VCE VOCATIONAL MAJOR –
NUMERACY

UNIT 4

ODDS AND PROBABILITY

Acknowledgements

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BE AHEAD OF THE GAME

Introduction

What is Be Ahead of the Game?

Be Ahead of the Game is a school education program about the risks of gambling. Drawing on the latest research, the program's free, curriculum-aligned resources support the whole school community to help students navigate the rapidly evolving gambling landscape and avoid harm from gambling.

Be Ahead of the Game resources are co-developed by the Victorian Responsible Gambling Foundation and Victorian teachers and education professionals. It's one of the ways the Foundation works towards reducing harm from gambling in our communities. The Be Ahead of the Game program offers:

- face-to-face information sessions for teachers, parents and students about the risks of gambling and gaming
- curriculum-aligned teaching resources covering a variety of subject areas
- tools for parents, teachers and schools to develop a gambling harm prevention strategy.

To find out more, visit **beaheadofthegame.vic.gov.au**.

What's the issue?

Gambling has never been more heavily promoted and accessible to young people. Saturation levels of advertising during sport makes it feel like a normal part of the game, while online games and apps put gambling and simulated gambling within easy reach of all age groups. Be Ahead of the Game helps young people cut through the myths and the marketing to be able to think critically about gambling and gaming.

If you are concerned that gambling is affecting a student or someone they know, you can refer them to our free and confidential Gambler's Help Youthline support service on 1800 262 376 or visit gamblershelp.com.au/youthline.

Educators and parents can also contact this service for advice or visit gamblershelp.com.au for more information.

Be Ahead of the Game resources for VCE Vocational Major

The Victorian Responsible Gambling Foundation (VRGF) provides resources to support the delivery of the Victorian Certificate of Education Vocational Major (VCE VM) subjects. VCE VM is accredited at two levels: Year 11 Units 1 and 2, and Year 12 Units 3 and 4. The qualification levels cater for a range of students with different abilities and interests, and support development of personal, workplace and subject-specific skills, knowledge, and attributes. They are designed to help students make informed choices about employment and education pathways.

The Foundation's VCE VM resources support the achievement of outcomes in:

- Literacy
- Numeracy
- Personal development skills.

The following table lists the resources, curriculum areas, units and outcomes that are supported. Detailed curriculum alignment can be found in each resource.

	Literacy							
	Unit 1		Unit 2		Unit 3		Unit 4	
Outcome	1	2	1	2	1	2	1	2
Love the game	●	●						
Potential influences					●	●		

	Personal development skills											
	Unit 1			Unit 2			Unit 3			Unit 4		
Outcome	1	2	3	1	2	3	1	2	3	1	2	3
Knowing the score					●	●						
Knowing when it's a concern										●	●	●

	Numeracy											
	Unit 1			Unit 2			Unit 3			Unit 4		
Outcome	1	2	3	1	2	3	1	2	3	1	2	3
Finances and gambling	●	●	●									
What are the chances?				●	●	●						
Earnings, expenditure, and gambling							●	●	●			
Odds and probability										●	●	●

Note: Not all learning outcomes from a VCE VM unit are covered in each resource.

Resource overview of this unit

Resource focus

Odds and probability (Numeracy - Unit 4) covers a range of topics to help students understand the concepts of chance, probability and odds related to gambling and betting.

The aim is to develop informed attitudes to gambling by clearly:

- illustrating that chance has no memory
- demonstrating that gambling games such as pokies involve random processes, and that previous results have no impact upon future outcomes, which are impossible to predict
- demonstrating that the real winners from gambling are betting agencies and gaming venues seeking to make profits by taking money from players.

Students learn about the randomness of gambling games and experience the difficulty of predicting outcomes and will explore firsthand how betting agencies design products to maximise profits.

Students are encouraged to think critically about the sports and race betting advertising they see to develop informed attitudes to gambling.

Students may work individually, in groups, or as a class to complete the activities. Educators are encouraged to use these worksheets in a manner that both suits student needs and meets the requirements of the VCE Vocational Major curriculum.

The resources in this unit model the approach outlined in the VCE Vocational Major Numeracy Study Design. Further information about the design is available at the Victorian Curriculum and Assessment Authority (VCAA) **website**.

For assessment guidelines and practices, refer to the **VCE Vocational Major Numeracy section** of the website.

Differences between Units 2 and 4

Odds and probability (Numeracy - Unit 4) has been developed to address the learning outcomes from VCE Vocational Major Numeracy Unit 4.

Some of the key differences between the Outcomes and Areas of Study as you move from Units 1 and 2 up to Units 3 and 4 include the following aspects.

- In Outcome 1, the numeracy contexts are very similar, but in Units 3 and 4 there is a move from more local and personal contexts at Units 1 and 2 level, to having a broader perspective of a state-wide, national, or global level. This includes taking a more reflective and critical approach.
- In Outcome 2, each of the four stages of the problem-solving cycle are more complex with students expected to take more responsibility for implementing each stage. For example:
  - the maths being undertaken will be more embedded in a range of relevant, but possibly unfamiliar or non-routine text, materials and tasks as described in stage 1 of the problem-solving cycle.
  - the maths and problem-solving processes being used and applied in stage 2 will be more sophisticated as described in the relevant areas of study.

  - being able to be more reflective when reviewing their work, as described in stage 3 of the problem-solving cycle.
- In Outcome 3, the use of different tools and applications and how they are used is expected to be broader and more sophisticated.
- The mathematical content as described in the areas of study are broader with a range of higher levels of mathematical knowledge and skills.

These differences are reflected in this resource through:

- less dependence on worksheets that contain explicit information up front and pre-set questions, with more expected of the student in terms of researching and finding the information themselves, alongside the use of more open-ended questioning and investigations
- students being asked to take more responsibility for deciding what to do and how – which can include asking the teacher for support and advice
- the use of technology, especially the use of spreadsheet applications, is at a higher level.

Resource elements

This unit comprises five lesson plans, each including:

- learning sequences with teacher notes
- student worksheets for use in class activities
- spreadsheets for demonstrating gambling outcomes and data.

The most up-to-date version of this resource is available at **beaheadofthegame.vic.gov.au**.

Meeting VCE Vocational Major Numeracy requirements

Odds and probability addresses the learning outcomes from VCE Vocational Major Numeracy Unit 4.

The VCE Vocational Major Numeracy units are designed to support students to develop mathematical skills to carry out processes and functions in everyday life. These numerical and mathematical skills should allow for practical application of mathematics in life, work, and the community. The skills in this resource focus on understanding and interpreting a range of different pieces of everyday numerical data and information and using and applying associated calculation skills. They also address financial literacy skills.

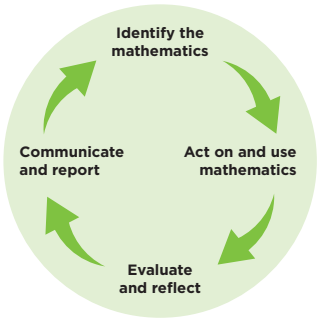
The structure of the VCE Vocational Major Numeracy includes four components.

Outcome 1. Six different numeracy contexts**:**

- personal numeracy
- civic numeracy
- financial numeracy
- health numeracy
- vocational numeracy
- recreational numeracy.

Outcome 2. The four-stage problem-solving cycle required to solve a real-world mathematical problem:

- identify the maths
- act on and use the maths
- evaluate and reflect
- communicate and report.



Problem-solving cycle

Outcome 3. The development and use of a mathematical toolkit as students undertake their numeracy activities and tasks.

Areas of Study. These cover a range of mathematical skills to be applied across the three outcomes. The areas are:

1. number
2. shape
3. quantity and measures
4. relationships
5. dimension and direction
6. data
7. uncertainty
8. systematics.

Curriculum links

The activities in this resource support the development of all three learning outcomes and one main area of study from Unit 2.

Unit	Outcome 1	Outcome 2	Outcome 3	Main Area of Study
4	• Personal • Civic • Financial	●	●	Uncertainty

Below is a summary of how this resource and the associated activities can meet the study design requirements.

Outcome 1

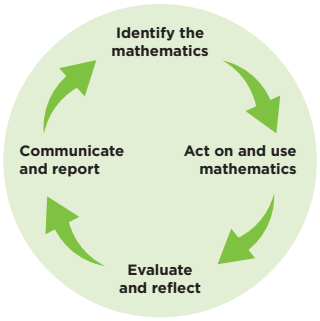
The content of this resource may be used in relation to three numeracy contexts about chance and probability: personal, civic or financial numeracy.

- **Personal numeracy** relates to the mathematical requirements for personal organisational matters involving numbers, data, money, time, and travel, and as such this resource and activities fits into that context.
- **Civic numeracy** relates to participating in civic life through knowing how to stay informed, and understanding government, political and social data, information and processes and it can incorporate the understanding, use and interpretation of quantitative and statistical information.
- **Financial numeracy** relates to understanding and undertaking financial transactions and making informed judgments and decisions regarding the use and management of money. The financial and chances of winning and losing money based on the chance related aspects of gambling and betting is relevant to use for this numeracy.

