

F	1	2	3	4	5	6	B6
---	---	---	---	---	---	---	----

# What are my chances?

**Strand:**

Chance and data

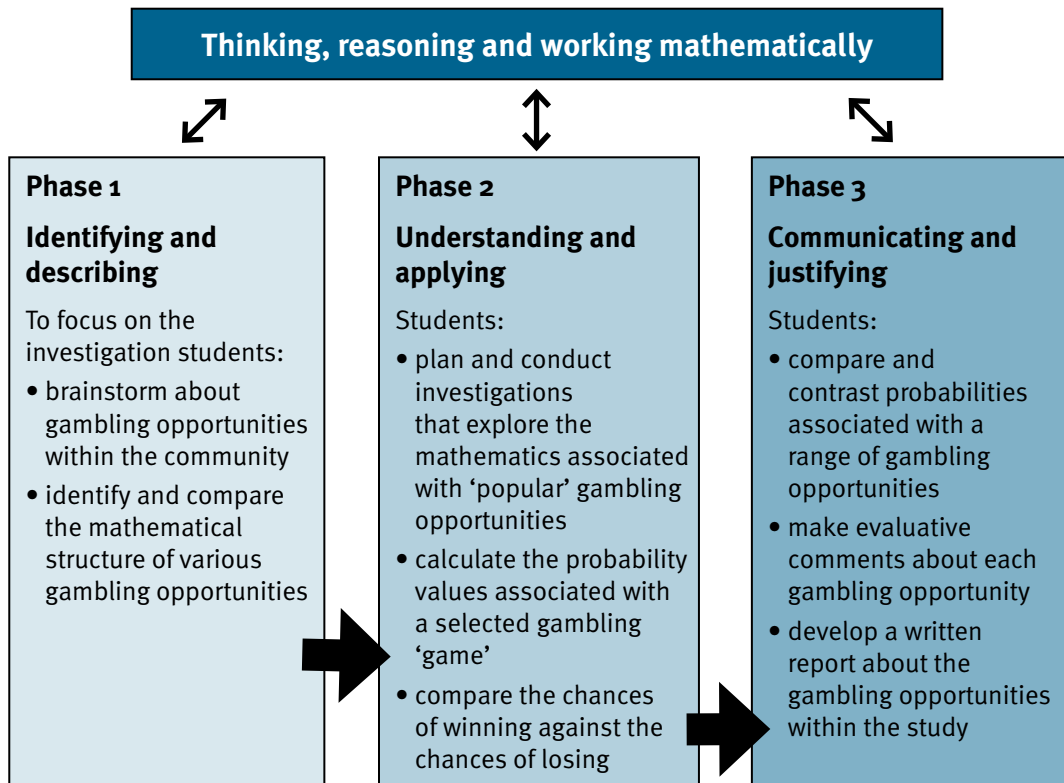
**Purpose:**

The main purpose of this module is to allow students to discover the real chance of ‘winning big’ on any of the common gambling opportunities in the community. As they do this, students will explore the language and concepts of chance through the context of gambling opportunities that are readily visible within the community. They will model and evaluate some of these gambling opportunities and explore the numerical values of various outcomes. They will work out the probability values of these outcomes, expressing them using decimal fractions (between 0 and 1) or as percentages (between 0% and 100%).

The students will create written and oral reports that describe the realistic picture about winning and losing. These reports will also identify the criteria students use when reasoning about chance events and making judgements about likelihood.

**Overview of activities**

The following table outlines the activities in this module about common gambling opportunities and the mathematics associated with them. It illustrates the way in which these are organised in phases and how they promote **thinking, reasoning and working mathematically**.



## Core Learning Outcome

This module focuses on thinking and reasoning about a range of gambling opportunities. The related Level 5 Chance core learning outcome is:

CD 5.1 Students model and determine probabilities for single events to justify statements and decisions.

## Core Content

The assessment criteria related to demonstration of this outcome in blue type have some relevance to the context of this module. All of the other criteria appear in green type. Teachers can use the blue criteria as the basis of their assessment of students' understanding of the chance concepts included in this investigation.

