Year 10 · Probability: Chance in Action: Experiment vs Theory

Name: _____ Date: _____

Hi! This sheet helps you see how the probabilities we predict on paper compare to what actually happens when we run experiments. Grab a die or a coin if you can, and keep an eye on how bigger experiments give steadier results.

Warm-up

1. A fair six-sided die is rolled once. What is the theoretical probability of rolling a number greater than 4? Give your answer as a fraction in simplest form.

2. A spinner was spun 50 times and landed on red 20 times. What is the experimental probability (relative frequency) of landing on red? Give a fraction, a decimal and a percentage.

3. A bag holds 3 red, 5 blue and 2 green marbles. One marble is drawn at random. What is P(blue)?

4. Using the same bag as the question above, what is P(not blue)?

Practice

5. Two fair coins are tossed together. (a) List all the outcomes in the sample space. (b) Find P(two heads). (c) Find P(at least one head).

6. Aria finds an old drawing pin and wonders about the chance it lands point-up. She tosses it 40 times and it lands point-up 24 times. (a) Why can Aria only find this probability by experiment, not by calculation? (b) What is her experimental probability of the pin landing point-up?

7. Tane rolled a fair die 120 times and recorded: 1 → 18, 2 → 25, 3 → 19, 4 → 22, 5 → 16, 6 → 20. (a) What is the theoretical probability of each number, and roughly how many of each would you expect in 120 rolls? (b) Compare the experimental probability of rolling a 2 with its theoretical probability. (c) Explain why the results are not exactly equal to the expected values.

8. At a Vertex Academy games night, two fair dice are rolled and the two numbers are added. (a) Systematically list or tabulate the sample space of possible totals and count the outcomes. (b) Find P(total = 8). (c) Find P(total is 10 or more).

9. A four-colour spinner (red, blue, yellow, green) is spun 80 times with these results: red 26, blue 18, yellow 14, green 22. (a) Calculate the experimental probability of each colour as a decimal. (b) Describe how you would draw a data visualisation of these results and what it would show.

10. On the way to Avondale School, Mia passes a set of traffic lights that is red 40% of the time, and independently her bus is late 15% of the time. (a) Explain why these two events are independent. (b) Find the probability that the light is red AND the bus is late. (c) Explain why you cannot simply add 0.40 and 0.15 to find P(red or late).

Challenge

11. Leo uses a spreadsheet to simulate tossing a fair coin. In 30 tosses he gets 12 heads; in 100 tosses he gets 46 heads; in 1000 tosses he gets 508 heads. (a) Find the experimental probability of heads for each set of trials. (b) The theoretical probability is 0.5. Which result is closest, and why? (c) State the Law of Large Numbers and explain what it predicts if Leo ran 100 000 tosses.

12. A bag contains 4 red and 6 blue marbles. Two marbles are drawn one after the other WITHOUT replacement. (a) Draw a tree diagram (describe the branches and their probabilities). (b) Find P(both red). (c) Find P(one of each colour).