Outcome 2

All four stages of the problem-solving cycle can be covered by this resource, which details the following four stages and activities:

- identifying the mathematics to be used
- acting on and using mathematics to solve the problem
- evaluating and reflecting on the results
- communicating and reporting the outcomes.



Problem-solving cycle

Outcome 3

This resource requires students to use various tools and applications from their mathematical toolkit to undertake activities and calculations. These tools or applications could include:

- online access to a range of data sources
- calculators
- spreadsheet software
- report or presentation software.

Areas of study covered

The focus of the resource is on **uncertainty**. In this area of study students are expected to use concepts of randomness, chance, and probability. Students should be able to:

- make mathematical predictions about the likelihood of events occurring or not occurring
- consider and make conclusions about likelihood based on different data sets
- make straightforward inferences
- apply the idea of uncertainty to risk
- select the appropriate method or approach required and communicate their ideas
- perform probability and chance related calculations both mentally, manually and using software tools and devices.

There are also some aspects of the Area of Study 6: Data, covered, but it is not covered explicitly in this resource. These materials could easily be adapted and extended to also cover the Data Area of Study for Unit 4.

Key knowledge

In this resource, as described in the VCE Vocational Major numeracy study design, students will need to understand:

- likelihood of events or occurrences happening and how to represent them
- simple unconditional probability events with randomness and chance
- relevant language of chance and their relationship to numerical values associated with chance and probability
- randomness and chance of unconditional probability events
- inferencing from likelihood estimates to inform decision making in relation to real-life events, including risk.

Key skills

Upon completion of this unit, students will need to be able to:

- identify possible outcomes of an event and create visual representations of sample spaces or options
- estimate, predict and calculate the likelihood of events occurring using decimals, ratios, and percentages
- compare different real-life events or probabilities
- make decisions based on inferences about sets of accessible, relevant, and appropriate data and information
- evaluate risk in relation to relevant and appropriate problems with reference to likelihood of events occurring.

Further references to links between the activities and specific elements and learning outcomes is noted in the table below and the following pages. However, the activities are broad and can be undertaken in different ways. The alignment shows what is possible. It is up to teachers to check the students work against the curriculum.

Planning your time

The time allocation for each lesson is 50–100 minutes, although this is a broad estimate. The length of each lesson will depend on several factors, including:

- the amount of discussion generated
- the way the activities are conducted
- the number of trials run for activities.

If there is insufficient class time to deliver all five lessons, it is recommended that Lesson 1 be included as it is key to debunking many of the gambling myths.

Suggested approach

As well as the learning outcomes outlined in the curriculum links above, this unit focuses on three key messages:

1. chance has no memory
2. the greater the number of bets, the greater the certainty of losing the money you start with.
3. payouts are less than the amount bet over time.

Ideally students will go through each lesson, but if time is limited the following components are recommended:

- **Lesson 1** - 'Chance has no memory' is essential to lay the foundation work for lessons that follow it as it includes an activity to help students learn various gambling terminology.
- **Lesson 2** - 'Who are the real winners?' part A focuses on understanding payouts and how gambling agencies use these to make a profit.
- **Lesson 3** - `Pokies' Part A delves further into the risks involved with betting more. Part B, `Know your odds', involves a short engaging activity, although this can be omitted if pressed for time.

The final two lessons further explore the three key messages through sports betting (Lesson 4) and horseracing (Lesson 5), both prominent forms of gambling in Australia. Either lesson flows well from Lesson 3 and can be done in either order. Consider student's interests if you have time for only one.

Assessment

Students are asked to complete a self-assessment and reflection at the end of the unit (Appendix 2 and Appendix 3). They are also expected to undertake a presentation about the risks of gambling based on what they have learnt. This helps meet the requirements of Stage 4 of the problem-solving cycle in Outcome 2.

Additional resources

Students should have access to:

- an interactive whiteboard or a data projector
- the student resources contained and mentioned in this unit (see below)
- cards, coins and tokens as required
- word processing, spreadsheet and presentation software.

Worksheets

Worksheets are provided for each lesson.

There is also a reflection activity handout for students to complete after they have finished the unit. This can be incorporated into their final assessment and is a crucial aspect of the final stages of the problem-solving cycle.

Spreadsheets

Spreadsheets are provided for some lessons. These enable the teacher to demonstrate gambling outcomes, and to collect data for completion of the worksheets, and should be projected in class using a data projector or screen.

NOTE: It is highly recommended that teachers familiarise themselves with these spreadsheets prior to running any of the lessons, so that they know how they work and how the different inputs work and can be manipulated.

Instructions for preparing each spreadsheet are provided in each spreadsheet on the first tab that loads after opening.

Teachers need to ensure that they are set up and working properly. Run some simulations before starting lessons with students.

It also recommended to allow students direct access to the spreadsheets so that they can become familiar with these functions and capabilities of spreadsheet software. It would also support and enable students to generate their own data.

Spreadsheets to be used:

Lesson	Spreadsheet
1 & 2	**Card sharp**
2	**Setting limits**
3	**Pokies**
4	**Sports betting agency**
5	**Melbourne Cup**
5	**A day at the races**

Spreadsheets can also be accessed from **responsiblegambling.vic.gov.au/reducing-harm/schools/resources-teachers/**.

Outline of activities

The tables below detail each of the activities and worksheets and how they meet the VCE Vocational Major Study design.

Lesson:	**1. Chance has no memory (50–100 minutes)**		
Activities	• Initial activities and discussion • Whole class simulation • Worksheets • Final discussion		
Learning objectives	The student will learn that: • chance has no memory • outcomes are impossible to predict • previous outcomes do not affect future ones • for equally likely events, after a very large number of outcomes, the results tend to even out.		
Resources and links to assessment	• Packs of playing cards • Activities 1 and 2 'Be aware of gambling: Terminology' • Activity 3 'Maths knowledge and skills about probability and chance' • 'Card sharp' spreadsheet • Student worksheet 1 'Card sharp' • Student Worksheets 2A and 2B 'Chance has no memory'		
Curriculum links	**Outcome 1**	**Outcome 2**	**Outcome 3**
Outcomes	• Personal, or • Civic, or • Financial	• Identify the maths • Act on and use the maths • Evaluate and reflect • Communicate and report	• The internet and access to a range of sources of information and data • A calculator • The use of spreadsheet software
Area of study	Students will: • identify possible outcomes of an event and create visual representations of sample spaces or options • estimate, predict and calculate the likelihood of events occurring using decimals, ratios and percentages • compare different real-life events or probabilities • make decisions based on inferences about sets of accessible, relevant, and appropriate data and information • evaluate risk in relation to relevant and appropriate problems with reference to likelihood of events occurring.		

Outline of activities

Lesson:	**2. Who are the real winners? (50– 100 minutes)**		
Activities	• Whole class simulation • Spreadsheet demonstration • Worksheets • Final discussions		
Learning objectives	The student will learn that: • differences in payouts arise when a gaming venue is involved • total payouts are not always 100% of the amount bet • games provided by gaming venues are designed to make a profit. • the more a player gambles, the more likely they are to lose money • if a player sets a limit ahead of time and keeps to it, they will be less likely to lose money. Students will also interpret graphs generated by a spreadsheet.		
Resources and links to assessment	• A pack of playing cards • Tokens • 'Card sharp' spreadsheet • Student worksheet 3 'Who are the real winners?' • 'Setting limits' spreadsheet • Student worksheet 4 'Setting limits'		
Curriculum links	**Outcome 1**	**Outcome 2**	**Outcome 3**
Outcomes	• Personal, or • Civic, or • Financial	• Identify the maths • Act on and use the maths • Evaluate and reflect • Communicate and report	• The internet and access to a range of sources of information and data • A calculator • The use of spreadsheet software
Area of study	Students will: • identify possible outcomes of an event and create visual representations of sample spaces or options • estimate, predict and calculate the likelihood of events occurring using decimals, ratios, and percentages • compare different real-life events or probabilities • make decisions based on inferences about sets of accessible, relevant, and appropriate data and information • evaluate risk in relation to relevant and appropriate problems with reference to likelihood of events occurring.		

