Is it fair?

Student booklet

6

Mathematics

Queensland Comparable
Assessment Tasks
(QCATs) 2011

Given name: .....

Family name: .....

School: .....

Queensland Government

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Setting the scene: Group discussion

Games of **chance** are games where an outcome is decided using devices such as dice, coins, cards, spinners, wheels or tickets. These devices produce a **random** result.

Games of chance can be **fair** or **unfair**.

Your teacher will lead a discussion about games of chance. Think about these questions:

- What are some examples of games of chance?
- What does the term **fair** mean?
- What does the term **unfair** mean?

Activity

In the game “Take a spin”:

- players use their spinners, and score a point based on the difference between the two spinners
- the first player to score 10 points wins the game.

Your teacher will now read through the rules for the game, and will organise you into pairs to play the game.

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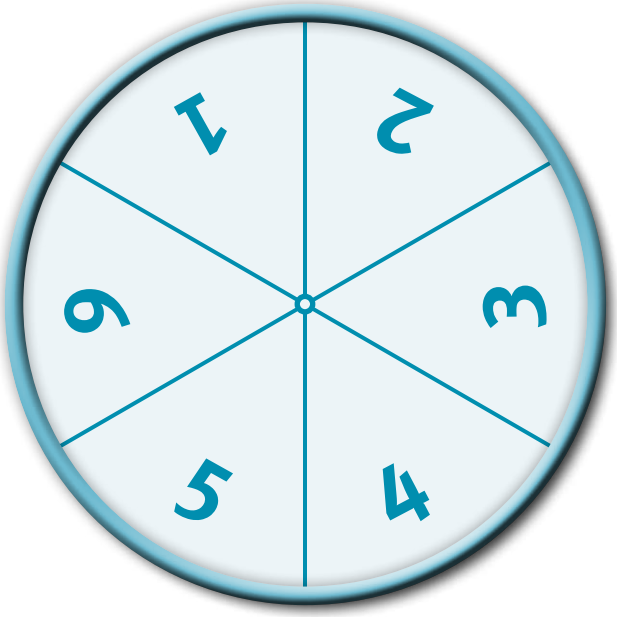
Images Creative Commons Attribution 2.0 Generic licensed photos <http://creativecommons.org/licenses/by/2.0> accessed 6 Jan 2011: p. 1 Spinner: Calsidyrose’s photostream, “Spinner”, <www.flickr.com/photos/calsidyrose/4533776312>; Dice: Kirstea’s photostream, “Dd: Dice”, <www.flickr.com/photos/kirstea/4884298267>. All other images © QSA.

Take a spin

Number of players: 2

Equipment: pencil, paperclip



Rules for play

Getting ready

- Both players spin.
- The player who spins the lowest number will be Player A.

Playing the game

- Both players spin.
- When each spinner stops, find the difference between the numbers.
- If the **difference** is 0, 1 or 2, then Player A scores a point.
- If the **difference** is 3, 4 or 5, then Player B scores a point.
- Use a tally mark to record each point.

Winning the game

The first player to score 10 points wins the game.

Game	Player A (0, 1 or 2)	Player B (3, 4 or 5)
Sample	𝍸 𝍸	𝍸 |
1		
2		

More group discussion

Your teacher will lead a discussion about the game "Take a spin". Think about this question:

Is the game "Take a spin" fair or unfair?

In this assessment, you will:

- collect and analyse data
- think about what possible outcomes can occur
- find different likelihoods
- write an explanation
- plan and explain a new set of rules.

Stop here: Wait for your teacher's directions.

Collecting and analysing experimental data

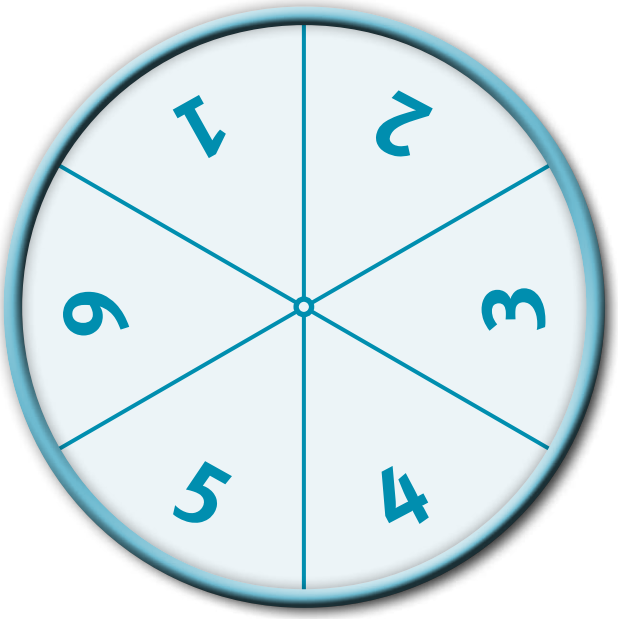
Activity

Play "Take a spin" in your pairs again. Complete Question 1 as you play.

