Test answers - Probability: experiments, Venn and tree diagrams

Year: Year 11 · Duration: 45 minutes · /20

Answer to Question 1 (4 marks)

a. $1 - 0.4 - 0.3 = 0.3$, shared equally: **0.15** (1 for 0.3, 1 for 0.15) The four probabilities add up to 1, so green and yellow share what is left equally.
b. $200 \times 0.15 =$ **30** (1) Yellow has the same probability as green, 0.15. Expected frequency = trials × probability.
c. $1 - 0.3 =$ **0.7** (1) 'Not blue' is the complement of 'blue'.

Check (a): $0.4 + 0.3 + 0.15 + 0.15 = 1$. In (b), 30 is an expected value, not a guaranteed result.

Answer to Question 2 (4 marks)

a. Bike only 12, both 6, scooter only 9, neither 13 (2) Start with the overlap of 6, then subtract it from each total: $18 - 6 = 12$ and $15 - 6 = 9$. The rest, $40 - 27 = 13$, own neither.
b. $\frac{13}{40}$ (1) Those who own neither are outside both circles: 13 out of 40.
c. $\frac{6}{15} = \frac{2}{5}$ (1) Only the 15 scooter owners count, and 6 of them own a bike.

Answer to Question 3 (4 marks)

a. $0.2 \times 0.2 =$ **0.04** (1) The days are independent, so multiply the probabilities.
b. Late then on time $0.2 \times 0.8 = 0.16$ (1); on time then late 0.16 (1); total **0.32** (1) Being on time has probability $1 - 0.2 = 0.8$. Exactly one late day can happen in two orders, so add the two products.

A common error in (b) is to give only 0.16, forgetting the second order. Check: $0.04 + 0.32 + 0.64 = 1$, where 0.64 is the chance of being on time on both days.

Answer to Question 4 (4 marks)

a. $\frac{3}{10} \times \frac{2}{9} = \frac{6}{90} = \frac{1}{15}$ (1 for each product step) The counter is not replaced, so the second white has probability $\frac{2}{9}$. Multiply along the branches.
b. $1 - \frac{1}{15} = \frac{14}{15}$ (2) 'At least one red' is the complement of 'both white', so subtract

from 1.

In (b), the long method also works:
$P(RR) + P(RW) + P(WR) = \frac{42}{90} + \frac{21}{90} + \frac{21}{90} = \frac{84}{90} = \frac{14}{15}$. A common error is to use $\frac{3}{10} \times \frac{3}{10}$ in (a), as if the counter were replaced.

Answer to Question 5 (4 marks)

a. $\left(\frac{3}{3+x}\right)^2 = \frac{9}{25}$ (1) There are $3+x$ counters, and the counter is replaced, so the probability of blue is the same both times.

b. $\frac{3}{3+x} = \frac{3}{5}$ (1), so $3+x=5$ (1), $x=2$ (1) Take the square root of both sides, then cross-multiply. Check: $\left(\frac{3}{5}\right)^2 = \frac{9}{25}$. There are 2 red counters.

In (b), only the positive square root makes sense, since a probability cannot be negative. With 3 blue and 2 red counters, $P(\text{blue}) = \frac{3}{5}$ each time, confirming the answer.