



How much is too much? – Teacher notes for recorded version

Thank you for joining us for this enrichment event! These notes are designed to support you in supporting your students. Please don't read these notes to your students before the event or it will spoil some of the surprises! The presenters will share this information with students, this is for your use as a reminder / prompt for further thinking.

At various different times, you might want to pause the recording to allow students to take part in the activity or to ask them to think about the maths. We have suggested some opportunities for this, but you can pause whenever you feel your students will benefit.

Your students will need a normal six-sided dice between 2 students (ideally one each), or access to an online dice rolling simulation such as: <https://nrich.maths.org/6717> .

The game:

Students roll a dice, adding the scores. At any point the player can 'bank' and the score for that round is added to the previous total. However, if a '1' is rolled then any score not banked is lost. This will be explained at the start of the event. Students will be asked to play the game, then consider strategies to play the game better.

It is helpful to print out the worksheet for students to record their scores. Each pair needs two copies of the table. The worksheet is page three of this document. Students could record scores on plain paper.

There are two groups of strategies: one group looks at the number of rolls and the other group looks at the reaching a target score before banking. We are asking students to focus on deciding a total score to reach before banking. There are notes later in this document to support looking at the number of rolls if wish to do this as an extension activity after the event.

As students complete the 10 rounds, they or you will need to enter their score strategy and total to the form: <http://bit.ly/PigScoreData>. You may want to gather this data by collecting their worksheets or asking students to write their score and total on the back and hold it up. You can see a live graph of this data [here](#), though with this much data, it is not easy to see the changes.

You may want to collect the data from your class or year, we have provided a spreadsheet for you to enter this data and the graph with update automatically.

Hints:

You might like to ask:

- How many points would you expect to score on a roll?
- What score would you risk before you expect to roll a '1'?

Extension ideas:

- What would happen if you change the 'lose everything this round' score to a '6' instead of a '1'? What about the strategy would change? What would stay the same? Why?
- What would happen if you rolled two dice? What about the strategy would change? What would stay the same? Why?
- What would happen if you rolled a dice with a different number of sides? What about the strategy would change? What would stay the same? Why?

Additional notes – the roll strategy

In this set of strategies, the game is the same, but the player chooses a number of rolls before deciding to bank. We would suggest running the activity in a similar way to our event where students try different strategies before tackling the maths behind it.

You might like to ask:

- How often would expect a '1' to be rolled?
- How many rolls would you risk before a '1' is rolled?

For this set of strategies, the maths focuses on the expected score:

Possible outcomes:

- Lose everything: probability = $\frac{1}{6}$
- Score stuff: probability = $\frac{5}{6}$ (score 4 on average)

Expected score after 1 roll:

- $0 \times \frac{1}{6} + 4 \times \frac{5}{6} = 3.33 \dots$

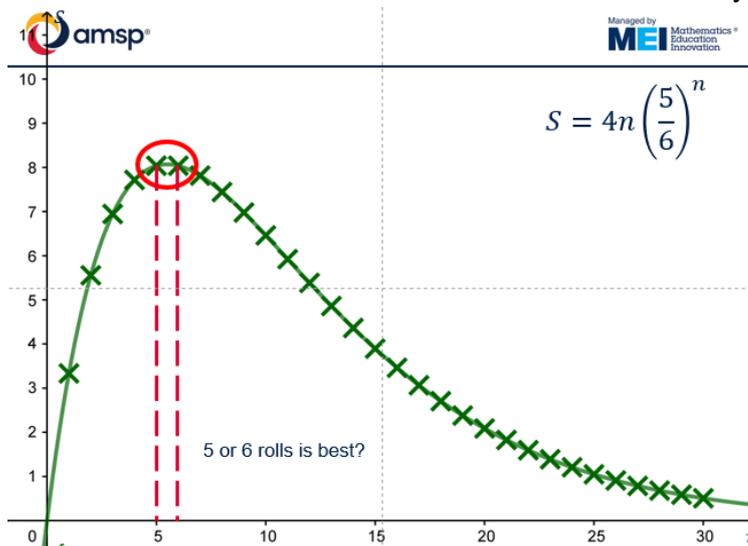
After 2 rolls:

- $8 \times \frac{5}{6} \times \frac{5}{6} = 5.55 \dots$

After n rolls:

- $4n \times \left(\frac{5}{6}\right)^n$

Students could calculate this for different values of n or you might want to create a graph:



This shows that the best strategy is either 5 or 6 rolls, giving an expectation of 8 per round (over a large number of rounds).

You might want to explore how some people prefer to win less each round but win more rounds.

Additional notes - playing against someone else

We have only looked at a strategy in isolation. Students may want to consider what happens when you play against someone – is 'play until I have scored more than the other person' a good strategy?

This time decide on a strategy and stick to it – each player can choose a different strategy.

Playing for fun

Round	Player 1 score	Player 1 total	Player 2 score	Player 2 total
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

	Player 1 strategy		Player 2 strategy	
Round	Player 1 score	Player 1 total	Player 2 score	Player 2 total
1				
2				
3				
4				
5				
6				
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