PIG

PLAY

Both players start with zero points and take turns to throw the dice as many times as they like adding the total at each throw to their score.

LEARN AND WIN

You throw a double one. On the next throw, is your chance of throwing a double one the same, more likely or less likely?

On each throw, which of the following 3 options is most likely and which is least likely? How do you know?

(A) 1 and some other number

(B) A double 1

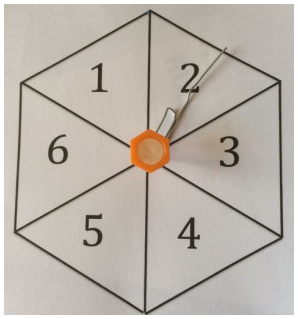
(C) Two numbers other than 1.

Can you work out a strategy so that you can win more often than you lose?

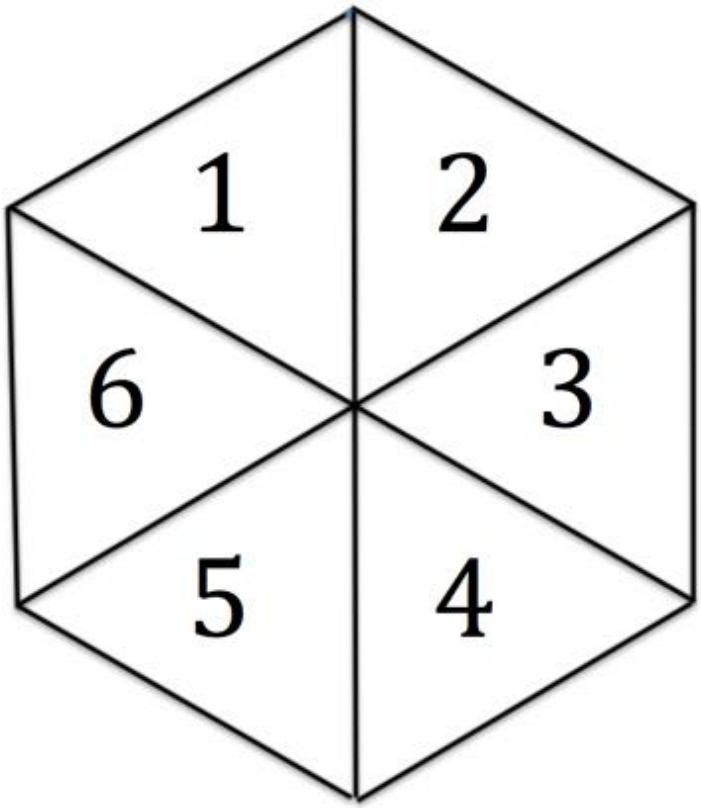
HELP

MAKE YOUR OWN SPINNERS

You will need a pair of dice or a spinner for each pair of learners.



To make your own spinner as shown in the picture you will need a paper clip and a pin. Straighten out one end of the paper clip, cut out the template and then pin the paper clip and the hexagon on a flat surface so that the spinner spins freely. Now you are ready to play the game.



NEXT

The game described on page 1 is sometimes called Piggy Ones and there is a Piggy Sixes version of the game. Would it make much difference to the game if the number 1 was the same as the numbers 2, 3, 4 and 5 and instead, throwing a double six would take the score down to zero and throwing a six and another number would end the turn without adding anything to the total score?

Throw two dice 50 times and record the results. What percentage of the throws gave a double one, what percentage one and another number, and what percentage two numbers other than one?

Compare your experimental probability with the theoretical probabilities of 28% for one and another number, 3% for a double one and 69% for two numbers neither of which is a one.

Why are these two sorts of probability different?

NOTES FOR TEACHERS

SOLUTION

Table showing scores for all possible throws.

	1	2	3	4	5	6
1		0	0	0	0	0
2	0	4	5	6	7	8
3	0	5	6	7	8	9
4	0	6	7	8	9	10
5	0	7	8	9	10	11
6	0	8	9	10	11	12

After throwing a double one you have the **same chance** of throwing a double one on the next throw.

On each throw all 36 outcomes are **equally likely**.

(A) 1 and some other number
Probability 10/36 or 28%

(B) A double 1
Least likely, probability 1/36 or 3%

(C) Two other numbers
Most likely, probability 25/36 or 69%

(answers rounded to the nearest whole number).

A good strategy is only to throw once if you are ahead. That way you are most likely to stay ahead and avoid the disaster of throwing a double 1.

For a detailed analysis of the game and more about winning strategies, see Durango Bill's website http://www.durangobill.com/Pig.html

Why do this activity?

This activity provides an enjoyable introduction to probability for younger learners. For other learners it provides a context in which to review some of the basic concepts of probability. Because they will want to win the game, learners can be motivated to understand what will give them the best chance. So they will be interested in counting all the possible outcomes (members of the sample space). To count the number of outcomes which lead to a particular event is both fundamental to probability, and to understanding how to find probabilities. The activity can also provide a context in which to introduce 2-way tables.