1. Complete Graph 1 by using a cross (✕) to record the difference for each spin while you play the game.

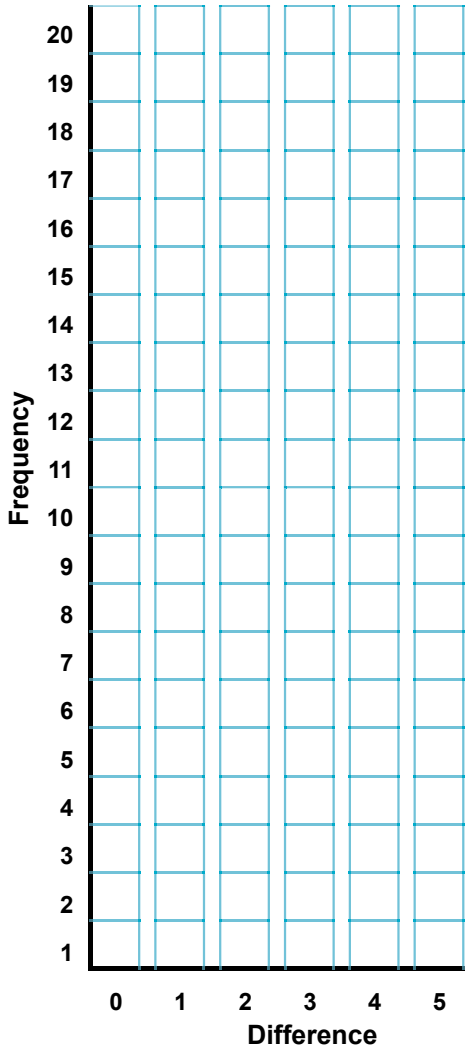
Stop recording if one of the differences reaches the top of the graph.
Finish the game you are playing if this happens.

Take a spin



Game	Player A (0, 1 or 2)	Player B (3, 4 or 5)
1		
2		
3		
4		
5		
6		

Graph 1: Frequency of each difference



Use Graph 1 on page 4 to answer Question 2.

2. **a) Complete the Frequency column in Table 1 below.**

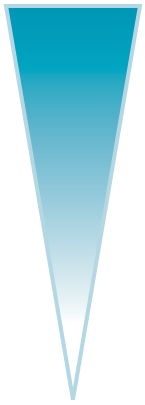
b) In the Likelihood column, express the likelihood of spinning each difference as a common fraction.

c) Order the differences from most likely to least likely in Diagram 1.

Table 1: Likelihood of spinning each difference

Difference	Frequency	Likelihood
0	.....	.....
1	.....	.....
2	.....	.....
3	.....	.....
4	.....	.....
5	.....	.....
Total	.....	

Diagram 1: Order of likelihood

Difference	Likelihood
	most likely  least likely

Stop here: Wait for your teacher's directions.

Exploring outcomes and theoretical likelihood

This grid shows all **possible outcomes** when using two spinners and finding the difference.
Use the grid to answer the questions below.

Player A	Player B: 1	2	3	4	5	6
1	0	1	2	3	4	5
2	1	0	1	2	3	4
3	2	1	0	1	2	3
4	3	2	1	0	1	2
5	4	3	2	1	0	1
6	5	4	3	2	1	0

The difference of 4 has 4 possible outcomes.

These can be written as:

(1, 5) (2, 6) (5, 1) (6, 2)

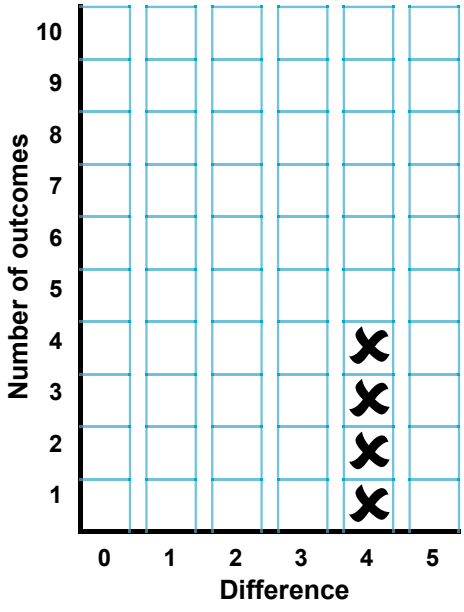
3. **a) How many possible outcomes have a difference of 2?** .....

b) Write all the possible outcomes that have a difference of 3.

