Name _____ Period _____

# 6.4 Theoretical & Experimental Probability Exercises:

1. (a) A fair coin is tossed 100 times. How many heads and how many tails would your expect to obtain?

(b) Toss a fair coin 100 times and display your results using a bar chart.

(c) Compare your theoretical predictions with your experimental results.

2. Two fair coins are to be tossed at the same time.

(a) Calculate the probability of obtaining:

(i) 2 heads, (ii) a head and a tail, (iii) 2 tails.

(b) Calculate the number of times you would expect to obtain each outcome if the coins are tossed 100 times.

(c) Toss two coins 100 times and illustrate your results using a bar chart.

(d) Compare your theoretical predictions with your experimental results.

3. (a) List the 8 possible outcomes when 3 fair coins are tossed at the same time.

(b) If three fair coins were tossed 32 times, how many times would you expect to obtain:

(i) 3 heads, (ii) 2 heads,

(iii) 1 head, (iv) 0 heads ?

(c) Carry out an experiment and compare your theoretical predictions with your experimental results.

4. (a) What are the expected frequencies of the totals 2, 3, 4, ..., 11, 12 when two fair dice are thrown at the same time and the experiment is repeated 36 times?

(b) Carry out the experiment in (a) and compare the predicted and experimental frequencies.

(c) Repeat (a) and (b) for 144 throws.

(d) Comment on how carrying out the experiment more times influences the differences between the predicted and experimental frequencies.

5. A fair coin and an unbiased dice are thrown at the same time. A score is then calculated using the following rules:

- *if the coin shows a head, you double the score shown on the dice;*
- *if the coin shows a tail, you subtract 1 from the score on the dice.*

(a) Use a table to show all the possible scores.

(b) Draw up a table showing the theoretical probabilities for the various scores.

(c) If the coin and the dice are thrown 120 times, how many times would you expect to obtain each score?

(d) Conduct an experiment and compare your experimental results with your answers to part (c).

6. A dice with 4 faces has one blue, one green, one red and one yellow face. Five pupils did an experiment to investigate whether the dice was biased or not.

The following table shows the data they collected.

| *Pupil's Name* | *Number of Throws* | *Face Landed On* | | | |
|---|---|---|---|---|---|
| | | *Red* | *Blue* | *Green* | *Yellow* |
| Peter | 20 | 9 | 7 | 2 | 2 |
| Caryl | 60 | 23 | 20 | 8 | 9 |
| Shana | 250 | 85 | 90 | 36 | 39 |
| Keith | 40 | 15 | 15 | 6 | 4 |
| Paul | 150 | 47 | 54 | 23 | 26 |

(a) Which pupil's data is most likely to give the best estimate of the probability of getting each colour on the dice? Explain your answer.

The pupils collected all the data together.

| *Number of Throws* | *Face Landed On* | | | |
|---|---|---|---|---|
| | *Red* | *Blue* | *Green* | *Yellow* |
| 520 | 179 | 186 | 75 | 80 |

(b) Consider the data. Write down whether you think the dice is biased or unbiased, and explain your answer.

(c) From the data, work out the probability of the dice landing on the blue face.

(d) From the data work out the probability of the dice landing on the green face.

7. Some pupils threw 3 fair dice. They recorded how many times the numbers on the dice were the same.

| *Name* | *Number of throws* | *Results* | | |
|---|---|---|---|---|
| | | *all different* | *2 the same* | *all the same* |
| Morgan | 40 | 26 | 12 | 2 |
| Sue | 140 | 81 | 56 | 3 |
| Zenta | 20 | 10 | 10 | 0 |
| Ali | 100 | 54 | 42 | 4 |

(a) Write the name of the pupil whose data are *most likely* to give the best estimate of the probability of getting each result. Explain your answer.

(b) This table shows the pupils' results collected together:

| *Number of throws* | *Results* | | |
|---|---|---|---|
| | *all different* | *2 the same* | *all the same* |
| 300 | 171 | 120 | 9 |

Use these data to estimate the *probability* of throwing numbers that are *all different*.

(c) The theoretical probability of each result is shown below:

| | *all different* | *2 the same* | *all the same* |
|---|---|---|---|
| *Probability* | $\frac{5}{9}$ | $\frac{5}{12}$ | $\frac{1}{36}$ |

Use these probabilities to calculate, for 300 throws, *how many times* you would theoretically expect to get each result. Copy and complete the table below.

| *Number of throws* | *Results* | | |
|---|---|---|---|
| | *all different* | *2 the same* | *all the same* |
| 300 | ..... | ..... | ..... |

(d) Explain why the pupils' results are not the same as the theoretical results.