



AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES  
SCHOOLS ENRICHMENT CENTRE (AIMSSEC)

AIMING HIGH

**THE GAME OF PIG Inclusion and Home Learning Guide** is part of a Learning Pack downloadable from the AIMING HIGH website

<https://aiminghigh.aimssec.ac.za/years-5-10-game-of-pig/>

It provides related activities for home learning for all ages and learning stages from pre-school to school-leaving, together with guidance for home-learning and also for inclusion in school lessons, all on the **Common Theme: PROBABILITY**

Guidance for school lessons is given in the separate Notes for Teachers document.

**Choose what seems suitable for the age or attainment level of your learners.**

## PIG

You will need 2 dice, or you can throw one die twice, or instead make your own spinner.

### PIG A GAME FOR 2 PLAYERS



The first to get 100 wins.  
Throw 2 dice, add your scores and stop any time.



Double 1 takes your total score back to zero.

One 1 ends your turn and you add zero.

### PLAY

Both players start with zero points and take turns to throw the dice as many times as they like, adding to their running total at each throw as long as they don't throw a one. See the rules on the left.

### LEARN AND WIN

If you throw a double one, is your chance of throwing a double one at the next throw, the same, more likely or less likely?

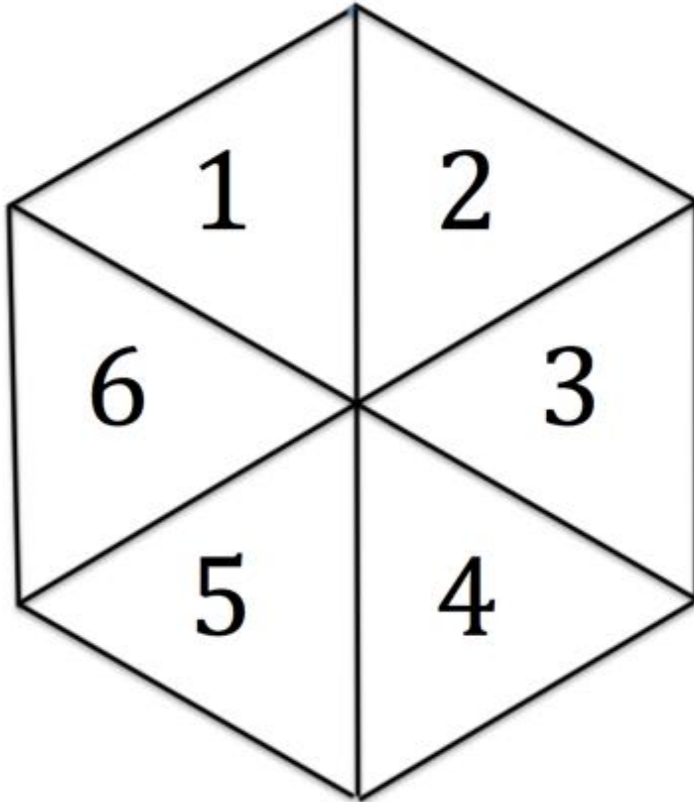
On each throw, which of the following 3 options is most likely and which is least likely? How do you know?

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

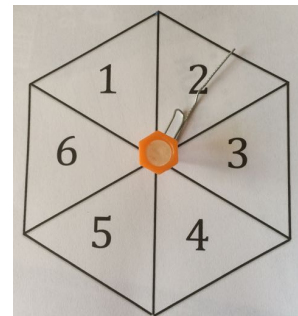
Can you work out a strategy so that you can win more often than you lose?

## 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?

## INCLUSION AND HOME LEARNING GUIDE

### THEME: PROBABILITY

#### Early Years and Lower Primary



#### PIGGY ONE DIE

Take turns to throw the die and keep the score adding 3, 4, 5 or 6 when those numbers come up on the die. You can throw as many times as you like when it's your turn, but you go back to zero if you throw a 1 and you lose the score for that turn if you throw a 2.

The first player to get to 20 points or more is the winner.

#### Upper Primary

Just play the game with 2 dice as described on page 1. Play for fun at first then discuss the answers to some of these 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?
- 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?

#### Lower Secondary      Years 7 - 10

Make a spinner if you don't have dice available. Play the game a few times so that everyone learns the rules. If you are working with a group, divide them in two teams and have a representative from each team take turns to throw the dice or spin the spinner. With one die or a spinner they will need to throw or spin twice at each throw. Each time the teams have to decide whether to stop or to throw again. Write the scores on a board or large sheet of paper so everyone can see.

Then get learners to play the game in pairs as many times as they want to do so, and to come back to the game again on another day.

Ask the learners if they want to know a good way of increasing their chances of winning.

If they say yes, then ask 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) Double 1      (C) Two numbers other than 1.

Ask: should their decision to throw again depend on whether they are ahead or behind? Suggest they think of a strategy and play a few games to see what happens.

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.

**For older learners only:** You may like to use the Diagnostic Quiz to assess the learning at the end of the session.

### 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 a double 1 come up more often or less often than a pair 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?

### Upper Secondary

Study the analysis of this game and the strategies for giving yourself a better chance of winning. Explain some of the ideas to your classmates and try out the strategies.

<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 and to do this 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.

## SOLUTION

The table below, called a **two-way table**, shows all the possible outcomes when 2 dice are thrown. The columns, labelled at the top in green, relate to all possible throws of one die.

The rows, labelled at the left in blue, relate to all possible throws of the second die. The 36 possible outcomes from the combined scores on the two dice, according to the Piggy-Ones rules, are shown in the white cells.

Secondary age learners meet two-way tables in school by Year 8, or earlier in many countries. This game provides a good way to gain a better understanding of how to use two-way tables.

Younger learners, especially those age 10 and up, could be introduced to this table, but it is important to avoid doing so until they have played the game many times and only after they have talked about strategies for winning and how likely it is to lose all their score by throwing a double 1.

| Table showing scores for all possible throws. |   |   |   |    |    |    | After throwing a double one you have the <b>same chance</b> of throwing a double one on the next throw.<br><br>On each throw all 36 outcomes are <b>equally likely</b> .<br><br>(A) A throw of 1 and some other number has a probability $10/36$ or 28%<br>(B) A throw of double 1 is <b>least likely</b> . It has a probability $1/36$ or 3%<br><b>(B)</b> A throw of two other numbers is <b>most likely</b> . (C) It has a probability $25/36$ or 69% (answers rounded to the nearest whole number). |
|---|---|---|---|----|----|----|---|
|   | 1 | 2 | 3 | 4  | 5  | 6  |   |
| 1   | 0 | 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 |   |

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/>

## Learning objectives

In doing this activity students will have an opportunity:

### 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

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 |

**Diagnostic Assessment** This should take about 5–10 minutes.

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 fingers 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 develop their oral communication skill and because putting ideas into words encourages mathematical thinking.
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 get the wrong answer, 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>

## Follow up

For more ideas see: [https://en.wikipedia.org/wiki/Pig\\_\(dice\\_game\)](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>

Download the whole AIMSSEC collection of resources to use offline with the AIMSSEC App see <https://aimssec.app> Find the App 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<br>Approx. Age 5 to 8 | Upper Primary<br>Age 8 to 11 | Lower Secondary<br>Age 11 to 15 | Upper Secondary<br>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             |