.....

c) Complete Graph 2 by using a cross (✕) to indicate the number of outcomes for each difference.

Graph 2: Number of outcomes for each difference



The possible outcomes for the difference of 4 have been completed for you.

Look at the shape of Graph 1 on page 4 and Graph 2 on page 6, then complete the sentence below.

4. **The two graphs may not be the same shape because:** .....

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Use Graph 2 to answer the following.

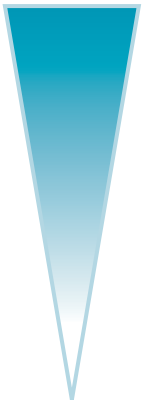
5. **a) Complete Table 2 below.**

b) Order the differences from most likely to least likely in Diagram 2.

Table 2: Likelihood of spinning each difference

Difference	Number of outcomes	Likelihood
0	.....	.....
1	.....	.....
2	.....	.....
3	.....	.....
4	.....	.....
5	.....	.....
Total	.....	

Diagram 2: Order of likelihood

Difference	Likelihood
	most likely  least likely

Stop here: Wait for your teacher's directions.

It’s not fair!

During the group discussion (page 3), you talked about the question:

Is the game “Take a spin” fair or unfair?

6. Explain why the game is not fair.

Use the information you have collected to support your explanation.

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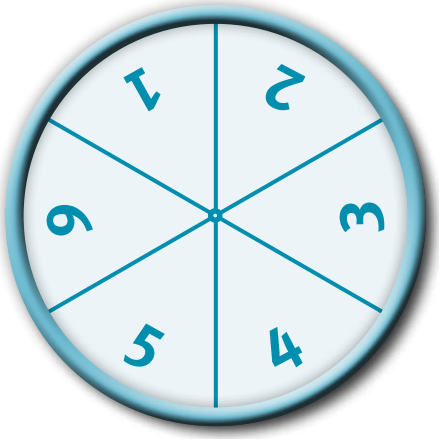
Stop here: Wait for your teacher's directions.

Applying your learning

In a fair game, each player has an equal chance of winning.

7. **Make the game "Take a spin" fair.**
Complete the rules below.

Take a spin



Rules for play

Getting ready

- Both players spin.
- The player who spins the lowest number will be Player A.

Playing the game

- Both players spin.
- When each spinner stops, find the difference between the numbers.
- If the **difference** is .....

  then Player A scores .....
- If the **difference** is .....

  then Player B scores .....
- Use a tally mark to record each point.

Winning the game

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8. **Explain how your changes to the game make it fair.**

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9. **If "Take a spin" is now a fair game and Player A has won 5 out of 5 games, what is the likelihood that Player B will win game 6?**

Use a cross to indicate the likelihood on the line below.

Explain your answer.

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Guide to making judgments — Year 6 Mathematics

Name .....

Focus: Apply knowledge of chance events, variation and bias to develop arguments and improve game fairness.

Knowledge and understanding	Thinking and reasoning Reflecting	Communicating	
Uses possible outcomes and frequency to estimate likelihood as a common fraction. Compares and orders estimates of likelihood. Identifies differences between graphs. Questions 1–5	Reflects on learning and applies new understandings to: • develop mathematical arguments • plan, evaluate and explain changes to game rules. Questions 6–9	Communicates using mathematical language and representations to justify thinking and reasoning. Questions 1–3, 6, 8, 9	
◀ Explains differences between graphs using a comprehensive understanding of the factors influencing chance events and variation.	◀ Justifies arguments using a comprehensive mathematical interpretation of the quantitative data and factors influencing chance events and bias.	◀ Communicates and justifies thinking and reasoning using clear mathematical language.	**A**
	◀ Makes changes to rules which make the game fair. Accurately judges Player B's chances of winning, and justifies using an understanding of chance events.		**B**
◀ Correctly compares and orders estimates of likelihood, and identifies outcomes with equal likelihoods. Considers chance events when explaining differences between graphs. ◀ Correctly expresses likelihoods as common fractions.	◀ Makes changes to rules which improve the fairness of the game. Considers chance events in arguments.	◀ Communicates using appropriate mathematical language.	**C**
◀ Translates information from graphs into tables. Identifies obvious mathematical differences between graphs. Identifies a most and least likely outcome.	◀ Makes a relevant statement about why the game is unfair or why the rule changes are fair. Identifies likelihood of Player B winning.		**D**
◀ Identifies numbers of outcomes from grid.	◀ Makes a change to the rules.	◀ Records possible outcomes and frequency in graphs.	**E**

Feedback .....

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