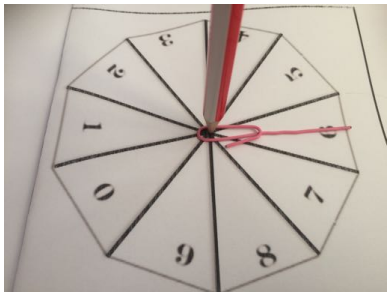
SPIN HIGH SPIN LOW Inclusion and Home Learning Guide is part of a Learning Pack downloadable from the AIMING HIGH website https://aiminghigh.aimssec.ac.za
It suggests related activities for home learning for all ages and learning stages from pre-school to school-leaving, together with guidance for home-learning and also for inclusion in school lessons, all on the Common Theme **NUMBER AND CHANCE**
Guidance for school lessons is given in the separate Notes for Teachers documents.
Choose what seems suitable for the age or attainment level of your learners.

SPIN HIGH SPIN LOW

PLAY FOR FUN - THINK AND WIN - PLAY AND LEARN

This game can be played by any number of players and it is a good game for a family or 2 players.

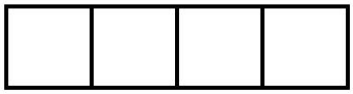


The game helps you to understand place value and helps you to think about probability.

The game can easily be adapted to 2-digit or 3-digit numbers or to include decimals. All versions of the game can be played with any number of players, by a whole class as a lesson starter, or in pairs.

You will need a set of 10 cards numbered 0 to 9 or a 0-9 spinner like the one in the picture. Before you start decide if you are going to play Spin High where the highest number wins or Spin Low where the lowest number wins.

Each player must draw a grid. The one shown is for the 4-digit game. In the **Spin High** game the players aim to make the largest possible 4-digit number. As a whole class game one person draws a card at random, or spins the spinner, and calls out the digit (for example, 6 as shown in the picture) and the players must choose which of the 4 squares to place the digit in.



Spin again and call out the digit three more times and each time the players must write the digit called in one of their boxes. Players with the highest number win a point. The game is repeated and the first player to get 5 points wins the match.

In the **Spin Low version** of the game the players with the lowest 4-digit number win a point.

As a **variation of the game**, other targets can be set, for example the target could be to get as close as possible to 25. The players can take turns to choose the target.

The grid shown is for the decimal version.

If you use a decimal comma in your country then make your grid with a comma.

Again, this game can be played with a spin high target or a spin low target.

HELP

If you are a bit uncertain you could start to play the game with 2-digit numbers and then progress to 3-digit numbers and then to 4-digit numbers

With the 4-digit game, if you want to win 'Spin High' you need a high number in the thousands place. When for example a 6 comes up you have to think about the chance of one of the spins yet to come giving an even higher number, and you have to act accordingly.

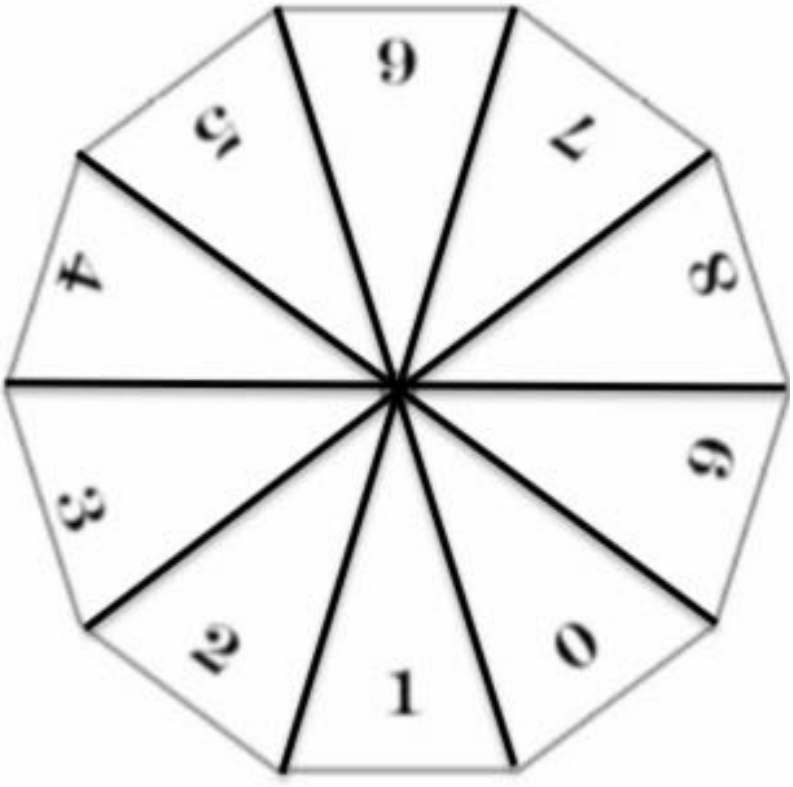
As there are 6 digits less than 6 (0, 1, 2, 3, 4 and 5) and 3 digits greater than 6 (7, 8 and 9) the probability of getting lower numbers is double the probability of getting higher numbers.