Lesson:	**3. Poker machines (50–100 minutes)**		
Activities	• Whole class simulation • Spreadsheet demonstration • Worksheets • Final discussions		
Learning objectives	The student will learn that: • random mathematical processes control poker machines, • payouts are less than the amounts bet over time • gaming machine venues can legally make payouts less than the amounts played • the greater the number of bets the greater the certainty of losing all the money they started with Students will also collect and analyse data to compare results of short-term and long- term gambling.		
Resources and links to assessment	• 'Pokies' spreadsheet • Student worksheet 5 'Pokies' • **Knowyourodds.net.au** website • Student worksheet 6 'Discover how much you can lose'		
Curriculum links	**Outcome 1**	**Outcome 2**	**Outcome 3**
Outcomes	• Personal, or • Civic, or • Financial	• Identify the maths • Act on and use the maths • Evaluate and reflect • Communicate and report	• The internet and access to a range of sources of information and data • A calculator • The use of spreadsheet software
Area of study	Students will: • identify possible outcomes of an event and create visual representations of sample spaces or options • estimate, predict and calculate the likelihood of events occurring using decimals, ratios, and percentages • compare different real-life events or probabilities • make decisions based on inferences about sets of accessible, relevant, and appropriate data and information • evaluate risk in relation to relevant and appropriate problems with reference to likelihood of events occurring.		

Lesson:	**4. Sports betting (50 minutes)**		
Activities	• Whole class simulation • Spreadsheet demonstration • Worksheets • Final discussions		
Learning objectives	The student will learn that: • the difference in potential winnings for players depending on whether or not a betting agency is involved • that higher payouts are matched with lower probabilities of winning • you can explain expected gambling losses in terms of probabilities and payouts.		
Resources and links to assessment	• A pack of playing cards • A coin • Tokens • 'Sports betting' spreadsheet • Student record sheet 'Sports betting simulation' • Student worksheets 7 and 8 'Sports betting'		
Curriculum links	**Outcome 1**	**Outcome 2**	**Outcome 3**
Outcomes	• Personal, or • Civic, or • Financial	• Identify the maths • Act on and use the maths • Evaluate and reflect • Communicate and report	• The internet and access to a range of sources of information and data • A calculator • The use of spreadsheet software
Area of study	Students will need to be able to: • identify possible outcomes of an event and create visual representations of sample spaces or options • estimate, predict and calculate the likelihood of events occurring using decimals, ratios and percentages • compare different real-life events or probabilities • make decisions based on inferences about sets of accessible, relevant, and appropriate data and information • evaluate risk in relation to relevant and appropriate problems with reference to likelihood of events occurring.		

Lesson:	5. Horseracing (50–100 minutes)		
Activities	• Whole class simulation • Spreadsheet demonstration • Worksheets • Final discussions • Reporting back and presentations		
Learning objectives	The student will learn that: • betting products provided by betting agencies are designed to make profits from players • higher payouts are matched with lower probabilities of winning. • calculate the probability of winning and the 'bet-to-payout ratio' • recognise that gaming venues make money when the • bet-to-payout ratio is greater than the probability of winning.		
Resources and links to assessment NOTE: Includes final assessment and presentations	• Horse name cards • Suitable prizes to simulate money • 'Melbourne Cup' spreadsheet • 'A day at the races' spreadsheet • A video clip of the **2017 Melbourne Cup** • Student worksheets 9, 10, and 11 'The sweep' • Student record sheet 'A day at the races' • Play money • Six-sided die • Student worksheets 12, 13 and 14 'A day at the races' **Assessment, report and presentation:** • Students are asked to complete a self-assessment at the end of the unit. Students complete the reflection activity (Appendix 2) and the self-assessment (Appendix 3), and also undertake the development of a presentation about the risks of gambling based on what they have learnt. • Teachers will provide feedback to students via conferencing, reflecting on the key elements achieved and areas for future development and focus.		
Curriculum links	**Outcome 1**	**Outcome 2**	**Outcome 3**
Outcomes	• Personal, or • Civic, or • Financial	• Identify the maths • Act on and use the maths • Evaluate and reflect • Communicate and report	• The internet and access to a range of sources of information and data • A calculator • The use of spreadsheet software • Software for creating a report or presentation.
Area of study	Students will need to be able to: • identify possible outcomes of an event and create visual representations of sample spaces or options • estimate, predict and calculate the likelihood of events occurring using decimals, ratios, and percentages • compare different real-life events or probabilities • make decisions based on inferences about sets of accessible, relevant, and appropriate data and information • evaluate risk in relation to relevant and appropriate problems with reference to likelihood of events occurring.		

LESSON 1

Chance has no memory

Learning outcomes

- chance has no memory
- outcomes are impossible to predict
- previous outcomes do not affect future ones
- for equally likely events, after a very large number of outcomes, the results tend to even out.

Resources

- Packs of playing cards (1 pack per pair)
- Tokens to be used as $1 coins (optional)
- Access to a data projector
- Copies of activities 1 and 2 'Be aware of gambling: Terminology'
- Copies of Activity 3 Maths knowledge and skills about probability and chance
- Copies of worksheet 1 `Card sharp', and worksheets 2A and 2B 'Chance has no memory.'

Tuning in

Ask students to give examples of different forms of gambling. They may mention:

- racing
- sports betting
- casinos
- pokies (electronic gaming machines) in hotels and clubs
- lotteries
- Keno
- raffles
- spinning wheels.

Students complete activity 1 and/or activity 2 'Be aware of gambling: Terminology'. If time permits, enlarge these activities on A3 paper and cut them out ahead of time. Students can work in pairs or groups to match the words. Alternatively, you could conduct a word search. Mix up the terms and definitions among groups. Students then need to ask other groups if they have their matching pair. This encourages discussion and collaboration.

Discuss with students their responses to the activity sheets to build understanding of the term 'gambling'.

Ask students in what other contexts they may have heard the term 'gambling' used. They may mention 'gambling with your life' or 'gambling' in financial markets. Ask whether they have heard of any other sayings that represent odds.

This discussion is supported by Appendix 1, Teacher resource: Definitions.

Students then complete Activity 3 'Maths knowledge and skills' about probability and chance. Students can work in pairs discuss the different maths calculations and knowledge they will need to use and apply throughout this resource.

This explicitly helps to address Stage 1 of the problem-solving cycle in Outcome 2. It is an opportunity to point out to students what maths skills they will need to know about throughout this piece of work, and a chance for you as the teacher to make sure they have the underpinning skills and knowledge to be able to do this. It will also enable you to introduce and further discuss the mathematical terminology related to odds and gambling.

Activity 1. Be aware of gambling: Terminology

Match the word/term on the left with the meaning on the right. The first one has been done as an example.

1. Bet	A. The person who provides the product or opportunity to bet
2. Bookie/Bookmaker	B. Electronic gaming machine that uses random numbers to decide on wins and losses
3. Chance	C. The person placing the bet
4. Gambler	D. Low odds offered on a likely winner
5. Each way	E. Money lost from one or more bets
6. Loss	F. Money won from one or more bets
7. Odds	G. Likelihood
8. Pokies/Poker Machine	H. A ratio for the possibility of something happening
9. Profit	I. Bet for a win and a place
10. Short-priced favourite	J. Put money at risk for the chance to win more

1. **J**	2.	3.	4.	5.
6.	7.	8.	9.	10.

Activity 2. Be aware of gambling: Terminology

Match the word/term on the left with the meaning on the right. The first one has been done as an example.

1. Betting agency	A. Calculate or describe how likely something is to happen
2. Expenditure	B. Decide beforehand how much money or time to spend in a gambling session
3. Gambling	C. All legal forms of betting on racing and sporting events
4. Payout	D. Any opportunity to bet provided by a betting agency
5. Pre-commitment	E. Put money at risk for the chance to win more
6. Probability	F. Total money bet on a race or game
7. Gambling option	G. The amount paid on a winning bet
8. Turnover	H. The business that provides the opportunity to bet
9. Wagering	I. Monies won
10. Winnings	J. The amount a player loses from their gambling

1. **H**	2.	3.	4.	5.
6.	7.	8.	9.	10.

Activity 3. Maths knowledge and skills about probability and chance

Think about what mathematical knowledge and any related calculations you might need to use and apply throughout this unit of work about probability, chance and odds. Indicate below if you think you will need to use and apply the following skills or not.

Maths skill	Will you need to use this skill?
Understand and compare different numbers: decimal, fractions, and percentages	YES ☐ NO ☐
Undertake calculations such as +, -, ×, and ÷	YES ☐ NO ☐
Work out proportions and ratios of one value compared to another, including to express them as a fraction or percentage.	YES ☐ NO ☐
Estimate, predict and calculate the likelihood of events occurring using decimals, ratios, and percentages.	YES ☐ NO ☐
Identify possible outcomes of probability and chance events and represent them in different ways	YES ☐ NO ☐
Compare different real-life events or probabilities	YES ☐ NO ☐
Make decisions based on sets of probability-based, relevant, and appropriate data and information	YES ☐ NO ☐
Understand and evaluate risk in relation to relevant and appropriate problems with reference to the chance or likelihood of events occurring.	YES ☐ NO ☐

NOTE: Please make sure you ask your teacher for help and advice about each of the above skills, especially if you are unsure about what they mean and how to do any of them. You will need to use and apply these skills throughout these activities.

