



# Is it fair?

Sample responses



# 6

## Mathematics

Queensland Comparable  
Assessment Tasks  
(QCATs) 2011

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## B Sample: Response 1

### 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: <ul style="list-style-type: none"><li>• develop mathematical arguments</li><li>• plan, evaluate and explain changes to game rules.</li></ul> 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.
◀ Correctly compares and orders estimates of likelihood, and identifies outcomes with equal likelihoods. Considers chance events when explaining differences between graphs.	◀ 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.	
◀ 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.
◀ 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.	
◀ Identifies numbers of outcomes from grid.	◀ Makes a change to the rules.	◀ Records possible outcomes and frequency in graphs.

Demonstrates all of the descriptors up to this level and aspects of the descriptor above.

The factors influencing chance events and variation are not drawn out enough in Q5 to be considered "comprehensive".

Demonstrates all of the descriptors up to this level and aspects of the descriptor above.

The analysis of quantitative data in the justification in Q6 is not considered "comprehensive".

Demonstrates all of the descriptors up to this level and aspects of the descriptor above.

Explanations and justifications use appropriate mathematical language.

### Overall grade

This response demonstrates a high level of achievement across all assessable elements. It is judged to be a B.

# Collecting and analysing experimental data

## Activity

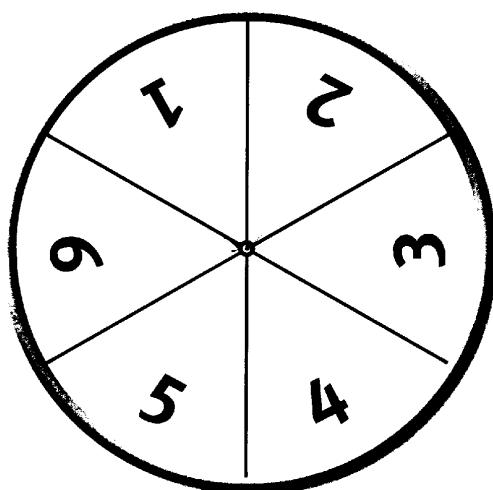
Play "Take a spin" in your pairs again. Complete Question 1 as you play.



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

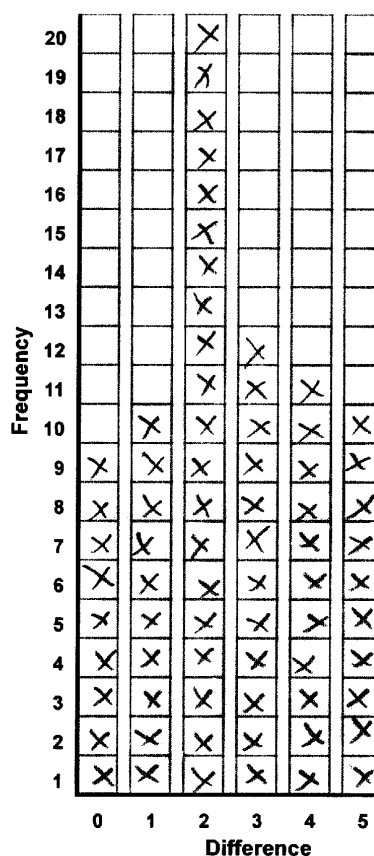
Stop recording if one of the differences reaches the top of the graph.  
Finish the game you are playing if this happens.

**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



## B Sample: Response 1

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	9	$\frac{9}{72}$
1	10	$\frac{10}{72}$
2	20	$\frac{20}{72}$
3	12	$\frac{12}{72}$
4	11	$\frac{11}{72}$
5	10	$\frac{10}{72}$
Total	72	

Diagram 1: Order of likelihood

Difference	Likelihood
2	most likely
3	
4	
5, 1	
0	
	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 B					
		1	2	3	4	5	6
Player A	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)

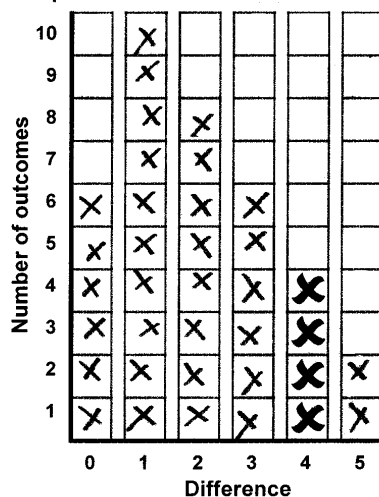
3. a) How many possible outcomes have a difference of 2? 8

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

(4, 1), (5, 2), (6, 3), (1, 4), (2, 5), (3, 6)

c) Complete Graph 2 by using a cross (X) 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.

