VCE Mathematical Methods Unit 1

Sample investigation: Exploring long run probabilities

The investigation is to be conducted over a period of about one week.

Introduction

This task involves students predicting the number of trials required before experimental results closely align with the expected long run probabilities.

Students then conduct a random experiment to test out their prediction and use a technology-based pseudo-random simulation to compare outcomes with expected long run probabilities.

**Equipment:** Each student will need four different coloured six-sided dice.

Formulation

*Overview of the context or scenario, and related background, including historical or contemporary background as applicable, and the mathematisation of questions, conjectures, hypotheses, issues or problems of interest.*

The expected long run probability of each number being rolled on a fair six-sided dice is $\frac{1}{6}$ .

Students are to predict the number of trials required of rolling a fair six-sided dice before experimental results start to closely match the expected long run probability, explaining their reasoning and listing any assumptions made.

Exploration

*Investigation and analysis of the context or scenario with respect to the questions of interest, conjectures or hypotheses, using mathematical concepts, skills and processes, including the use of technology and application of computational thinking.*

Part 1:

Roll four six-sided dice simultaneously at least 150 times, recording the results and graphing the corresponding distribution.

Part 2:

To enable analysis of experimental results representing a range of total number of rolls, collate and compare the results as follows:

1. for each of the four six-sided dice
2. combined total of their four six-sided dice results
3. combined total of their and nine other students’ step b. results.

Analyse the results in steps a. to c. by calculating the percentage difference between the experimental results and the expected long run probabilities for a suitable level of accuracy, and consider how these results compare to the initial prediction.

Part 3:

Use technology to simulate the pseudo-random rolling of a fair six-sided dice to determine the number of trials required before the simulated outcomes and the expected long run probabilities match the level of accuracy used previously.

Communication

*Summary, presentation and interpretation of the findings from the mathematical investigation and related applications.*

Summarise findings and compare and interpret them in relation to the initial prediction made.

Describe the relation between the experimental probability and the expected value.

Areas of study

The following content from the areas of study is addressed through this task.

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| **Unit 1** |
| **Area of study** | **Content dot points** |
| Functions and graphs | – |
| Algebra | – |
| Calculus | – |
| Probability and statistics | 1, 2 |

Outcomes

The following outcomes, key knowledge and key skills are addressed through this task.

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| --- | --- | --- |
| **Outcome** | **Key knowledge dot point** | **Key skill dot point** |
| 1 | 9, 10 | 16 |
| 2 | 1, 2, 3, 5 | 1, 2, 3, 5, 6 |
| 3 | 1, 7, 8 | 1, 2, 4, 5, 10, 12, 13 |