1.1 Class simulations: Card sharp game

Introduce and explain the game and show Student worksheet 1 'Card sharp' on the data projector.

Each student selects a suit (hearts, diamonds, spades or clubs), and then a card is pulled at random from the pack. If the card matches their selected suit, they win. The card is placed back into the deck and the deck is shuffled.

- Each student will start with an imaginary budget of $50.
- It costs $1 to play each round.
- If they win a round, they receive $4.

It may need to be explained that if a student wins Round 1, their balance will be $53, not $54.

If they lose Round 1, their balance will be $49.

This is a good opportunity to discuss the idea of payout and how this relates to the cost of betting and about profit versus loss for the player in relation to total money won or lost.

Discuss strategies that students might like to adopt when they play:

- 'random guess'
- 'hasn't come up in a while'
- 'lucky streak'
- 'consistent guesses'.

Which strategy do students expect to be most successful?

- Once students have grasped how to play, distribute the worksheet.
- If sufficient counters are available, you could distribute 50 counters to each student.
- At the end of the game, ask who did the best, and whether any of the strategies were better than others.
- Show students how to tally the game on the dot plot at the bottom of Worksheet 1 by modelling it on a projection of the worksheet.
- Alternatively, students could enter their individual results on the projected worksheet on the whiteboard.

Note that the 'Card sharp' spreadsheet has a 'Matching cards' tab that may be used to illustrate large numbers of trials. Make sure you demonstrate how this works to students and how it imitates what they are doing with the cards.

1.2 Chance has no memory

- Arrange students in pairs. One student from each pair receives Worksheet 2A, 'Chance has no memory' and the other receives Worksheet 2B.
- Encourage students to complete the worksheets by modelling what they need to do on both sheets if, for example, a diamond is drawn.
- Either use cards or use the 'Frequencies' tab of the 'Card sharp' spreadsheet to carry out 50 trials, one at a time, as students add results to their worksheets.
- If time permits, use the 'Sampling cards' tab of the 'Card sharp' spreadsheet to show students associated bar graphs for 1,000, 10,000 and 100,000 rounds. Use this to scaffold them filling out the second half of this sheet.
- Reinforce to students that 'chance has no memory'.

This content is supported by the **'Card sharp' spreadsheet** and worksheets 2A and 2B, 'Chance has no memory'

1.3 Class discussion and reflection

Ask questions about what happened and why students gave the answers they did on the worksheets. Discussion should centre on worksheet solutions, addressing student misconceptions and highlighting key points.

Key message

Chance has no memory; outcomes are impossible to predict.

Worksheet 1 – Card sharp (20 rounds)

NAME: _____

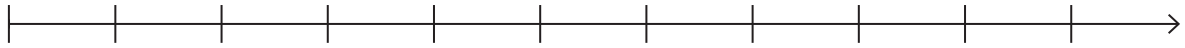
Bet = $1 Payout = $4 Round number	Guess first (circle one)	Result: Did you win?	Your balance (start with $50)
1	♣ ♦ ♥ ♠		
2	♣ ♦ ♥ ♠		
3	♣ ♦ ♥ ♠		
4	♣ ♦ ♥ ♠		
5	♣ ♦ ♥ ♠		
6	♣ ♦ ♥ ♠		
7	♣ ♦ ♥ ♠		
8	♣ ♦ ♥ ♠		
9	♣ ♦ ♥ ♠		
10	♣ ♦ ♥ ♠		
11	♣ ♦ ♥ ♠		
12	♣ ♦ ♥ ♠		
13	♣ ♦ ♥ ♠		
14	♣ ♦ ♥ ♠		
15	♣ ♦ ♥ ♠		
16	♣ ♦ ♥ ♠		
17	♣ ♦ ♥ ♠		
18	♣ ♦ ♥ ♠		
19	♣ ♦ ♥ ♠		
20	♣ ♦ ♥ ♠		
		Total number of wins	Money won or lost

Draw dot plots on the following number lines.

Number of wins for everyone:

Money won or lost:

Blank number lines for students who bet with different values:



Worksheet 2A – Chance has no memory

NAME: _____

PART A

You are now going to run through 100 rounds of 'Card sharp'.

As you play the rounds, record your results in the grid by placing an X in the next free box immediately above the winning suit for that round.

Before you do the rounds, answer the following:

1. Pick one suit to be your winning suit (circle):

   ♣ ♦ ♥ ♠

2. Complete this prediction:

   I think that out of 100 rounds, the suit that I chose is going to come up

   _____ times.

3. For the following sentences tick those that you agree with and cross the ones you don't.

   Note: The following assumes that after each card is drawn, it is replaced in the deck and the deck is shuffled.

   ☐ At some point, one of the suits will probably have 'a run' and will come up a few times. This will make it more likely to come up again.

Number of times the suit comes up					
	45				
	44				
	43				
	42				
	41				
	40				
	39				
	38				
	37				
	36				
	35				
	34				
	33				
	32				
	31				
	30				
	29				
	28				
	27				
	26				
	25				
	24				
	23				
	22				
	21				
	20				
	19				
	18				
	17				
	16				
	15				
	14				
	13				
	12				
	11				
	10				
	9				
	8				
	7				
	6				
	5				
	4				
	3				
	2				
	1				
		♣	♦	♥	♠

- ☐ If a suit comes up lots of times in a row, it will be less likely to come up the next time.
- ☐ In a game like this you're better off picking a strategy (one suit) and sticking with it than choosing a different suit for each round.
- ☐ The suit that comes up in one round does not affect the suit that comes up in the following round.

4. After the rounds, turn your tally table into a column chart by shading the columns. After some class discussion/demonstration for larger numbers, answer the following questions:

   - Out of the _____ rounds my suit came up _____ times.
   - How does this compare with what you expected to happen?

_____

_____

5. Look at your partner's worksheet. What was the longest 'winning streak'?

_____

6. What was the main point of question 3?

_____

_____

7. In this game, with four equally likely outcomes, you can expect to win _____ time/s out of every 100 games.

   Therefore, the probability of winning at 'Card sharp' is: _____

8. If we played 1,000 games, how many times would you expect your suit to come up?

_____

9. Express the phrase 'chance has no memory' in your own words.

_____

_____

Worksheet 2B – Chance has no memory

NAME: _____

PART B

You are now going to run through 100 rounds of 'Card sharp'. Before you do the rounds, complete the following tasks.

1. Pick one suit to be your winning suit (circle): ♣ ♦ ♥ ♠

2. Complete this prediction:

   I think that out of 100 rounds the suit that I chose is going to come up

   _____ times.

3. Tick the box next to each of the sentences that you agree with and place a cross next to the ones you don't agree with.

   Note: The following assumes that after each card is drawn, it is replaced in the deck and the deck is shuffled.

   ☐ One of the suits will be luckier and will come up more.

   ☐ At some point, one of the suits will probably have 'a run' and will come up a few times. This will make it more likely to come up again.

   ☐ If a suit comes up lots of times in a row, it will be less likely to come up the next time.

   ☐ In a game like this you're better off picking a strategy (one suit) and sticking with it than choosing a different suit for each round.

   ☐ The suit that comes up in one round does not affect the suit that comes up in the following round.

4. As you play the rounds, keep a tally of which suit comes up in the chart below. Write 'C' for clubs, 'D' for diamonds, 'H' for hearts or 'S' for spades. Start in the top left and work to the right, then move to the beginning of the next row.

Rounds 1–10 ⟶										
Rounds 11–20 ⟶										
Rounds 21–30 ⟶										
Rounds 31–40 ⟶										
Rounds 41–50 ⟶										
Rounds 51–60 ⟶										
Rounds 61–70 ⟶										
Rounds 71–80 ⟶										
Rounds 81–90 ⟶										
Rounds 91–100 ⟶										

5. After the rounds, circle or highlight the longest 'streak' of the same suit. After some class discussion/ demonstration for larger numbers, answer the following questions:

   - Out of 100 rounds, my suit came up _____ times.
   - How does this compare with what you expected to happen?

   _____

   - What was the longest 'streak'? _____

6. Were any of your choices in question 3 incorrect?

_____

_____

7. What was the main point of question 3?

8. In this game, with four equally likely outcomes, you can expect to win _____ time/s out of every 100 games.

   Therefore, the probability of winning at 'Card sharp' is: _____

9. If we played 1,000 games, how many times would you expect your suit to come up?

10. Express the phrase 'chance has no memory' in your own words.

LESSON 2

Who are the real winners?

Learning outcomes

Students will understand:

- differences in payouts arise when a gaming venue is involved
- total payouts are not always 100% of the amount bet
- games provided by gaming venues are designed to make a profit.