## B Sample: Response 1

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: graph 1 was chance  
and we didn't know what we would get & graph  
2 was showing the chances to win, we know  
what we would get on this graph.

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	6	$\frac{6}{36}$
1	10	$\frac{10}{36}$
2	8	$\frac{8}{36}$
3	6	$\frac{6}{36}$
4	4	$\frac{4}{36}$
5	2	$\frac{2}{36}$
Total	36	

Diagram 2: Order of likelihood

Difference	Likelihood
1	most likely
2	
0, 3	
4	
5	
	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.

There are more possible outcomes of player A's numbers. 0 has 6 possible outcomes, 1 has 8 possible outcomes and 2 has 8 possible outcomes. For player B, 3 has 6 possible outcomes, 4 has 4 possible outcomes and 5 has only 2 possible outcomes. So player A has a way better chance of winning every game than player B.



## 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

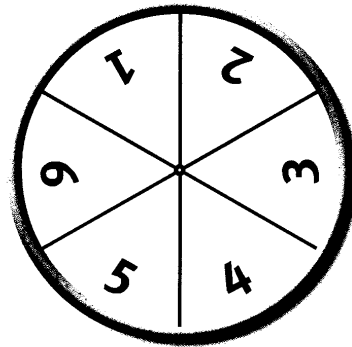
- Both players spin.
- The player who spins the lowest number will be Player A.

##### Playing the game

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

##### Winning the game

the first person to 20 points win



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

my changes to the game make it fair because  
there are 36 possible outcomes altogether and then  
are divided into 2 which is 18 and then I gave 0, 1  
and 5 to player A and I gave 2, 3, 4 to player B  
which gave them 18,

## B Sample: Response 1

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.

impossible      unlikely       $\times$       equally likely      likely      certain

Explain your answer.

now both of them have an equal chance of 18  
possible outcomes each, and its an even chance of  
anyone winning

## B Sample: Response 2

### 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: <ul style="list-style-type: none"><li>develop mathematical arguments</li><li>plan, evaluate and explain changes to game rules.</li></ul> Questions 6–9	Communicates using mathematical language and representations to justify thinking and reasoning. Questions 1–3, 6, 8, 9
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◀ 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.
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◀ Identifies numbers of outcomes from grid.	◀ Makes a change to the rules.	◀ Records possible outcomes and frequency in graphs.

Demonstrates all descriptors up to and including this level.

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Judgment of Player B's chances of winning in Q9 demonstrates a lapse in understanding of fairness and independent events.

There is a lack of depth in the explanation of why the new rules are fair in Q8, but this is balanced by an elegant solution in Q7.

Demonstrates all of the descriptors up to this level and aspects of the descriptor above.

Explanations and justifications use appropriate mathematical language.

### Overall grade

This response demonstrates a sound level of achievement in **knowledge and understanding** and high level of achievement in **thinking and reasoning, reflecting** and **communicating**.

The focus of this QCAT is on **thinking and reasoning** and **reflecting**.

On balance, it is judged to be a B.

# Collecting and analysing experimental data

## Activity

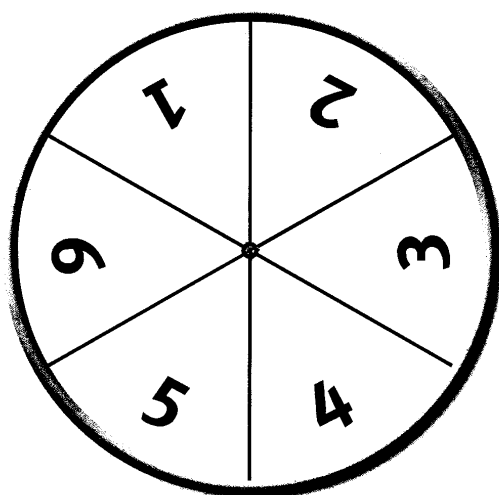
Play "Take a spin" in your pairs again. Complete Question 1 as you play.



