
- | | | | | | |
|-----------|----|----|----|----|----|
| Number | 1 | 2 | 3 | 4 | 5 |
| Frequency | 48 | 51 | 95 | 30 | 26 |
- Answer
- (b) Estimate the probability that the spinner lands on 3. [1 mark]
- Answer
- (c) Is the spinner fair? Give a reason for your answer. [2 marks]

Total for D4: 4 marks

E Extension Stretch

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

E1 Amir spins a spinner and the relative frequency of red is 0.35. He spins it 20 more times and gets red every time. Now the relative frequency of red is 0.48. How many times did he spin it at first? [4 marks]

Answer

Extension hints
Cover these with paper. Uncover one at a time.

E1 **Hint 1** Try a number of spins at first, for example 40, and see what the relative frequency would become.

Hint 2 If he spun it n times at first, he had $0.35 \times n$ reds. After the extra spins he has $0.35n + 20$ reds out of $n + 20$ spins.

Hint 3 Try $n = 80$: 28 reds at first, then 48 reds out of 100 spins, which is 0.48. So 80.

How did it go?
Colour one circle on each line: not yet, nearly, yes.

I can estimate a probability from the results of an experiment. ☐ ☐ ☐

I can work out relative frequencies and choose the best estimate. ☐ ☐ ☐

I can use an estimate to say how often something should happen. ☐ ☐ ☐

I can decide whether results show that something is biased. ☐ ☐ ☐