### Chance

#### Likelihood

- language of chance
  - o theoretical probability (of a single event)
- probability models
  - o lists, tables, tree diagrams
  - o computer simulations
  - o experiments

#### Judgements

- quantitative judgements
  - o probability of events with equally likely outcomes
  - o fair, unfair and biased judgements
  - o probability to support statements and decisions (single events)
  - o experimental and theoretical probability links
  - o extrapolations from simplified explorations

## Assessment

The assessment advice in the following table is based upon the *Elaborations* provided by the Queensland Studies Authority on its website ([www.qsa.qld.edu.au](http://www.qsa.qld.edu.au)).

The *Elaborations* are a resource that supports teachers to unpack each core learning outcome. They include statements about what students should know and what they should be able to do with that knowledge. The latter set of statements can be used as assessment criteria when determining the quality of students' learnings.

### CHANCE Topic

Core learning outcome	What students should know	Assessment criteria
		What students should be able to do
CD 5.1 Students model and determine probabilities for single events to justify statements and decisions.	5a different ways to model single events involving probability	<ul style="list-style-type: none"> <li>o use probability models to illustrate possible outcomes and their probability</li> <li>o make and justify judgements in terms of fairness, unfairness and bias</li> <li>o use lists, tables, tree diagrams, computer simulations and experiments to model various probability events</li> </ul>
	5b theoretical and experimental probabilities provide numerical values for the likelihood of occurrence of single events	<ul style="list-style-type: none"> <li>o compare experimental and theoretical probabilities and use the information to justify decisions such as amending rules to enhance the flow of the game</li> <li>o conduct simulated experiments involving equally likely outcomes to critically investigate the probabilities involved (e.g. determining the chances of winning the raffle if you have one ticket or five tickets, or the chance of rolling a six for a game)</li> <li>o determine and calculate the theoretical probabilities in appropriate events</li> <li>o calculate the experimental probabilities of various events by collecting relevant data</li> </ul>
	5c statements and decisions are justified by theoretical and experimental probabilities	<ul style="list-style-type: none"> <li>o analyse collected or given data collections to inform predictions and decisions</li> <li>o model and determine the probability of particular outcomes</li> <li>o comment on the probability of predictions and decisions based on the quantity and appropriateness of the available data</li> <li>o use probability to predict the likelihood of other outcomes in similar situations</li> </ul>

### **Contributions to the valued attributes of a lifelong learner**

Through engagement with activities in this module, students develop the following attributes:

#### **Knowledgeable person with deep understanding**

- understands the concept of chance
- is able to make judgements about likely outcomes

#### **Complex thinker**

- analyses and organises information

#### **Active investigator**

- uses experiments and other tools to investigate questions
- accesses information from a variety of sources

#### **Responsive creator**

- uses a variety of displays to present information to a chosen audience

#### **Effective communicator**

- presents data collections to others using different data displays
- uses data displays as a means of communicating information

#### **Participant in an interdependent world**

- works independently and in groups, and acknowledges the ideas of others

#### **Reflective and self directed learner**

- looks for and recognises ways of “working mathematically” in everyday life

## Background information

### Gambling in Australia

Gambling is an integral part of Australian culture. It is an activity that has saturated the everyday and has impacted on the realities of children and young people.

*Today's juveniles are the first generation to be raised in an environment where legalised gambling is so pervasive, readily accessible and socially acceptable.*<sup>1</sup>

For many people, gambling is a recreational interest that provides important opportunities for social interaction, and is a harmless and enjoyable pastime. However, others may gamble excessively, resulting in high economic, social, family and personal costs. According to the *Queensland Household Gambling Survey (2001)* 0.83% of the Queensland adult population or about 22,000 people experience problems with their gambling<sup>2</sup>.

It is difficult to define 'problem gambling' because behaviours and situations that harm some individuals may not cause problems for others. However, a problem gambler can be defined as 'a person whose gambling has caused unmanageability or problems in some areas of ...life, e.g. financial, marital, work, emotions, health, loss of identity, depression etc.'<sup>2</sup> For the purpose of this module, responsible gambling could be defined as participating in gambling practices that do not result in negative health outcomes.