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

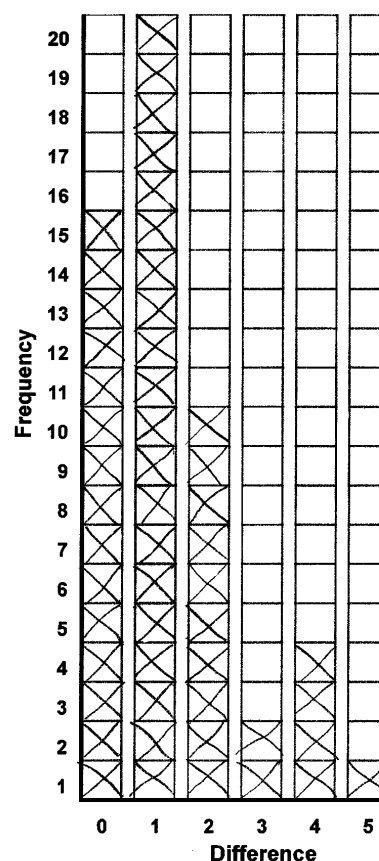
Stop recording if one of the differences reaches the top of the graph.  
Finish the game you are playing if this happens.

**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



## B Sample: Response 2

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	15	$\frac{15}{52}$
1	20	$\frac{20}{52}$
2	10	$\frac{10}{52}$
3	2	$\frac{2}{52}$
4	4	$\frac{4}{52}$
5	1	$\frac{1}{52}$
Total	52	

Diagram 1: Order of likelihood

Difference	Likelihood
1	most likely
0	
2	
4	
3	
5	
	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 B					
		1	2	3	4	5	6
Player A	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)

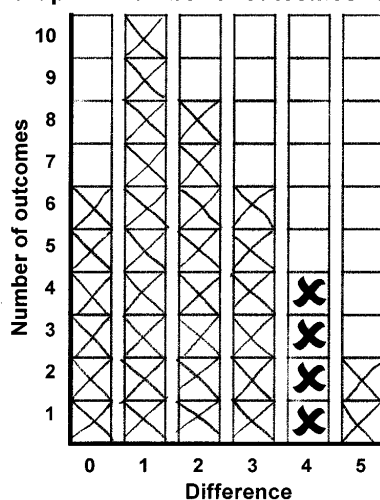
3. a) How many possible outcomes have a difference of 2? 8

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

(1, 4) (2, 5) (3, 6) (4, 1) (5, 2) (6, 3)

c) Complete Graph 2 by using a cross (X) 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.

## B Sample: Response 2

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: the 2<sup>nd</sup> graph is a graph of theoretical outcome where as the 1<sup>st</sup> graph is our actual outcome. It is very unlikely for both graphs to both be the exact same

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	6	$\frac{6}{36}$
1	10	$\frac{10}{36}$
2	8	$\frac{8}{36}$
3	6	$\frac{6}{36}$
4	4	$\frac{4}{36}$
5	2	$\frac{2}{36}$
Total	36	

Diagram 2: Order of likelihood

Difference	Likelihood
1	most likely
2	
3, 0	
4	
5	
	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.

The game 'take a spin' is definately not fair because there is much more chance of player a's differences coming out than player b's differences. Player a has exactly double the chance of getting their own difference than player b. Player a has all the numbers that are most likely to come up and player b has the numbers that is least likely to come out. Therefore, this is clearly and totally unfair.



## 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**

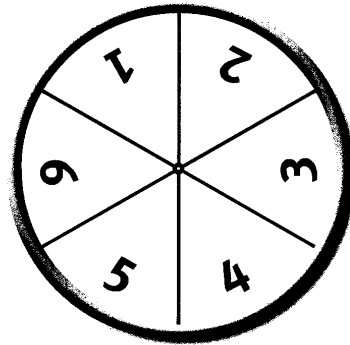
- Both players spin.
- When each spinner stops, find the difference between the numbers.

- If the **difference** is 0, 1, 2  
then Player A scores 1 point for each
- If the **difference** is 3, 4, 5  
then Player B scores 2 points for each

- Use a tally mark to record each point.

##### **Winning the game**

1<sup>st</sup> player to reach 20 points wins



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

I still kept the differences the same but doubling the  
amount of points player b gets each time makes it fair

## B Sample: Response 2

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.

impossible                  unlikely                  equally likely                  **X**                  likely                  certain

Explain your answer.

If I make the points more for player b the game would be over more quickly. Player a would have to get 1 point  $\times 20$  but it is more likely difference and player b would get 2 points  $\times 10$ .