NEXT

There are many ways to vary this game and you might like to make up your own rules.

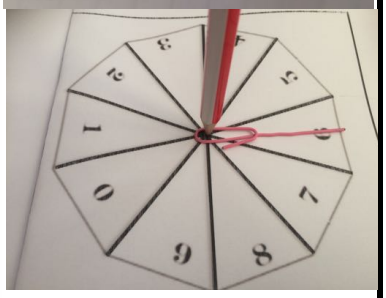
MAKE YOUR SPINNER

Use thick card for the spinner. Prick through this template to make marks on your card. Hold it still. Make an EXACT copy of the spinner shown here. Cut it out. With a little practice your spinner will work beautifully



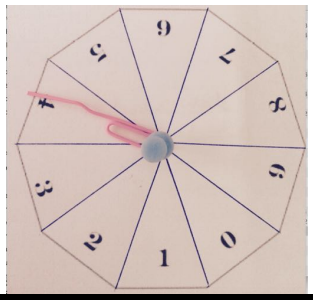
Now you are ready to play the games.

You will need a paper clip opened out as shown and a pencil.

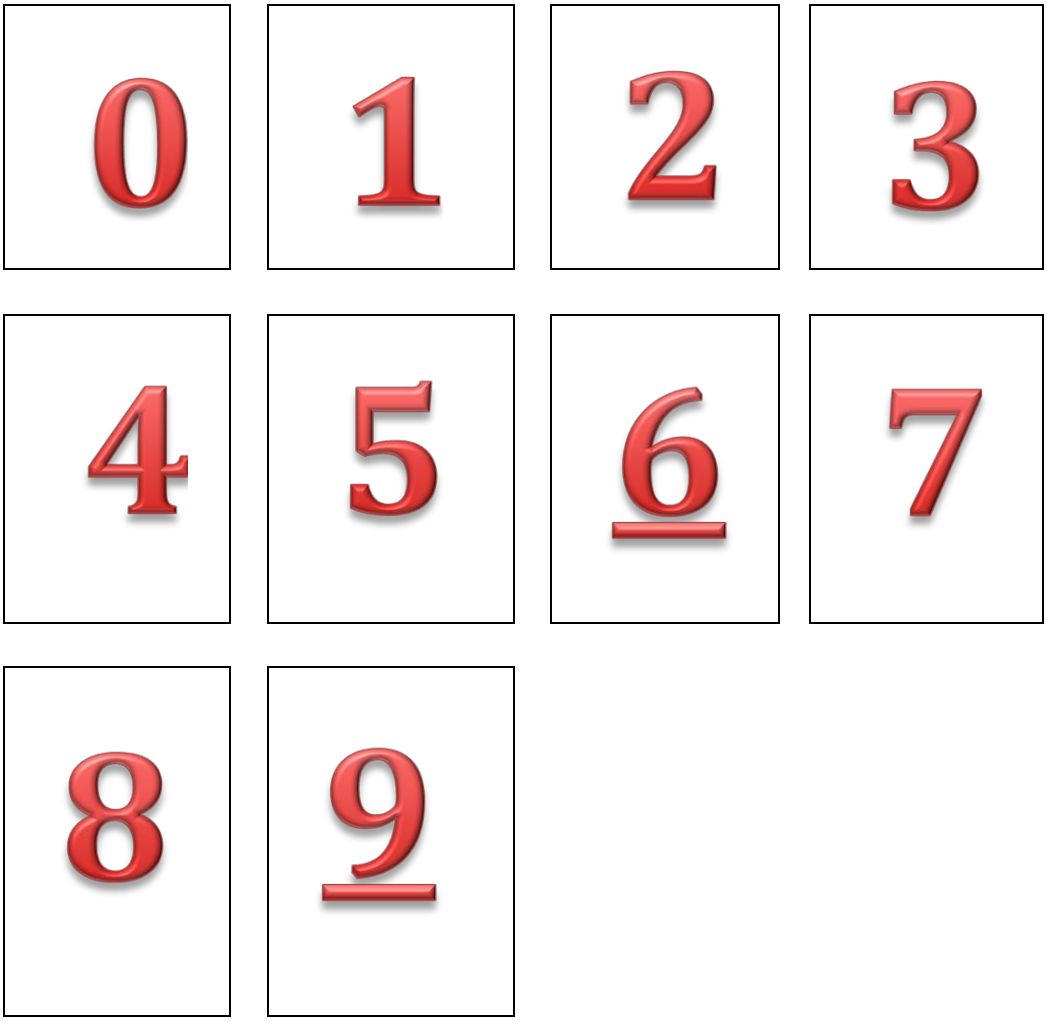


Put the pencil tip in the centre of the template to hold the paper clip so that it can spin freely.

You can use a pin so that you do not need to hold the paperclip in place.



Alternatively make 10 cards so that you can draw one randomly from a box.



INCLUSION AND HOME LEARNING GUIDE

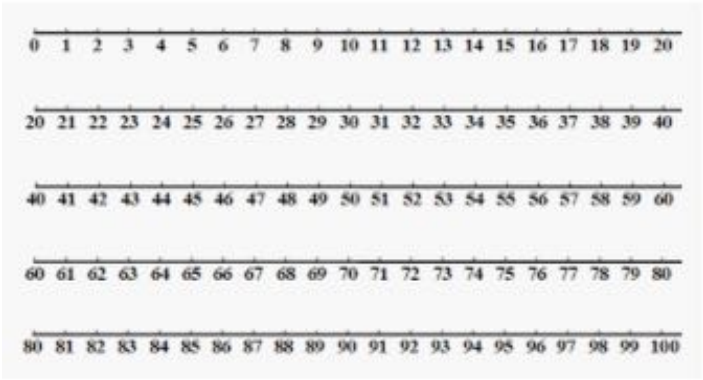
THEME: NUMBER AND CHANCE