To read more about gambling's impact on young people refer to the Introduction section of your *Responsible Gambling Teaching Resource Kit*.

### Students and disclosure

If students make personal disclosures about gambling-related issues, professional support for the family or child is available through the Gambling Helpline (1800 222 050), local Gambling Help services and other community agencies such as Gam-Anon. Students may also access the Kids Help-line (1800 551 800).

Contact numbers for Gambling Help services are provided on a poster in the folder of your *Responsible Gambling Teaching Resource Kit*.

Details of help services can also be accessed via the Responsible Gambling website (<http://www.responsiblegambling.qld.gov.au>)

### School authority policies

Be aware of and observe school authority policies that may be relevant to this module. Education Queensland policies can be found at ([www.education.qld.gov.au/corporate/doem/sindex/m-ind.htm](http://www.education.qld.gov.au/corporate/doem/sindex/m-ind.htm)).

For policies and guidelines for the Catholic sector, refer to the Queensland Catholic Education Commission website ([www.qcec.qld.catholic.edu.au/policies.htm](http://www.qcec.qld.catholic.edu.au/policies.htm)).

*Responsible Gambling Education Principles and Guidelines* should be referred to. These can be found in section 2 of your Teaching Resource Kit or accessed via the Responsible Gambling website ([www.responsiblegambling.qld.gov.au](http://www.responsiblegambling.qld.gov.au)).

<sup>1</sup> Jacobs (2000) *Juvenile Gambling in North America: Analysis of long term trends and future*, *Journal of Gambling Studies* 16 (2/3) pp 119-152.

<sup>2</sup> Queensland Treasury (2001) *Queensland Household Gambling Survey*, Queensland Government, p.2.

<sup>3</sup> Symond, P. (1997) *A synopsis of problem/compulsive gambling*, in K. Healey (ed.), *Gambling: Issues for the Nineties*, The Spinney Press, Sydney.

Phase 1 Identifying and describing

## What is gambling and why do people gamble?

### Students

- ▶ Have the students brainstorm about gambling and their perceptions of what constitutes gambling.
- ▶ Have students make suggestions about why people take up gambling and why some people gamble too much.
- ▶ They should discuss their own observations about gambling in response to questions such as:
  - o *Where can people go in the community to gamble?*
  - o *Should all of the ‘games’ people play (such as Lotto, Keno, Scratch Caskets) be classed as gambling?*
  - o *Aren’t most of these games just harmless fun?*

### Teaching considerations

- In your class discussion, refer to Resource Sheet 1 and OHTs 1 and 2. The orienting activities in Idea Sheet 1, *The games we play*, will provide you with some discussion points around these resources.
- As students share their perceptions about gambling, teachers should be sensitive about privacy issues and stop students if they seem to be sharing information that is too personal about their family beliefs and practices.
- The students should be encouraged to access the Responsible Gambling website (<http://www.responsiblegambling.qld.gov.au>) and read the information provided in *School Stuff*.
- Investigate some of the history of gambling using Resource Sheets 3 and 4 and OHT 4. The orienting activities in Idea Sheet 2, *As time goes by*, will provide you with some discussion points around these resources.
- They should also refer to the materials in the *Responsible Gambling Teaching Resource Kit* for information about gambling in the community. Students might watch and discuss the video programs or listen to the CD material. Section 12 of the Resource Kit provides a brief synopsis of the audio-visual contents.
- Students might watch one of the programs within the ABC video – perhaps *Enough Rope* which explores the life-changing issues associated with problem gambling.
- Discuss the issue of problem gambling with the students – and why it is considered a problem. Refer to OHT 24 for a definition of problem gambling. You should also consider using Resource Sheets 10 and 24 in your Resource Kit to assist with this discussion.
- Have students read the newspaper article in Resource Sheet 35 – *Concerns raised over rising rate of teen gambling*. (Note: Orillia is a town in the south of the Ontario Province in Canada, near the Great Lakes). There are three underlined statements that students should discuss.
  - The first refers to one of the myths about gambling – that it is an easy way to make money.
  - The second is the often quoted reason for many forms of gambling – for entertainment and fun.
  - The third raises the rise in gambling amongst older adults through their regular participation in lotteries (Lotto, Pools, Keno) and raffles.