Resources

- A pack of cards
- Tokens (at least 20)
- A coin (not essential but will help illustrate the experiment)
- Five coloured counters: red, yellow, pink, green, blue (also not essential but handy to demonstrate)
- Copies of worksheet 3 'Who are the real winners?'
- Copies of worksheet 4 'Setting limits'
- **'Card sharp' spreadsheet**
- **'Setting limits' spreadsheet**

Tuning in

- Remind students of Lesson 1 'Chance has no memory' – the games they played, the cost to play, the payout.

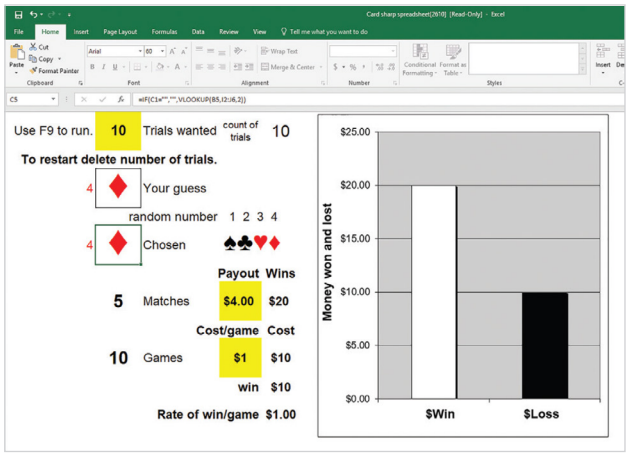
2.1 Class simulations Part A

Card sharp – with a difference

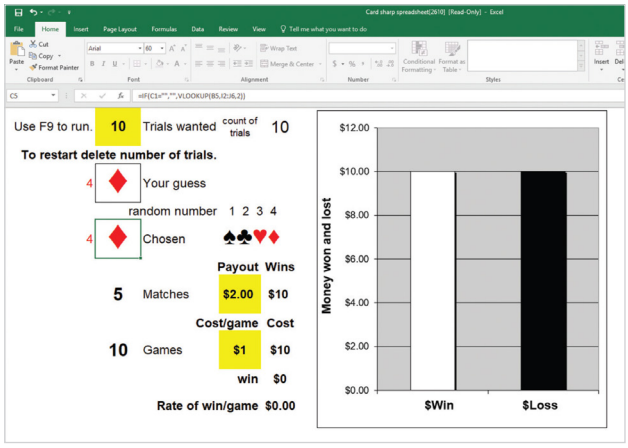
- Bring four students to the front of the class and give each student five tokens. Everyone pays one token to play a round.
- Each student is assigned to a suit. If a student's suit is selected, they win the payout. Those who win receive two tokens; those who lose receive nothing.
- Explain that you are going to act as the gaming venue. Keep two tokens from each round.
- At some point students will likely object to the fact that they are losing their money. This stimulates a conversation and provides an opportunity for the teacher to contrast this game with the game in the previous lesson, in which no gaming venue was involved. Explain how this game is an example of commercial gambling in which a gaming venue is involved.
- Run the 'Matching cards' tab of the 'Card sharp' spreadsheet twice, first with a payout of $4 to show what happens when no gaming venue is involved, and then with a payout of $2 to show the outcome when the gaming venue takes half the money bet. Highlight the difference in payouts when no gaming venue is involved, compared with when a gaming venue is involved.
- As part of this activity, it is important to make it clear to students what the differences are in the calculations based on whether the game is organised **with** or **without** a gaming venue. Make sure they can see this by checking if the total payouts are 100% of the amount bet or not. This is a critical message from this activity. Demonstrate and reinforce this throughout, including as part of the use of the 'Card sharp' spreadsheet, to make sure learners understand this.

For those unable to run the 'Card sharp' spreadsheet, here are two sample screenshots.

Payout $4 per game – no gaming venue involved.



Payout $2 per game – gaming venue involved.



2.2 Individual worksheets

- Hand out worksheet 3 'Who are the real winners?' to students
- Give students time to work on the worksheets. Monitor their work and help them to relate it to their understanding of the whole class activity.
- It is important to leave sufficient time for a full discussion.

2.3 Class discussion and reflection

As you circulate during the lesson, identify students who would like to share their answers. It can often be difficult to get students to share and this can be one way to scaffold them to talk in front of the class. (This situation will differ from class to class.)

Key messages

- Differences in payouts arise when a gaming venue is involved.
- Total payouts are not always 100% of the amount bet.
- Games provided by gaming venues are designed to make a profit.
- As a consequence, most gamblers must lose money in the long run if a gaming provider is involved.

Worksheet 3 – Who are the real winners?

NAME: _____

Game 1: Think back to the 'Card sharp' game. A card is randomly pulled out of the pack, and you win if it belongs to your selected suit.

Cost to play one round: $1 **Payout if you win a round: $4**

1. Based on this information, do you think that a gaming venue is involved? Explain your answer.

_____

_____

_____

Game 2: A coin is tossed, and you win if it shows heads.

Cost to play one round: $5 **Payout if you win: $8**

2. Based on this information, do you think that a gaming venue is involved? Explain your answer.

_____

_____

_____

3. What would the payout be if it was a game organised without a gaming venue?

_____

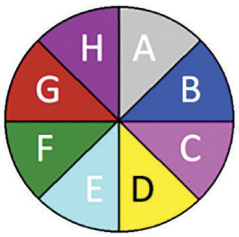
Game 3: Five coloured counters (red, yellow, pink, green, blue) are placed in a bag. You win if a red counter is pulled out.

Cost to play one round: $2 **Payout if you win: $8**

4. Based on this information, do you think that a gaming venue is involved? Explain your answer.

5. What would the payout be if it was a game organised without a gaming venue?

Game 4: A spinner is split up into eight equal sections, with different colours and letters, as shown. Select one letter. The spinner is spun, and you win if the arrow lands on your letter.



Cost to play one round: $3

6. What would the payout be if this was a game organised without a gaming venue?

7. If a gaming venue was going to run this game, suggest two possibilities for the payout that they might offer.

Game 5: A die is rolled and you win if a 1, 3 or 5 comes up.

Cost to play one round: $2

8. What would the payout be if this was a game organised without a provider profit?

9. If a gaming venue was going to run this game, suggest two possibilities for the payout that they might offer.

Game 6: A card is selected out of a full pack. You win if it's an ace.
(There are 52 cards in a pack and four of them are aces.)

Cost to play one round: $3

10. What would the payout be if this was a game organised without a gaming venue?

11. If a gaming venue was going to run this game, suggest two possibilities for the payout that they might offer.

12. For each person who plays this game, how much money could the gaming venue expect to make for each round that was played?

Explain

13. Explain at least one difference between gambling informally with friends and with a gaming venue that exists to make a profit.

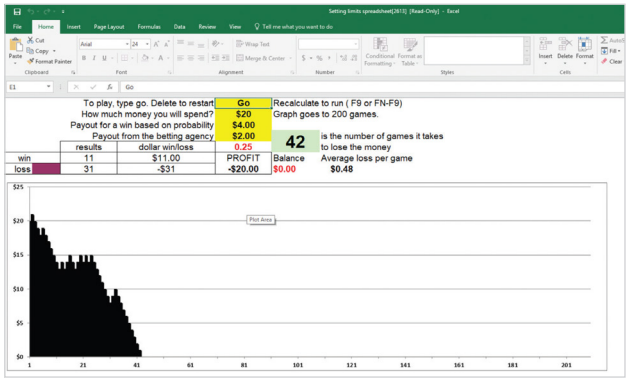
2.4 Class simulations Part B

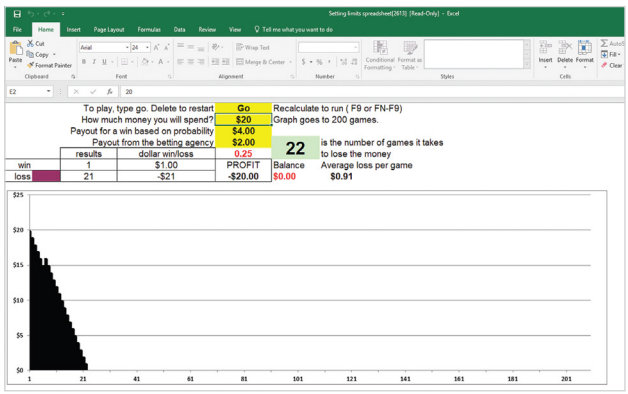
Card sharp – with a difference and a spending limit

- Introduce the idea of a pre-commitment – a spending limit.
- Explain that, when playing the game 'Card sharp' at a gaming venue, a player could choose to limit their spending to a set amount.
- Ask students what amounts they might set for themselves. After some responses, suggest a limit of $20.
- Remind students that it costs $1 per round to play and the payout is $2.
- Get predictions from students of how many games a player would play if they limited their spending to $20.
- Introduce the **'Setting limits' spreadsheet** and run a few simulations to demonstrate how it works, using the 'Play 200' tab. The 'Play 400' option can be used as an extension.

Alternatively, students could play the game in pairs, small groups or as a whole class.

