THE RIVERS SECONDARY COLLEGE
*The heart of secondary education for Lismore*

**Assessment Task Notification**

**RICHMOND RIVER HIGH CAMPUS**

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|---|---|---|---|
| **Task Number** | 1 | **Task Name** | Game On |
| **Course** | Stage 4 Mathematics | **Faculty** | Mathematics |
| **Teacher** | Ms Humphrys, Mrs Tyson, Mr Broadley, Mr Whitehall | **Head Teacher** | R Humphrys |
| **Issue date** | First Lesson in Week 6 | **Due date** | First Lesson in Week 9 |
| **Focus (Topic)** | Making Predictions | **Task Weighting** | 25% |

**Outcomes**

**MAO-WM-01** develops understanding and fluency in mathematics through exploring and connecting mathematical concepts, choosing, and applying mathematical techniques to solve problems, and communicating their thinking and reasoning coherently and clearly

**MA4-PRO-C-01** solves problems involving the probabilities of simple chance experiments

**Task description**

Can knowing how a game works ruin all the fun?

Students will explore how probability influences games to consider this question. Board games and video games utilise probability to create a random element to the actions we take and decisions we make. This ensures that we don't have absolute control over the outcomes but must adapt to the results we receive.

This uncertainty is what helps to make games, particularly board, video, and card games, popular to play time and again.

This task consists of 3 parts:

- Part 1 - What are the chances?
- Part 2 - Create a game
- Part 3 - The problem of points

This assessment task can be handed in on the Google Classroom (code wvqsetl) or hand written.

**Marking Guidelines**

See the marking rubric attached

## Part 1 – what are the chances?



**The scenario**
Many games use the results of rolling a standard, fair, six-sided dice.

- Such a dice has a sample space of {1, 2, 3, 4, 5, 6}.
- Each outcome has an equally likely chance of 1/6 .
- These games most often require you to move a piece several spaces equal to the dice result and perform the action on the space on which it lands.
- As a player you have little to no control over the game and rely entirely on random chance to determine if you succeed or fail.

**The problem**
When changes are made to the sample space and likelihood of results, should this improve how engaging and re-playable a game becomes?

**Investigate**
Conduct an experiment involving multiple trials, to determine a relative frequency for all the results you receive from rolling and adding together the value of 2, standard, fair, six-sided dice.

Use actual dice or the desmos activity to get the results. You will need to roll the dice multiple times to gather enough data to see what is happening.

**Required student responses**

1. What is the sample space from your results?

2. Use these results to fill in the Part 1 - tabulating data table and calculate relative frequencies, as fractions, for each of the outcomes.

3. Which total occurred the most?

4. Which total occurred the least?

5. Can you explain why this is the case?

## Part 2 - Create a game

Create a simple game where players must roll 2 dice and add the numbers together. Your game should not be fair. It should give one player more chance of winning than the other. Test your game by playing it several times. Do the results of your test agree with what you thought would happen?

**Commented [1]:** How many trials, can we specify this? The marking rubric uses language to describe this number.

**Commented [2]:** I've made this very basic - as kids will need to copy to create their number of trials and tabulate the experiment - they will come across this in one of the lessons in this unit https://teacher.desmos.com/collection/64d877053c664c6e80562060

**Commented [3]:** _Marked as resolved_

**Commented [4]:** _Re-opened_

**Commented [5]:** do we open this up and let them create a game of their choosing? or does that make it too open and complicated and harder to mark

They could used the polygons on the second desmos slide maybe? or is that getting too hard

**Commented [6]:** _Marked as resolved_

**Commented [7]:** _Re-opened_

**Required student responses**

1. Clearly explain the rules of your game.

2. Use your knowledge of probability to explain each player's chances of winning.

3. How does your game favor one player over the other?

**Conclusion**

After studying different games and their outcomes, how might knowing the relative frequencies (chances of winning) impact your decisions during the game or your motivation to play the game? Justify your response.

## Part 3 – the problem of points

**The scenario**

- There are 2 players, Abe and Bea, playing a fair game split into rounds.
- The game consists of flipping a fair coin, with Abe winning on heads and Bea winning on tails.
- Abe and Bea have both contributed an equal amount to a winner-takes-all prize.
- The one who wins a total of 10 rounds will win the overall game and receive the entire prize.
- The game is stopped unexpectedly and can not be continued.
- Abe has won 7 rounds and Bea has won 8 rounds.

**The problem**

No one made it to 10 rounds so there is no winner according to the rules, and now Abe and Bea can't agree on what should happen with the prize.

It is possible that the next 4 rounds play out as follows:

Heads, Heads, Tails, Heads (HHTH).

In this outcome, Abe wins 3 more times and finishes with 10 points and wins the game. Bea wins one more time and finishes with 9 points.

**Required student responses**

1. How many other, different outcomes are possible? Create a list of all the possible ways these rounds could play out in the Part 2 - determining winners table (including the example provided).

2. To determine a winner, the maximum number of rounds that could possibly be played is 4. Explain why this is the case.

3. Abe and Bea agree to share the winnings based on the probability of them winning the game. Using your list of possible results from question 1, determine what fraction of the prize to give to each person, justifying your response.

4. What if Abe and Bea had played one extra round before the game was stopped – would this change your answer to the previous question? Justify your response.

5. Consider if Abe had won 9 rounds and Bea had won zero when the game was interrupted. Would it be a fair and reasonable outcome for Abe to receive the entire prize-pool? Explain your answer using mathematical arguments and reasoning.

## Part 1 – tabulating data

| Total of 2 dice | Frequency (use tally marks) | Total (as a number) | Relative frequency |
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## Part 2 – determining winners

Initial rounds

- Abe won 7 (Heads)
- Bea won 8 (Tails)

| Round 16 | Round 17 | Round 18 | Round 19 | Winner |
|---|---|---|---|---|
| **H** | **H** | **T** | **H** | **Abe** |
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