- Discuss the other aspects also raised by the writer of the article, including how governments have had to provide additional services to help people who have become problem gamblers as a result of gambling opportunities.
- The students can also use the *Know your limit, play within it* articles (Resource sheet 43) as the basis for discussions about responsible gambling. These articles are part of a series. Students should identify the criteria for responsible gambling discussed within the articles. OHT 23 provides a definition of responsible gambling. The Gamble Responsibly section of the Responsible Gambling website provides more information on responsible gambling.
- Have the students also examine available advertising about Lotto, Keno, Instant Scratch-It games, poker machines etc. They should identify the kinds of people who are the targets of the advertising (such as families, older people) as well as the theme of the particular advertisements (such as buying your kids a house or holiday, retiring comfortably etc).
- Refer to the Level 4 Arts module (*In Control – Taking Responsible Risks*) available in your Resource Kit for ideas on deconstructing these media texts in particular Student Resource 2 (p.27).
- Students could also access the Golden Casket website to read the advertising and information available (<http://www.goldencasket.com>).

• Teachers must be diligent in their monitoring of students' activities on the Golden Casket website and take care that they do not attempt to register on-line for any forms of gambling. Students should be made aware that it is against the law for people under 18 years of age (i.e. minors) to play the games or be sold tickets. Minors also cannot collect any winning prizes.

## Discuss the language and concept of chance

### Students

- ▶ Discuss the concepts of luck and risk with the students.
- ▶ Discuss theoretical probability and how it applies to common gambling opportunities.

### Teaching considerations

- It is important that students begin to understand that any form of gambling involves taking risks. They need to understand the mathematics of any gambling opportunity to understand the risk.
- Distribute Resource Sheet 29 to the class. Draw their attention to the section entitled *The Odds* – they should observe that all of the regular Newsagent games are there. The students should read and discuss the odds of winning the major prize in each of the games.
- Discuss the concept of theoretical probability with the students and how it applies to the various games within the brochure. Discuss the fairness aspect of the Scratch-It games – that every ticket purchased in a new game has the same chance as all the others of being the first prize. This is because no one knows whether the tickets are winners or losers until they are scratched.
- Distribute Resource Sheet 36 to the students for discussion. The tables provide data about the distribution of prizes in the \$5 Instant Scratch-It games in New South Wales and Queensland. Have the students read through the data and make comments about the probabilities of some of the results. They might for example compare the numbers of tickets overall in both games and also the proportions of winning and losing tickets.
- Distribute Resource Sheet 37. Have students refer to the data in Resource Sheets 29 and 36 when considering the answers.
- Once students have decided on their answers, collect the sheets and place them aside. After students have completed Phase 2 of this module, they might decide to make adjustments to some of their responses.

## What numbers are involved in Scratch-It games and could I be one of the lucky ones?

### Students

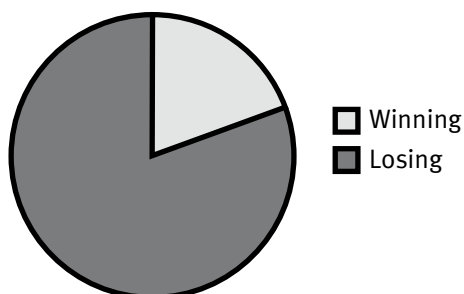
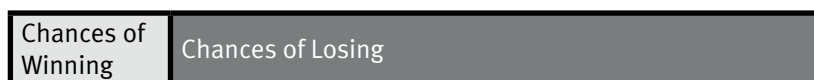
- ▶ Have the students investigate the numbers involved in real Scratch-It games
- ▶ Assist students to model an actual game and investigate their chances of being lucky
- ▶ Have the students experiment with the model and make predictions about their chances