Three sample snapshots from the simulation are below.

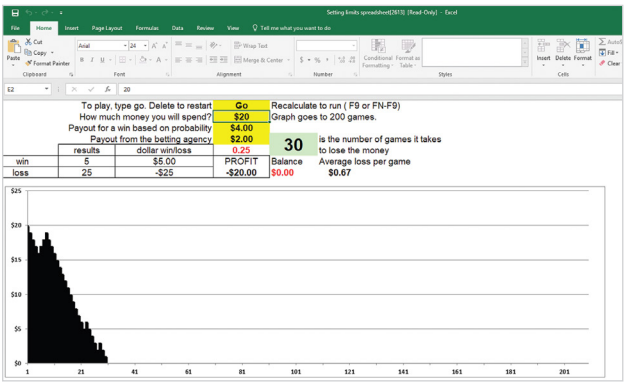




2.5 Individual worksheets

- Handout worksheet 4 'Setting limits' to students
- Give students time to work on the worksheets. Monitor their work and help them to relate it to their understanding of the whole class activity.
- Students complete the 'Predict' section of the worksheet.
- In the 'Observe' section of the worksheet, invite each student to have a go at operating the spreadsheet to see how long their pre-commitment of $20 would last if they were to play such a game. As many students as would like to participate can do so, and the data can be used for the 'Observe' section of the worksheet.
- Encourage students to complete the 'Explain' section.
- Prior to the 'Second prediction', you might like to conduct a conversation about how long it took each student to spend their $20. If this was a game at a casino, do they think this would be a good use of their $20?
- Move on to the 'Second prediction (extension)' part of the worksheet, followed by the 'Observe' and 'Explain' sections.

You can project the worksheet and complete the dot plots.



This content is supported by the **'Setting limits' spreadsheet**.

Worksheet 4 – Setting limits

NAME: _____

Predict

A player has a pre-commitment of $20. A gaming venue's card game costs $1 to play with a $2 payout when the correct suit is chosen randomly from a standard pack of cards without jokers.

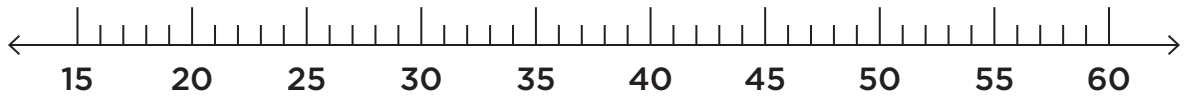
1. How many $1 bets do you think it will take the player, on average, to spend their $20? _____

Observe

Nineteen people at a casino set a pre-commitment of $20 and each played this game until they had spent their entire pre-commitment. Here are the number of rounds it took for them to spend all of their $20.

40, 34, 30, 28, 44, 36, 32, 34, 52, 34, 40, 38, 34, 32, 33, 41, 51, 29, 37

2. Use these numbers to construct a dot plot on the number line below.

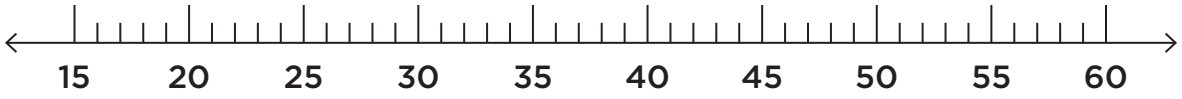


3. Investigate who is the most successful person in your class. That is, who can make their pre- commitment of $20 last the longest? Use the **'Setting limits' spreadsheet** to see how long your $20 will last. In the table below, record the initials of your classmates and how many rounds it took them to spend their limit.

Initials												
How long to spend their limit?												

Initials												
How long to spend their limit?												

4. Use the results from your class trials to construct a dot plot on the number line below.



Explain

5. Which group was luckier: the 19 people at the casino or your class? Why?

6. Suppose in real life, it took 30 seconds to play each round. How long would you expect to be able to play for if you set your pre-commitment at $20?

7. It usually costs about $17.50 to see a movie and a movie runs for between an hour-and-a half and two hours.

   If a person was to get the same amount of enjoyment per minute from watching a movie or playing the game described above, which activity do you think would be the 'better value' for them? Explain your answer.

Application

8. **Second prediction:** If someone started with a pre-commitment of $100, do you think they would ever spend their limit? If you think they will spend their limit, how many rounds do you think they will last?

9. **Observation:** Your teacher will now use the simulator to test out your prediction. Did the person with a pre-commitment of $100 spend their limit? If they did, how many rounds did they last and how did this compare to your prediction?

Explain

10. If someone is gambling with a pre-commitment or limit in a gambling venue, what do you think is going to happen in the long run?

2.6 Class discussion and reflection

Students present their predictions, observations, and explanations for Worksheet 4.

Ask:

- How did your own simulations compare with your prediction in question 1?
- Why do you think these players are persisting? Do they want to spend money, or do they want to win money?
- How did you answer the question 'Which group was luckier: the 19 people at the casino, or your class'? Discuss whether they based their answers on the average and whether or not that would have been appropriate.
- Students share with the class what they discovered, in particular - how they thought the value for money of gambling compared to seeing a film.

Extension opportunity

Ask students to predict the outcomes of a simulation with the unfair payout changed to $3 (and the fair payout still at $4). Ask:

- What might the graph look like?
- If time is available, sketch a graph or use the 'Card sharp' spreadsheet to simulate this scenario.
- How would this have changed the answers to Worksheet 4?

Key messages

- No matter how much you start out with, you're likely to lose money if you gamble.
- Set a limit you are prepared to lose and stick to it to avoid harm from gambling and spending/ losing a significant amount of money.

LESSON 3

Pokies

Learning outcomes

Students will understand:

- random mathematical processes control poker machines
- payouts are less than the amounts bet over time
- gaming machine venues can legally make payouts less than the amounts played
- the greater the number of bets, the greater the likelihood of losing all of the money they started with.

Students will also be able to read graphs to compare results of short-term and long-term gambling.

Resources

- **'Pokies' spreadsheet**
- Copy of worksheet 5 'Pokies'
- Factsheet - 'Facts about pokies'

Tuning in

- Point out that losses on pokies machines in Victoria increased from $2.699 billion in 2018-19 to $3.021 billion in 2022-23.
- In 2021-22, Victorian sport and race bettors lost an estimated $2.58 billion, an increase of 11 per cent on the $2.33 billion they lost just one year earlier (2020-21).
- The areas with the highest pokies losses were Brimbank, Casey and Hume.

Ask students to tell you what they know about how poker machines work.

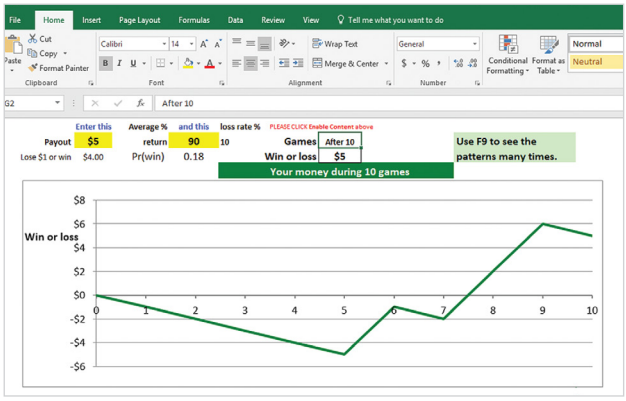
- Point out that 'chance has no memory' applies to the random numbers that determine the outcomes of each spin. The outcome of each spin of a pokies machine is random, with no reference to previous outcomes. This means that a winning spin or a jackpot is never 'due'.
- The 'Return to player' (RTP) rate is the percentage of the money gambled in games of chance that is required by law to be paid back to gamblers as 'winnings', over a set period of time.
- Point out that pokies machines in Victoria are required to have a minimum RTP rate of 85%. This means the machine must return at least 85% of the amount bet over a calendar year in payouts. This means that the operator of the machine can retain up to 15% of the amount bet over a calendar year.
- Ask students what an 'average return of 85%' means. Explain that over the period of a year, 85% of money bet is returned to players. It does not mean that each individual pokies user will end up with 85% of the money they started with in a single gambling session.
- It is also important to note that 'Return to player' is useful as an indicator of the machine's performance over the long term but is highly unlikely to describe the outcome over anything like the time period a single player is using it.