PLAY FOR FUN – THINK AND WIN – PLAY TO LEARN

Encourage the students not just to fill the boxes without thinking but to think about their best choices in order to win.

Young children

Make a Number Line



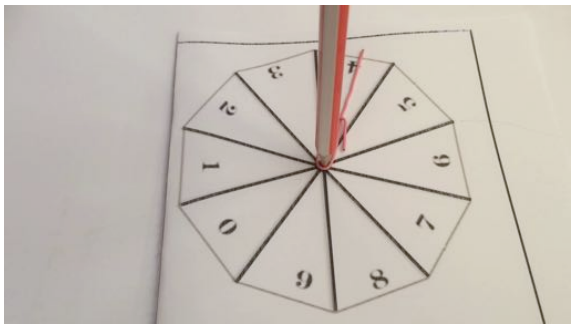
First you might like to make a number line and start counting along the line. Start with 1 to 20. The number line is not usually introduced in school until children are 7 or older but, if your child enjoys counting, and many do, then the number line is useful.

You need to plan to mount the line on a strip of wall as the line grows from 0 to 100 section by section. Make the line in sections on separate strips of paper, that you paste end to end: 0 to 20; 20 to 40; 40 to 60 etc… It may take weeks or months to complete the line from 0 to 100. In school it will eventually extend to higher numbers and, in the opposite direction, to negative numbers.