### Teaching considerations

- Have the students simulate the \$1 scratch casket game which involves 3 million tickets. By examining the actual numbers involved, students may better appreciate the probabilities and the risks associated with this kind of gambling. They should:
  - o Select a ‘medium’ such as grains of rice to simulate the game;
  - o Discuss ways of estimating 3 million grains of rice – such as fill one container such as a small cup with rice, count the grains and then work out how many cups are needed to make 3 million grains;
  - o Use the odds in Resource Sheet 29 to estimate the number of winning tickets – the odds given are 1 in 5, so there will be about 600,000 winning grains out of the total;
  - o The students should use the cup to estimate and separate out this number of grains – then these ‘winning tickets’ should be coloured by spraying them lightly with quick drying paint or stain with food colouring. Care should be taken not to change their texture too much otherwise they will ‘feel’ different to or may not mix well with the other grains;
  - o One of the grains might be coloured differently to represent the one major prize;
  - o Once all are dry (and not sticking together) the winning grains should be mixed with the others.
- Discuss students’ perceptions of their chances of selecting a winning ticket at random by inspecting the mixture of grains. If the odds of winning some prize are 1 in 5, then the odds of buying or picking a losing ticket are 4 in 5. The students should express these odds in different ways such as:

<b>Winning</b>	1 in 5	20%	0.2	Unlikely or very unlikely
<b>Losing</b>	4 in 5	80%	0.8	Very likely

The odds can also be represented using a divided bar graph and a pie graph such as those below:



- Using the grains of rice, students should observe and understand that there are four times as many losing tickets as winning tickets. The divided bar graph and the pie graph provide visual evidence about this relationship.
- The students should make statements about the theoretical probabilities of particular results such as: *My chances of drawing out any coloured grain (a 'winner') are 20%. My chances of picking out a 'loser' are 80%.*
- Allow students to conduct a number of 'blind draws' by placing all of the grains in an opaque container. They should draw out one grain, see if it is coloured and then place it aside (to simulate the purchase of tickets). They should keep records of the numbers of winning and losing grains. After a selected number of draws (such as 100 or more), the students should determine if their experimental data matches the given odds of winning and losing. Students may decide to continue the draws over a period of time and analyse the results.
- **NOTE:** If a student wins on their first attempt it is important to stress how many didn't win at the same time. The memory of past 'wins' can be extremely powerful for young people and it is important to balance the excitement of the win with an examination of the bigger picture.

## What kind of data is collected about other common forms of gambling?

### Students

- ▶ Have students examine data collected about Lotto draws over a long period of time (such as a year).
- ▶ Does this data provide useful information to people trying to identify 'lucky numbers'?

### Teaching considerations

- Distribute Resource Sheet 38 to the students for discussion. Have students describe the data in the table and ensure that they understand what it represents – a record of how many times each of the 49 numbers in the Florida Lotto occurred during 1997.
- Students should attempt to identify the same kind of information about Australian Lotto draws over a year – perhaps the Saturday Gold Lotto results. The Golden Casket website (<http://goldencasket.com>) can provide historical information about any year's results – students should click on the 'Results' icon and then link to the results file. Resource Sheet 39 provides a table of results about the 2004 results. Only the first six numbers are considered, not the two supplementary numbers.
- Using Resource Sheet 40, have students complete a frequency table using the 2004 results presented in Resource Sheet 39.
- Discuss with the students whether this kind of data should influence people's decisions about which numbers to choose in future draws. Students might conduct some simple surveys amongst available adults (including other teachers) about their decision-making criteria if and when they participate in games such as Lotto. You could adapt Resource Sheet 2b to assist with this activity.
- Discuss and emphasise the chance concepts of fairness associated with the Lotto draws and the independence of each draw.
- Students must understand that each draw is the result of chance – and is not influenced by any previous draws. Students might be involved in discussions about these concepts. For example, if the number 41 came up most in the 1997 data about the Florida Lotto, does this make it any more or less likely to 'come up' in 1998 draws.
  - Does the 41 ball know that it came up most in 1997?
  - Does it have any way to make itself occur most in the 1998 draws?
  - Does another ball, such as the 28 ball, know that it occurred least in 1997 and needs to come up more in 1998?