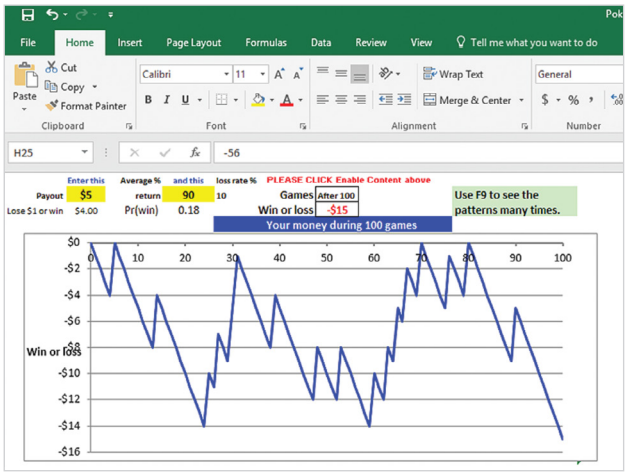
3.1 Class simulations linked to worksheet

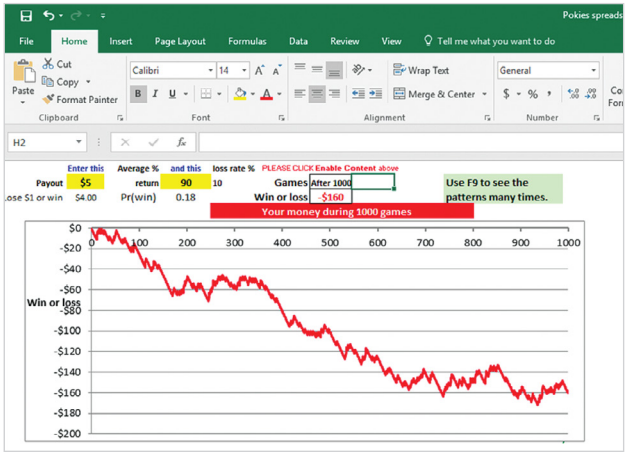
- Distribute worksheet 5 to students
- Ask 10 students to volunteer to be your 'players'. All students enter the volunteers' initials into their worksheets.
- Each player simulates 10, 100 and 1,000 trials for all students to record in their worksheets. (Students may need to be shown how to use the 'Pokies' spreadsheet.)
- Run through the 'predict, observe, explain' cycle, as supported by the worksheet and spreadsheet simulation.
- Run the simulation using the appropriate tab on the 'Pokies' spreadsheet.

This content is supported by the **'Pokies' spreadsheet**.

Sample snapshots of the 10-, 100- and 1,000-game simulations are below.







3.2 Class discussion and reflection

Have students sit together or in small groups. A few discussion questions that you may like to use are:

- The average loss per dollar is the same for all gamblers, so why do the small-time gamblers have the greatest chance of winning money?
- What is likely to happen in the long run if someone continues to play the pokies?

You could ask students who completed Worksheet 5 to share some of what they found in the final section of their worksheet.

A role play (regarding question 17 of each worksheet) would be an engaging way to elicit these discussions.

Key messages

- The more a person bets, the greater the likelihood of losing all the money they started with.
- If you keep gambling in the hope of winning back your losses, you are very likely to fail and lose even more.

Worksheet 5 – Pokies

NAME: _____

10 GAMES

Enter the initials of 10 players from your class into the boxes below.

Predict

1. If each of these players plays 10 games on the pokies, betting $1 per game, how many of them do you think will win money by the end of the 10 games?

   _____

Observe

2. Each player can now do a simulation using the 'Pokies' spreadsheet. Record their initials and how much they won or lost.

Initials												
How much won or lost?												

Explain

3. What percentage of the students ended up losing money after playing 10 games? _____

4. What was the average amount won or lost for a player playing 10 games at the pokies? _____

5. Assuming each round cost $1, what was the player's average loss per dollar spent? _____

100 GAMES

Predict

6. All 10 players come back the next day to play again. If each of these players play 100 games, again betting $1 per game, how many of them do you think will win money by the end of 100 games?

_____

_____

Observe

7. Each player can now do a simulation using the 'Pokies' spreadsheet. Record their initials and how much they won or lost.

Initials												
How much won or lost?												

Explain

8. What percentage of the students ended up losing money after playing 100 games? _____

9. What was the average amount won or lost for a player playing 100 games at the pokies? _____

10. Assuming that each round cost $1, what was the player's average loss per dollar spent? _____

1,000 GAMES

Predict

11. The players now really want to play again. A week later they all go back but this time they each play 1,000 games, each betting $1 per game. How many of them do you think will win money by the end of 1,000 games?

Observe

12. Each player can now do a simulation using the **'Pokies' spreadsheet**. Record their initials and how much they won or lost.

Initials												
How much won or lost?												

Explain

13. What percentage of the students ended up losing money after playing 1,000 games? _____

14. What was the average amount won or lost for a player playing 1,000 games at the pokies? _____

15. Assuming each round cost $1, what was the player's average loss per dollar spent? _____

Noticing patterns

16. Based on what you have seen, complete the following sentence:

    - If you're playing the pokies, the more you play, the more _____

17. A relative comes back from an afternoon at the pokies and tells you that they have just lost $100. They suggest to you that they weren't lucky today, but if they play more they might win all of their money back.

    Based on your observations above, what would you say to your relative?

18. Look at the average loss per dollar spent for 10, 100 and 1,000 plays. How do they compare?

19. How does the loss per dollar spent compare to the programmed return of 85%?

20. If the government made a rule that changed the programmed return to a player per dollar spent from 85% to 90%, how would you expect the average amount won or lost for 1,000 games to change?

3.3 Know your odds

Resources

- Tasmanian Government pokies loss calculator **http://knowyourodds.net.au/**
- Copies of Student worksheet 6 'Discover how much you can lose'

3.4 Tuning in

- Discuss with students how much money they would likely lose in a year if they played the pokies regularly.
- Discuss with students what factors would influence the amount of money lost.

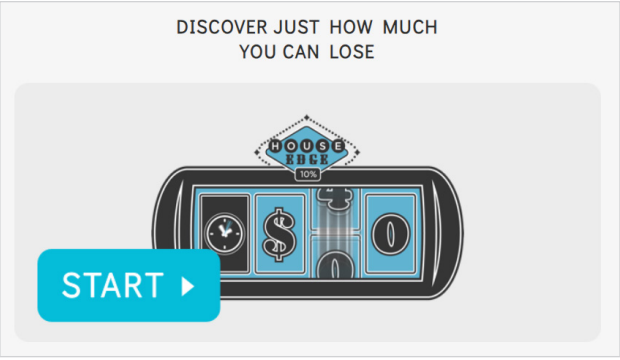
Explain that the purpose of this part of the lesson is to understand the factors that cause the amounts of money lost from playing the pokies to vary.

3.5 Class simulation and worksheet

Simulation:
Discover just how much you can lose

Distribute Worksheet 6 'Discover how much you can lose' to each student.

Have each student make the first prediction, then demonstrate the 'Discover just how much you can lose' simulator.
https://knowyourodds.net.au/

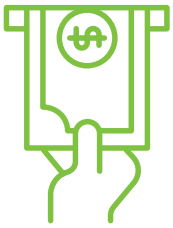


FACTS ABOUT POKIES

Electronic gaming machines, or pokies, are found in hotels, registered clubs and casinos. There are 488 pokies venues in Victoria. Each gaming machine has a built-in computer program that randomly generates thousands of possible outcomes every second.

Pokies are designed to take your money

Poker machines are not designed to make money for players. They are there to make money for venue owners. Even if you have a win or two, over time you are much more likely to lose money. Pokies use lights, sounds, and other psychological techniques to create excitement and keep you gambling... even if you're losing.



Pokies don't care if you're feeling lucky

The odds of winning a typical $5,000 prize on a $1 poker machine are 9,700,000 to 1. You can never predict the outcome of a bet on the pokies. It doesn't matter how long it has been since the machine last paid out a win, or whether you are wearing your lucky shirt – the odds always favour the house.

What's the real cost of pokies?

- Victorians lost $3.022 billion on pokies in 2022-23*.
- There are 26,380 pokies machines in Victoria (in 2023).
- Pokies machines are available in disproportionately higher numbers in disadvantaged Victorian suburbs.
- Pokies are the most common form of betting for Victorians who have issues with gambling (38%).

*Victorian Gambling and Casino Control Commission figures on pokies expenditure between 1 July 2022 and 30 June 2023.

THE ODDS OF WINNING $5,000 ON A $1 POKER MACHINE ARE

9,700,000 / 1

To find out more about the facts of gambling, visit **responsiblegambling.vic.gov.au**

Worksheet 6 – Discover how much you can lose

NAME: _____

Pretend you play the pokies three times a week for 30 minutes each time and each bet is $4. You make a spin about every six seconds.

The amount of each bet depends on the bet per line and the number of lines played per spin. These can be changed.

Prediction: How much money could you lose in a year? (Circle your choice.)

$18 **$180** **$1,800** **$18,000** **$180,000**

After you have made your prediction, the simulator will show the likely result.

1. What is the likely amount of losses in a year? _____

2. Was your prediction close? _____

3. What are the three factors that influence the amount you are likely to lose?

_____

_____

A family member plays the pokies two times per week for an hour each time and each bet is $4. Again, each spin is about six seconds long.