Learning objectives

In doing this activity students will have an opportunity to:

Primary:

- to learn and appreciate the meaning of the concepts of 'most likely', 'least likely' and 'equal chances'.

Lower secondary:

- to review of the basic concepts of probability;
- to practise counting all the possible outcomes (members of the sample space) and counting the number of outcomes which lead to a particular event;
- to learn to how to use, and practise using, two-way tables.

Generic competences

In doing this activity students will have an opportunity to:

- **think flexibly**, be creative and innovative and apply knowledge and skills;
- to play a game in a thoughtful way **with consideration for others.**

Suggestions for teaching

Play the game as a class a few times so that all the learners become familiar with the rules. Divide the class in two and have a representative from each group at the front to take turns to throw the dice. Each time the teams have to decide whether to stop or to throw again. Write the scores on the board.

Then get learners to play the game in pairs. They will need dice or a spinner. With one die or a spinner they will need to throw or spin twice at each throw.

Then, as a whole class, discuss whether the probabilities are the same on every throw and the question: "On each throw, which of the following 3 options is *most likely* and which is *least likely*? How do you know?

(A) 1 and some other number (B) A double 1 (C) Two numbers other than

Misconceptions about a 'run of good or bad luck' are common. Learners should understand that, whatever has happened in the past, all the probabilities are the same on the next throw.

An essential and fundamental idea in probability is counting the number of possibilities that make up the sample space. With a younger class it is enough to understand that 'there are more ways of getting a single one than there are of getting a double one, so a single one is *more likely* than a double one. And similarly there are more ways of getting other scores than throwing 1 or 2 ones so getting a positive score is *more likely* than scoring zero. Older learners can go on to listing and counting the 36 possibilities and working out the probabilities.

You may like to use the Diagnostic Quiz to assess the learning at the end of the lesson.

Diagnostic Assessment This should take about 5–10 minutes.

Two spinners are numbered 1 to 4. They are both spun and then the product of the two numbers is found. The sample space is shown to the right.

What is the probability of the result being 4?

×	1	2	3	4
1	1	2	3	4
2	2	4	6	8
3	3	6	9	12
4	4	8	12	16

A 3 B $\frac{1}{8}$ C $\frac{1}{16}$ D $\frac{3}{16}$

1. Write the question on the board, say to the class:
"Put up 1 finger if you think the answer is A, 2 fingers for B, 3 fingers for C and 4 for D".
2. Notice how the learners responded. Ask a learner who gave answer A to explain why he or she gave that answer and DO NOT say whether it is right or wrong but simply thank the learner for giving the answer.
3. It is important for learners to explain the reason for their answer to practise communication skills.
4. Then do the same for answers B, C and D. Try to make sure that learners listen to these reasons and try to decide if their own answer was right or wrong.
5. **Ask the class again to vote for the right answer by putting up 1, 2, 3 or 4 fingers. Notice if there is a change and who gave right and wrong answers**
6. If learners got the answer wrong, explain the right answer or give a remedial task.

The correct answer is D because there are 3 events out of 16 that give a score of 4.
https://diagnosticquestions.com

Key questions

- Does a double 1 come up more often or less often than a single 1?
- Which is more likely - a double 1 or a single 1?
- Does double 1 come up more often or less often than pairs of numbers without a 1?
- Which is more likely - a double 1 or a pair of numbers without a 1?
- Are you winning at the moment?
- Is it worth the risk of throwing again?
- Why would you want to go on and throw again?
- Why would you want to stop now?

Follow up

For more ideas and variations of the game see:
https://en.wikipedia.org/wiki/Pig_(dice_game)

Go to the **AIMSSEC AIMING HIGH** website for lesson ideas, solutions and curriculum links: http://aiminghigh.aimssec.ac.za

Subscribe to the **MATHS TOYS YouTube Channel**
https://www.youtube.com/c/MathsToys/videos

Download the whole AIMSSEC collection of resources to use offline with the **AIMSSEC App** see https://aimssec.app or find it on Google Play.

Note: The Grades or School Years specified on the AIMING HIGH Website correspond to Grades 4 to 12 in South Africa and the USA, to Years 4 to 12 in the UK and school years up to Secondary 5 in East Africa.
New material will be added for Secondary 6.
For resources for teaching A level mathematics (Years 12 and 13) see https://nrich.maths.org/12339
Mathematics taught in Year 13 (UK) & Secondary 6 (East Africa) is beyond the SA CAPS curriculum for Grade 12

	Lower Primary Approx. Age 5 to 8	Upper Primary Age 8 to 11	Lower Secondary Age 11 to 15	Upper Secondary Age 15+
South Africa	Grades R and 1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
East Africa	Nursery and Primary 1 to 3	Primary 4 to 6	Secondary 1 to 3	Secondary 4 to 6
USA	Kindergarten and G1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
UK	Reception and Years 1 to 3	Years 4 to 6	Years 7 to 9	Years 10 to 13