

Mathematical investigation: Fair Game?

Learning outcomes in focus

Students should be able to:

U.4 represent a mathematical situation in a variety of different ways, including: numerically, algebraically, graphically, physically, in words; and to interpret, analyse, and compare such representations

U.7 make sense of a given problem, and if necessary, mathematise a situation

U.8 interpret their solution to a problem in terms of the original question

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U.10 evaluate different possible solutions to a problem, including evaluating the reasonableness of the solutions, and exploring possible improvements and/or limitations of the solutions (if any)

U.13 communicate mathematics effectively: justify their reasoning, interpret their results, explain their conclusions, and use the language and notation of mathematics to express mathematical ideas precisely

SP.1 investigate the outcomes of experiments

N.2 investigate equivalent representations of rational numbers

Learning intentions

We are learning to:

- break problems down into parts
- generate sample spaces for an experiment in a systematic way
- use the fundamental principle of counting to solve authentic problems
- look for patterns and make conjectures
- validate our conjectures
- generalise our observations
- draw conclusions from our work
- use representations to communicate and justify mathematical ideas clearly

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Teaching and learning context

First year students were learning about probability by investigating the outcomes of games and determining whether or not the games were fair. The task was given as an end of unit assessment.

Task

Sadiq and Justyna play a game that involves them rolling two dice.

Sadiq wins if the total is 2, 3, 4, 10, 11 or 12

Justyna wins if the total is 6, 7 or 8.

Who has the best chance of winning?

Do you think this is a fair game? If not, adjust the rules to make the game fairer. Justify any decisions you make with mathematics

Success Criteria

I can

SC1 make a prediction justified by mathematics

SC2 represent the situation in a way that allows me to compare the options

SC3 explain my conclusion using the language of probability and mathematics

SC4 use fractions, decimals and/or percentages to display probabilities

SC5 devise fair rules to a game based on probabilities

Mathematical investigation: Fair Game?

Investigation: Fair Game?

Name: _____

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- SC1: makes a prediction justified by mathematics
- SC2: represent the situation in a way that allows me to compare the options
- SC3: explain my conclusion using the language of probability and mathematics
- SC4: use fractions, decimals and/or percentages to display probabilities
- SC5: devise fairer rules to a game based on probabilities

SHOW ALL YOUR THOUGHTS, WORKINGS AND CONCLUSIONS ON THIS WORKSHEET

This will be taken up at the end of class. Ask for extra pages if you need them ☺

Probably is fair because we have to look at the probabilities how many times can you get 2, 3, 4, 10, 11 or 12 or 6, 7, 8

SC1: Makes and attempt to make a prediction and refers to probabilities to explain it.

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$(1,1) = 2$ ✓	$(4,1) = 5$
$(1,2) = 3$ ✓	$(4,2) = 6$ ✓
$(1,3) = 4$ ✓	$(4,3) = 7$ ✓
$(1,4) = 5$	$(4,4) = 8$ ✓
$(1,5) = 6$ ✓	$(4,5) = 9$
$(1,6) = 7$ ✓	$(4,6) = 10$ ✓
$(2,1) = 3$ ✓	$(5,1) = 6$ ✓
$(2,2) = 4$ ✓	$(5,2) = 7$ ✓
$(2,3) = 5$	$(5,3) = 8$ ✓
$(2,4) = 6$ ✓	$(5,4) = 9$
$(2,5) = 7$ ✓	$(5,5) = 10$ ✓
$(2,6) = 8$ ✓	$(5,6) = 11$ ✓
$(3,1) = 4$ ✓	$(6,1) = 7$ ✓
$(3,2) = 5$	$(6,2) = 8$ ✓
$(3,3) = 6$ ✓	$(6,3) = 9$
$(3,4) = 7$ ✓	$(6,4) = 10$ ✓
$(3,5) = 8$ ✓	$(6,5) = 11$ ✓
$(3,6) = 9$	$(6,6) = 12$ ✓

SC2: Possible outcomes listed in a systematic way that allows comparison. Colour is used to identify outcomes of interest.

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$$P(\text{Sadiq Wins}) = \frac{12}{36}$$

$$P(\text{Justyna Wins}) = \frac{16}{36}$$

It's not fair Justyna has more chance of winning than Sadiq

Swap the 6 for the 2

in Justyna she wins

if she gets 2, 7, 8

there are 12 chances

SC4: Uses fractions to display probabilities.

SC3: Makes a conclusion and explains it using the language of probability.

SC5: Devises fair rules based on probability.

Overall judgement:  In line with expectations