- Do the balls have any way of influencing the results?
- These questions focus on the fairness and independence aspects that are critical to an understanding of chance.
- Suggest that students use the 2004 data about Saturday Gold Lotto results to make a range of predictions about the 2005 results. Then they can refer to the historical data on the Golden Casket website to see whether the 2004 data did actually have any influence at all over the 2005 results. Ask the students to make statements about the usefulness of this data.
- Refer students again to the data about the odds of successful results contained in Resource Sheet 29 to identify whether their results corresponded with the anticipated probabilities.

### Phase 3 Communicating and justifying

## What does theoretical probability tell me about the various forms of gambling?

### Students

- ▶ Have students identify and describe the theoretical probabilities of different forms of gambling.
- ▶ Have students make suggestions about whether or not particular forms of gambling provide value compared to the risk.

### Teaching considerations

- Distribute the students' responses to the True/False Quiz (Resource Sheet 37) again and allow them to reconsider their answers. They can make adjustments and then the quiz can be marked and discussed as a class.
- Use the data Resource Sheets 29 and 36 showing the NSW and Queensland \$5 Scratch-It games to focus discussions.
- Discuss the choices people have to make and the associated issues in relation to the legal forms of gambling (Note: remind students that it is not legal for people under 18 years of age to participate or collect prizes):
- Will I gamble and risk my money? Yes/No

If the answer is NO, then all of the money remains available for other purposes.

If the answer is YES then:

- How much money will I risk?
- Can I afford to lose all of this money?
- What are my chances of being successful?
- What are my chances of losing?
- Even if I win, is the prize worth the risk?
- Have the students study the odds of winning in Resource Sheets 29 and 36. Have the students convert that data into 'odds of losing'. Therefore, if the odds of winning a \$7 prize in the Queensland \$5 Instant Scratch-It game are one in seven, then the chances of not winning that prize are six in seven or almost 86%.
- From Resource Sheet 29, students can also see that the chances of winning any prize at all in the Super 66 draw are one in 50; therefore the chances of not winning any prize are 49 in 50 or 98%. Students should discuss whether this offers value for money when compared with the risk.
- Have the students write a short report that focuses on gambling. The report should examine the possible outcomes of the gambling opportunity, compare the chances of winning with the chances of losing, and then comment on the amount of risk compared with the worth of the available prizes.

## Useful websites

<http://indigo.ie/~gerryq/index.htm>

Gerry Quinn's website offers a range of games and includes an odds calculator for Lotto games.

<http://goldencasket.com>

The Golden Casket website provides a wealth of information about the legal gambling games played in Queensland. Information can also be found about responsible gambling and historical results of each of the games.

<http://www.phm.gov.au/gambling/>

This website is entitled *Gambling: calculating the risk*. The website presents information researched by staff from the Powerhouse Museum, NSW teachers and Macquarie University. The information on this website was correct at the time of writing (2004). This website has been funded by the Casino Community Benefit Fund (NSW) as an information and education initiative aimed at raising awareness about problem gambling in the community. This website is designed to explain the mathematical principles which underpin gambling.

## Answers to the True/False Quiz.

- a. **False** – minors under the age of 18 years are not permitted to play or collect prizes.
- b. **True** – if the odds of winning any prize are one in four for the \$3 instant scratch-it game, then the chances of winning must be 25%.
- c. **False** – the overall odds of winning a prize with a standard entry (12 game panels) in the Saturday Gold Lotto are calculated as one in 18. This means that the chances of winning any prize are just more than 5%.
- d. **True** – the odds of winning some prize in the \$5 Set for Life game is one in four. This means that three in four or 75% will be losing tickets.
- e. **False** – the odds of winning some prize in the Queensland \$5 instant scratch-it game are listed as one in four. This means that 25% of the tickets will be winners.
- f. **True** – there are 25 prizes worth \$250 each, 5 tickets worth \$2,500 each, one ticket worth \$25,000 and one worth \$250,000.
- g. **False** – the odds of winning some prize in the NSW \$5 instant scratch-it game are about three in 10 (or 30%), while the odds of winning some prize in the Queensland \$5 instant scratch-it game are about one in four (or 25%).
- h. **True** – the odds of winning any prize in the Super 66 game are listed as one in 50. This means that 49 out of 50 will be losers (98%).

