**Stage 1 Essential Mathematics**

**Assessment Type 2: Folio**

**Open Topic: Random Processes**

**Duelling Dice**

**Step 1: Make the duelling dice**

Make a set of duelling dice coloured red, green, blue and yellow. Get 4 large dice (or 2 cm cubes – but make sure they are properly made) and enough blank stickers to cover all the faces. Number the faces according to the lists below.

**RED: 0, 1, 7, 8, 8, 9**

**GREEN: 1, 2, 3, 9, 10, 11**

**BLUE: 5, 5, 6, 6, 7, 7**

**YELLOW: 3, 4, 4, 5, 11, 12**

**How do you play the game?**

*Player 1* chooses one of the four dice then *Player 2* chooses another die from the three that are left. Both players roll their dice and the higher number wins a point. If the two players roll the same number, this roll is done again. The player who has the most points after 7 rolls wins the game.

**Step 2: Play some games**

With a real (or imaginary) partner play some games with these dice using the rules above.

For each game played record:

* which dice were used
* the score
* which player won.

**Step 3: Questions for investigation**

Before you do any more analysis, think about each of the following questions and write down your answers:

* Which die would you choose if you were player 1? Why?
* Which die would you choose if you were player 2 and the first player chose the **RED** die?
* Which die would you choose if you were player 2 and the first player chose the **BLUE** die?
* Which die would you choose if you were player 2 and the first player chose the **GREEN** die?
* Which die would you choose if you were player 2 and the first player chose the **YELLOW** die?
* Explain the reasons for your choices.

**Step 4: Determine the probability of winning with each coloured die**

1. Using the skills you have learnt in this topic determine all the possible outcomes for one pair of dice and calculate the probability of winning for each colour.
2. Do your results affect any of the answers you gave in Step 3? Explain.
3. Continue your analysis for all the other pairs of dice. You should cover all of the following combinations:

|  |  |
| --- | --- |
| **RED and BLUE** | **BLUE and GREEN** |
| **RED and GREEN** | **BLUE and YELLOW** |
| **RED and YELLOW** | **GREEN** **and YELLOW** |

**Step 5: Conclusion**

Write a conclusion which sets out the best strategies for players of this game (both player 1 and player 2). Support your suggestions with appropriate mathematics.

**Step 6: Writing your report**

Your report should start with an introduction that explains the game and how it works to the reader. You should then follow with the data and mathematical working from the steps in the investigation. Your conclusion should contain your recommended strategy for playing the game.

***Optional Extension***

**Design a die that would fit into this game**

Design a fifth die that would fit into this game. Describe how you decided on which numbers should be on the die and show how it fits in the pattern of the game.

**Note to teacher:**

This task would lend itself to a class of students sharing data for Step 2 so that each pair of students does not have to play the game with every pair of dice, or so that they have more than one result for each dice combination.

**Performance Standards Stage 1 Essential Mathematics**

|  |  |  |
| --- | --- | --- |
|  | Concepts and Techniques | Reasoning and Communication |
| **A** | Knowledge and understanding of mathematical information and concepts in familiar and unfamiliar contexts.  Highly effective application of mathematical skills and techniques to find efficient and accurate solutions to routine and complex problems in a variety of contexts.  Gathering, representation, and interpretation of a range of data in familiar and unfamiliar contexts.  Appropriate and effective use of electronic technology to find accurate solutions to routine and complex problems. | Accurate interpretation of mathematical results in familiar and unfamiliar contexts.  Highly effective use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions to routine and complex problems.  Proficient and accurate use of appropriate mathematical notation, representations, and terminology.  Clear and effective communication of mathematical ideas and information to develop logical and concise arguments. |
| **B** | Knowledge and understanding of mathematical information and concepts in familiar and some unfamiliar contexts.  Effective application of mathematical skills and techniques to find mostly accurate solutions to routine and some complex problems in a variety of contexts.  Gathering, representation, and interpretation of data in familiar and some unfamiliar contexts.  Mostly appropriate and effective use of electronic technology to find mostly accurate solutions to routine and some complex problems. | Mostly accurate interpretation of mathematical results in familiar and some unfamiliar contexts.  Effective use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions to routine and some complex problems.  Mostly accurate use of appropriate mathematical notation, representations, and terminology.  Clear and appropriate communication of mathematical ideas and information to develop some logical arguments. |
| **C** | Knowledge and understanding of simple mathematical information and concepts in familiar contexts.  Application of some mathematical skills and techniques to find solutions to routine problems in familiar contexts.  Gathering, representation, and interpretation of data in familiar contexts.  Generally appropriate and some effective use of electronic technology to find solutions to routine problems. | Generally accurate interpretation of mathematical results in familiar contexts.  Appropriate use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions to routine problems.  Generally appropriate use of familiar mathematical notation, representations, and terminology.  Appropriate communication of mathematical ideas and information. |
| **D** | Basic knowledge and some understanding of simple mathematical information and concepts in some familiar contexts.  Application of basic mathematical skills and techniques find partial solutions to routine problems in some contexts.  Some gathering, representation, and basic interpretation of simple data in familiar contexts.  Some appropriate use of electronic technology to find solutions to routine problems. | Some interpretation of mathematical results in some familiar contexts.  Attempted use of mathematical reasoning to consider the appropriateness of solutions to routine problems.  Some use of familiar mathematical notation, representations, and terminology.  Attempted communication of simple mathematical ideas and information. |
| **E** | Limited knowledge or understanding of mathematical information or concepts.  Attempted application of basic mathematical skills or techniques, with limited accuracy in solving routine problems.  Some gathering and attempted representation of simple data in a familiar context.  Attempted use of electronic technology in to find a solution to a routine problem. | Limited interpretation of mathematical results.  Limited awareness of the use of mathematical reasoning in solving a problem.  Limited use of mathematical notation, representations, or terminology.  Attempted communication of an aspect of mathematical information. |