FOUNDATION & HIGHER

SAME AT BOTH TIERS

Name ..... Class .....

P2: Expected outcomes and fairness

Reason about randomness, fairness and expected outcomes

20 marks · 25 minutes · Non-calculator

1) Explain why expecting 20 sixes in 120 rolls of a fair dice does not mean there will be exactly 20

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[Question 1: 2 marks]

2) In a game you win if you roll a 6 and lose otherwise. Is the game fair? Explain.

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[Question 2: 2 marks]

3) A game costs £1 a go. The probability of winning £4 is $\frac{1}{5}$. Show that the expected profit for the organiser from 100 goes is £20.

[Question 3: 2 marks]

4) Kim says that if she flips a coin 4 times she will get exactly 2 heads. Explain why she might not.

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[Question 4: 1 marks]

5) Two dice are rolled. Ali wins if the total is 7. Bea wins if the total is 2 or 12. Show that the game is not fair.

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[Question 5: 2 marks]

6) Explain how you could change the rules in question 5 to make the game fair.

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[Question 6: 2 marks]

7) $P(\text{red}) = 0.3$ for a spinner. Show that you would expect 15 reds in 50 spins and explain why the actual number may be different.

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[Question 7: 2 marks]

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8) A raffle sells 200 tickets and has 10 prizes. Ben buys 20 tickets and says he will win exactly 1 prize. Explain why he is wrong.

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[Question 8: 2 marks]

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9) Explain what "chosen at random" means.

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[Question 9: 1 marks]

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10) A game costs 50p. You win £3 if you roll a 6 on a fair dice. Show that the game is fair.

[Question 10: 2 marks]

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11) Explain why 10 flips are not enough to tell whether a coin is biased.

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[Question 11: 2 marks]

End of paper – 20 marks in total

Answers and brief mark scheme

Q	Answer	Method / notes
1	Explanation	Expected is a long-run average (C1); results vary (C1).
2	No	$P(\text{win}) = \frac{1}{6} \neq \frac{5}{6}$ (C2).
3	Shown	Takings £100, expected payout $20 \times \$4 = \$80$ (M1); C1.
4	Explanation	Each flip is random (C1).
5	Shown	$\frac{6}{36}$ and $\frac{2}{36}$ (M1); unequal (C1).
6	Explanation	e.g. Bea wins on 2, 3, 11 or 12 (6 ways) (C2).
7	Shown	0.3×50 (M1); random variation (C1).
8	Explanation	Expected value 1, but he could win 0, 1, 2, … (C2).
9	Explanation	Every item is equally likely to be picked (C1).
10	Shown	Expected win $\frac{1}{6} \times 3 = 50\text{p}$ (M1); equals the cost (C1).
11	Explanation	Small samples vary a lot (C2).