Spin High Spin Low is a good game to play with 5 and 6 year olds when your child understands how to count up to 100, and can write the numbers, and if you start with 2-digit numbers up to 99.

If your family or household likes to play games, and if the small children can manage their emotions and not get upset if they don't win, then it can be a good family game.

Upper Primary



RESOURCES: Using the instructions on page 2 and 3 you can make sets of cards or spinners. Ideally use card, but it can be scrap card. Make one for each pair of learners or group. Alternatively, learners can make their own number cards or spinners. You will need a paper clip for each spinner with one end opened out as shown.

This is the grid for the 4-digit version of the game. (Thousands, Hundreds Tens and Units). You might like to start with the 3-digit version (Hundreds Tens and Units). You could start by playing the spin high game between 2 players, or with 2 teams to involve a whole group playing together. First ask the everyone to copy the grid. Then tell them that the player or team who gets the highest number wins.

Draw a card randomly from a box or hat or spin the spinner. Call out the **number** and tell the players to choose one of the boxes in the grid and write that **digit** in it. Repeat this 3 times and the players should all have a **4-digit number** in their grid. Then find out who has the highest number. There may be more than one winner of the first round and all players with the highest number win a point. After 5 rounds check who has the most points.

Later you can progress to 5-digit and 6-digit numbers.

Important Mathematical Language
Suppose a player has written 4361 in his boxes, then the DIGITS are 1, 3, 4 and 6 and the number is 4 thousand 3 hundred and sixty one.

Suppose another player has written 6431in her boxes, then the DIGITS are the same: 1, 3, 4 and 6 and the number is 6 thousand 4 hundred and thirty one. For these digits this is the biggest possible number.

Ask if anyone could have got closer to the target if they had known all four digits before filling any digits in.

Start a game where everyone is able **to join in the discussion** of where to put each of the four digits as they come up. Ask questions similar to the key questions below to encourage discussion of probability (but don't use technical language, just what comes naturally like "is there a good chance of getting a higher digit to put in the thousands box?" For example, if the first digit to come up is 3 then next time you are more likely to throw a higher digit (4, 5, 6, 7, 8, or 9) than a lower or equal digit (0, 1, 2 or 3) so it is not a good idea to put 3 in the thousands box. Probably the best place for 3 is in the tens or units box.

Key questions *Ask these questions to help learners to think for themselves.*

Whenever possible stop yourself telling children what to do next, instead ask a question.

- If the first digit to come up is 3 would you place it in the thousands box? Why or why not?
- If the second digit is 8 and your thousands box is empty would you place the 8 there? Why or why not?

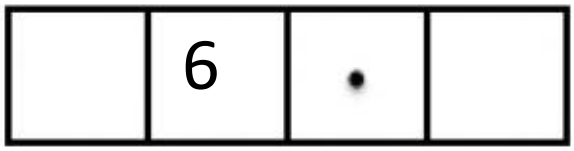
Lower Secondary

Play the game for a few minutes exactly as described above for Primary. Then play the decimal version of game with the grid shown.

If you use a decimal comma in your country then make your grid with a comma.
This game can be played with a spin high target or a spin low target. You can make the game more challenging by drawing longer grids, increasing the number of digits.

Years 10 and 11

Read the rules of this game on page 1 and play a few games with a friend so you understand the rules. In order to have a better chance of winning, consider some questions about probability.



Suppose the first spin was a 6 and you have written it in the units place as shown.

Suppose the next spin gives the digit 4. Where should it go?

Which is greater:

(1) the probability that the next random number will be greater than or equal to 4

(2) or the probability that it will be less than 4?

The next number could be 4, 5, 6, 7, 8, or 9 – that is greater than or equal to 4, or it could be 0, 1, 2 or 3 (less than 4).

The probability of (1) is 6/10 or 0.6 and the probability of (2) is 4/10 or 0.4.

So you should put the 4 in the tenths box and not in the tens box. Sometimes you will lose anyway, but you have a better chance of winning that way.

