Year 9 · Probability: Testing Theory Against Trials

Name: _____ Date: _____

Hi! This sheet is all about the difference between what we expect to happen (theoretical probability) and what actually happens when we run experiments (experimental probability). You'll list outcomes, crunch some numbers, and see the Law of Large Numbers in action. Grab a calculator and let's go!

Warm-up

1. A fair six-sided dice is rolled once. What is the theoretical probability of rolling a 4? Give your answer as a fraction and a percentage (to the nearest whole percent).

2. Aria tossed a coin 30 times and got 18 heads. What is the experimental probability of getting a head? Give your answer as a fraction in simplest form.

3. A bag holds 5 red, 3 blue and 2 green marbles. One marble is drawn at random. What is the theoretical probability it is blue?

4. Are the events 'rolling an even number' and 'rolling a 3' on a single dice roll mutually exclusive? Explain in one sentence.

Practice

5. A spinner is divided into 4 equal sections coloured red, yellow, blue and white. List the full sample space for one spin, then state the theoretical probability of landing on yellow.

6. Two fair coins are tossed together. Use a systematic list or table to write every possible outcome, then find the probability of getting exactly one head.

7. Tane rolled a fair dice 60 times. He recorded: 1 appeared 8 times, 2 appeared 11 times, 3 appeared 9 times, 4 appeared 12 times, 5 appeared 10 times, 6 appeared 10 times. Find the experimental probability of rolling a 4, and compare it with the theoretical probability.

8. At the Avondale Sunday Market, a lucky-dip drum contains 40 tickets: 4 are winners and 36 are blanks. Mere pays $2 for one ticket. What is the theoretical probability she draws a winning ticket? Give your answer as a fraction in simplest form and as a percentage.

9. A class ran a simulation of tossing a drawing pin 100 times to see how often it lands 'point up'. It landed point up 62 times. (a) Why can this probability only be found by experiment, not by theory? (b) Estimate the probability the pin lands 'point down'.

10. Ben used a computer to simulate rolling a fair dice. After 30 rolls the experimental probability of a 6 was 0.10. After 1000 rolls it was 0.165. Explain, using the Law of Large Numbers, why the second result is closer to the theoretical probability.

Challenge

11. A fair coin is tossed and a fair dice is rolled. (a) Draw or list all outcomes using a systematic method. (b) Find the probability of getting a head AND a number greater than 4. (c) Explain why you cannot simply add P(head) and P(number greater than 4) to get this answer.

12. A bag has 3 kiwifruit stickers and 2 feijoa stickers. Two stickers are drawn one after the other WITHOUT replacing the first. (a) Are the two draws independent or dependent? (b) Use a tree diagram (describe the branches) to find the probability that both stickers are kiwifruit.