

Probability, expected frequency and risk

About 55 minutes Calculator allowed 46 marks



Hints online, answers free with an account:
mathswariz.uk/worksheets/stats-probability-expected-frequency-and-risk/

Date _____

A Do Now

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

- | | |
|--|--|
| <p>A1 Needed today [2 marks]</p> <p>A bag holds 6 red counters and some blue counters. The probability of taking a red counter is $\frac{2}{3}$. How many blue counters are in the bag?</p> <p style="text-align: right;">Answer</p> | <p>A2 From chapter 7 [2 marks]</p> <p>Some patients were asked how many times they visited the dentist last year. The answers were: 2 (11 patients), 3 (4 patients), 4 (7 patients), 5 (5 patients). Work out the interquartile range.</p> <p style="text-align: right;">Answer</p> |
|--|--|

- | | |
|---|--|
| <p>A3 From chapter 7 [2 marks]</p> <p>A box plot shows the distances, in km, travelled to work by 60 staff: lower quartile 23, median 29, upper quartile 36. Estimate how many of the staff travel less than 23 km.</p> <p style="text-align: right;">Answer</p> | <p>A4 From chapter 9 [2 marks]</p> <p>For a theatre's ticket sales, the first two 4-point moving averages are 119 and 120. The first one starts at Q1 of year 1, when the value was 38. Work out the value for Q1 of year 2.</p> <p style="text-align: right;">Answer</p> |
|---|--|

B Example, then your turn

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

EXAMPLE 1

A spinner can land on one of four colours. The table shows the probabilities. The spinner is spun 400 times. Work out an estimate for the number of times it lands on green.

Colour	Red	Blue	Green	Yellow
Probability	0.3	0.25	x	x

Hint The four probabilities add up to 1.

EXAMPLE 2

Omar throws a coin and records the total number of heads at four points. (a) Which value gives the best estimate of the probability of heads? Give a reason. (b) Is the coin fair? Give a reason for your answer.

Throws	10	50	100	400
Heads	7	31	58	248

Hint Work out each relative frequency: heads $\div$ throws.

B1 A bag holds counters of four colours. The table shows the probability of taking each colour. One counter is taken and replaced, 250 times. Work out an estimate for the number of white counters taken. [3 marks]

Colour	Pink	Orange	Purple	White
Probability	0.15	0.4	x	$2x$

Answer

B2 Leah spins a spinner numbered 1 to 5 and records the total number of fives. Work out the best estimate of the probability of a 5, with a reason. Is the spinner fair? Give a reason. [4 marks]

Spins	25	100	250
Fives	9	28	65

EXAMPLE 3

A study looked at people who walk to work and people who drive. (a) Work out the absolute risk of back pain for people who drive. (b) Work out the relative risk of back pain for people who drive compared with people who walk. Interpret your answer. (c) A town has 5000 people who drive to work. Estimate how many of them have back pain.

Travel	People	Back pain
Walk	800	24
Drive	600	42

Hint Absolute risk is the number with back pain divided by the number in that group.

EXAMPLE 4

A game costs 60p to play. You roll a fair dice. A six wins £2, a five wins £1 and any other score wins nothing. Is the game fair? You must show your working.

Hint Work out the amount a player wins on average in one game.

B3 A study looked at cyclists who had an accident.

Cyclists	People	Head injury
Helmet	2000	36
No helmet	500	27

(a) Work out the relative risk of a head injury for cyclists with no helmet compared with cyclists who wore a helmet. [2 marks]

Answer

(b) Interpret your answer to part (a) in context. [1 mark]

.....

.....

Total for B3: 3 marks

B4 A card game costs 80p to play. The table shows the probability of each prize. Is the game fair? You must show your working. [3 marks]

Prize	£5	£1	Nothing
Probability	0.1	0.3	0.6

.....

.....

c Practice

C1 The probability that a spinner lands on 4 is 0.15. Ali spins it and it lands on 4 sixty times. Estimate the number of times Ali spun it. [2 marks]

Answer

C2 In a survey, 54 of 240 shoppers paid in cash. Estimate how many of the next 1000 shoppers pay in cash. [2 marks]

Answer

C3 Amir and Beth each throw the same drawing pin. Amir throws it 20 times and it lands point up 13 times. Beth throws it 200 times and it lands point up 117 times.

- (a) Whose results give the more reliable estimate of the probability of point up? Give a reason. [1 mark]

- (b) Use all of their results to work out the best estimate of the probability of point up. Give your answer to 2 decimal places. [2 marks]

Answer

Total for C3: 3 marks

C4 For people under 70, the risk of a reaction to a medicine is 0.004. The relative risk for people aged 70 or over, compared with people under 70, is 2.5. A clinic gives the medicine to 3000 people aged 70 or over. Estimate the number who have a reaction. [3 marks]

Answer

D Exam-style questions

D1 Sian rolls a dice 12 times and does not get a six. Sian says, "The dice must be biased." [2 marks]

Is Sian correct? Give a reason for your answer.

D2 At a fair, a charity game costs £1 to play. A player picks one of 20 cards at random. One card wins £10, three cards win £2 each and the other cards win nothing.

- (a) Is the game fair to the player? You must show your working. [3 marks]

- (b) During the day, 150 people play the game. Estimate the profit the charity makes. [2 marks]

Answer

Total for D2: 5 marks

D3 A study recorded whether people smoke and whether they have a lung condition.

Group	People	Lung condition
Smokers	1200	84
Non-smokers	4800	96

- (a) Work out the relative risk of the lung condition for smokers compared with non-smokers. [2 marks]

Answer

- (b) Interpret your answer to part (a) in context. [1 mark]

- (c) A headline says, "Smokers have a 3.5% chance of the lung condition." Explain what is wrong with the headline. [2 marks]

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 game costs £1.50 to play. A player rolls a fair dice. A six wins £ p , a five wins £2, a four wins £1.50 and any other score wins nothing. The game is fair. Work out the value of p . [3 marks]

Answer

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** In a fair game, the average win equals the cost to play.
Hint 2 $\frac{1}{6}(p + 2 + 1.5) = 1.5$.
Hint 3 $p + 3.5 = 9$, so $p = 5.50$.

How did it go?

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

I can estimate a probability from relative frequency and say whether something is biased. ☐ ☐ ☐

I can work out expected frequency, absolute risk and relative risk, and interpret them. ☐ ☐ ☐

I can decide whether a game is fair. ☐ ☐ ☐