Play the game, but each time talk to your opponent about the probabilities. You will both be playing to learn rather than playing to win, but it's good to help each other to understand the probabilities and to learn together. When you are both confident, speed up the game, don't discuss the best moves, just play to win.

Years 12 and 13

This probability example is harder than you will meet in a school leaving exam. It's similar to a scholarship or competition question. Only read on if you are still interested.

Read the rules of this game on page 1 and play a few games with a friend so you understand the rules.

Suppose you play the Spin High game with this grid and a 3 comes up first. You decide on the best move and write in the 3.

Then a 4 comes up, you decide on the best move and write it in. Then a 7 comes up.

Where would you put the 3? Why?

Where would you put the 4? Why?

If you play your chosen best moves each time and your opponent plays randomly, what is your chance of losing the game anyway?

Stop and try to answer these questions before you read on.

Table of probabilities		Second Number	
		≤ 3	>3
First number	≤ 3	$\frac{16}{100}$	$\frac{24}{100}$
	>3	$\frac{24}{100}$	$\frac{36}{100}$

Whenever a number is drawn there are 10 possible outcomes. If we draw two numbers one after the other, then there are 100 possible outcomes. Think what happens with the 2nd and 3rd numbers.

Should the 3 go in the tens box? This is a bad move if either of the numbers that follow is greater than 3. One or both the 2nd and 3rd numbers is greater than 3 in 84 out of 100 outcomes. It follows that putting 3 in the tens box is a bad move with probability $\frac{84}{100}$, so we don't put it there.

Table of probabilities		Second Number	
		< 3	≥3
First number	<3	$\frac{9}{100}$	$\frac{21}{100}$
	≥3	$\frac{21}{100}$	$\frac{49}{100}$

What about putting 3 in the tenths box? This is a good move if both the 2nd and 3rd numbers are greater than 3 or equal to 3. This occurs with a probability $\frac{49}{100}$. It's almost a 50-50 situation but marginally it's a bad move so 3 should go in the units box.

The last number that comes up is 4. You have to decide whether to put it in the tens box or in the tenths box. Putting it in the tens box is a good move if the last number is 0, 1, 2 or 3, it makes no difference if the last number is 4, and it's a bad move if the last number is 5, 6, 7, 8 or 9 so the best choice is to put the 4 in the tenths box. Then a 7 comes up and your number is 73.4

Remember we are assuming that your opponent played randomly.

The only possible outcomes in the game are 74.3; 73.4; 47.3; 43.7; 37.4 and 34.7 and we are assuming that your opponent is equally likely to finish the game with any one of these. Your result is highlighted.

The probability of you losing with your chosen strategy is $\frac{1}{6}$.

The probability of a draw is $\frac{1}{6}$, and the probability of you winning is $\frac{4}{6}$.

If you want a further challenge you could work out the probabilities when other digits come up last. What if the last digit were 2 for example?

Why do this activity?

These games help to deepen learners' understanding of place value. The games also develop an appreciation of probability as they require judgement about **where** to place the numbers in the grid and whether a 'better' number for that position is likely to come up subsequently.

Learning objectives

In doing this activity students will have an opportunity to:

- To deepen understanding of place value.
- To develop number sense and awareness of how chance affects outcomes of an event.

Generic competences

In doing this activity students will have an opportunity to:
In doing this activity students will have an opportunity to:

- **think mathematically and flexibly**, reason logically;
- **apply knowledge** from one topic to a situation based around a different topic;
- **develop life skills** as many decisions in life depend on probability.

Follow up

These are a few examples and there are more on the AIMING HIGH website.
Target 100 https://aiminghigh.aimssec.ac.za/years-4-5-target-100/
Target 10 Thousand https://aiminghigh.aimssec.ac.za/years-5-7-target-10-thousand/
Target Subtraction https://aiminghigh.aimssec.ac.za/years-4-7-target-subtraction/
Target Multiplications
https://aiminghigh.aimssec.ac.za/years-4-7-target-multiplication/
Target Division https://aiminghigh.aimssec.ac.za/years-5-7-target-division/

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 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	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