Prediction: Compared to the amount you could lose, how much will your relative lose? (Circle your choice.)

A lot less **A little less** **About the same** **A little more** **A lot more**

After you have made your prediction, the simulator will again show the likely result.

4. What is the likely amount? _____

5. How does the likely amount compare with your prediction? _____

6. Which parameters would you change to decrease your losses?

Another relative plays the pokies once a month for about 15 minutes with each bet being $0.40. Again, each spin is about six seconds long.

Prediction: About how much will this relative lose in a year? (Circle your choice)

$7 **$70** **$700** **$7,000** **$70,000**

After you have made your prediction, the simulator will again show the likely result.

7. What is the likely amount? _____

8. Is this amount surprising? _____

This simulator is set to pay back 90% of the money played over the year. How would the three lost amounts from above change if the simulation was for Victoria, where 85% of the money played over the year is paid back? How much will be lost? (Circle your choice)

A lot less **A little less** **About the same** **A little more** **A lot more**

FACTS ABOUT SPORT AND RACE BETTING

People are spending, and losing, more on sport and race betting in Victoria than ever before. It is the fastest-growing form of gambling and is popular among young people, especially men aged 18–24. Sports betting apps make it easier than ever to bet anywhere, any time.

You are more likely to lose

Sport and race betting companies are not there to help you make money. In fact, sports betting companies make a lot of money from Australians who likely thought they could beat the odds. In 2023, **wagering company Sportsbet estimated the Australian sports betting market is worth $8.2 billion a year**.

Gambling companies use clever marketing tactics and inducements like 'cash back' offers to make people think winning is easy but in reality, betting on sports and racing is more likely to result in losing money.

Chance or skill?

It's impossible to know all the factors that can influence the outcome of a match or race. While you may feel like you have a skill for picking winners, you can never control the odds. Winning is a matter of chance, not skill.

What's the real cost of sport and race betting?

In 2021-22, **Victorian sport and race bettors lost an estimated $2.58 billion**. Collectively, sport and race betting account for 10 per cent of gambling harm in Victoria.

$2.58 BILLION

To find out more about the facts of gambling, visit **responsiblegambling.vic.gov.au**

LESSON 4

Sports betting

Learning outcomes

Students will understand:

- the difference in potential winnings for players depending on whether or not a betting agency is involved
- that higher payouts are matched with lower probabilities of winning.

Students will also be able to explain expected gambling losses in terms of probabilities and payouts.

Resources

- A coin and a pack of playing cards
- Tokens to represent $1
- The **'Sports betting agency' spreadsheet** (teacher needs to be familiar with its use)
- Copies of the student record sheet 'Sports betting simulation'
- Copies of worksheet 7 'Sports betting'

Tuning in

Discuss with students how many sports betting ads they have seen in the past week, the purpose of these ads and the likelihood of these ads showing the risks involved and limited chances of winning.

Discuss with students how sports betting agencies, through their advertising, are changing the way young people think about sport and why it's important to 'love the game, not the odds'.

Mention how sports betting advertising portrays betting as less risky than it is, and an easy way to make money, and why this is of concern.

Explain that the purpose of this part of the lesson is to understand the full story about sports betting, especially how agencies design their products to maximise their profits at the expense of most players.

4.1 Class simulations

Simulation 1: Even chances

Ask two students to each bet a token on who will win a match between two equally good teams. The outcome of the match will be decided by a coin toss. For example: heads = Matildas (Australia) versus tails = USA.

A third student acts as the 'bookie', collecting a token from each student, tossing a coin and then giving the 'payout' of all the tokens to the winner.

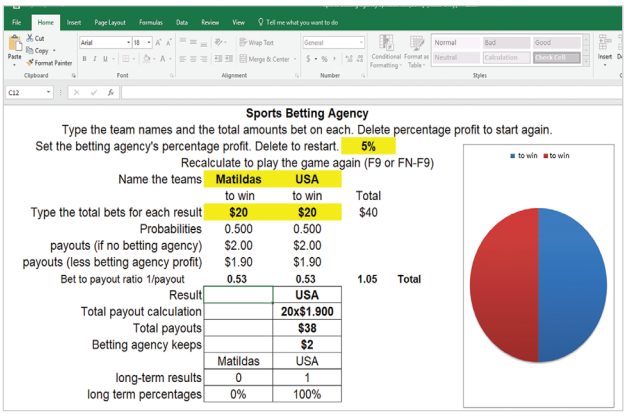
Ask students the following questions:

1. What is the probability of each team winning?
2. What is the payout for each team?
3. What might the payouts be if a betting agency that kept 5% was involved?

Note: Typically, betting agencies that set their payouts before the event pay out about 95% of all bets collected.

Show how this simulation can be repeated with the 'Sports betting agency' spreadsheet. At the bottom of the screen there is a 'Soccer' tab and an 'Other' tab. Choose the 'Other' tab.

$20 bet on each team, USA won this trial, only one trial run.



Sports Betting Agency

Type the team names and the total amounts bet on each. Delete percentage profit to start again.

Set the betting agency's percentage profit. Delete to restart. 5%

Recalculate to play the game again (F9 or FN-F9)

	Matildas	USA	
Name the teams	to win	to win	Total
Type the total bets for each result	$20	$20	$40
Probabilities	0.500	0.500	
payouts (if no betting agency)	$2.00	$2.00	
payouts (less betting agency profit)	$1.90	$1.90	
Bet to payout ratio 1/payout	0.53	0.53	1.05 Total

Result	USA
Total payout calculation	20x$1.900
Total payouts	$38
Betting agency keeps	$2

	Matildas	USA
long-term results	0	1
long term percentages	0%	100%

Simulation 2: One chance in four

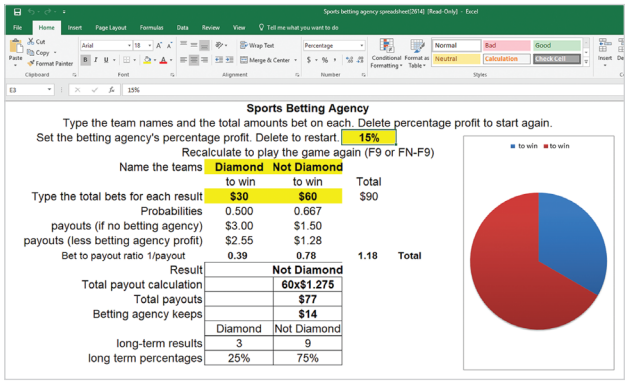
Repeat this experiment, this time with four students each betting a token on a card chosen at random from a pack of cards. A fifth student acts as the bookie, collecting a token from each student, selecting a card at random and then giving the 'payout' to the winner.

Ask students the following questions:

1. What is the probability of a diamond 'winning' (being selected)?
2. What is the probability of a diamond 'losing' (not being selected)?
3. How much should the payout be for a diamond win?
4. How much should each of the other three students be paid if a diamond loses?
5. What payouts should the fifth student give for: diamond $ ..... vs not diamond $ ..... ?
6. What might the payouts be if a betting agency that keeps 15% was involved?

Show how this simulation can be repeated with the **'Sports betting agency' spreadsheet**. Use the 'Other' tab with no draw.

The following is a screenshot of 12 trial runs with a $30 bet on diamond, $60 on not diamond, at a 'percentage profit' of 15% for the betting agency. This trial was won by not diamond.



Sports Betting Agency

Type the team names and the total amounts bet on each. Delete percentage profit to start again.

Set the betting agency's percentage profit. Delete to restart. 15%

Recalculate to play the game again (F9 or FN-F9)

Name the teams	Diamond to win	Not Diamond to win	Total
Type the total bets for each result	$30	$60	$90
Probabilities	0.500	0.667	
payouts (if no betting agency)	$3.00	$1.50	
payouts (less betting agency profit)	$2.55	$1.28	
Bet to payout ratio 1/payout	0.39	0.78	1.18 Total

Result		Not Diamond
Total payout calculation		60x$1.275
Total payouts		$77
Betting agency keeps		$14
	Diamond	Not Diamond
long-term results	3	9
long term percentages	25%	75%

Simulation 3: Soccer matches

Now distribute the Student record sheet. Using the 'Sports betting agency' spreadsheet, click on the 'Soccer' tab with a possible draw, to simulate the results of five matches for which each student bets $10 on a win, lose or draw.

Demonstrate to the class how the spreadsheet works and how it simulates the games being played and how each of the inputs work and relate to the agreed playing and betting scenarios.

Start with Australia vs Japan and the betting agency percentage set at 20%.

Set the total amounts bet at three times the other. For example, with 20 students the entries could be:

- 15 × $10 = $150 for Australia
- 5 × $10 = $50 for Japan
- $0 for a draw.

Ask the students:

1. Does that mean Australia is three times more likely to win than Japan?
2. Does that mean Australia has three chances out of four of winning, a probability of 75%?

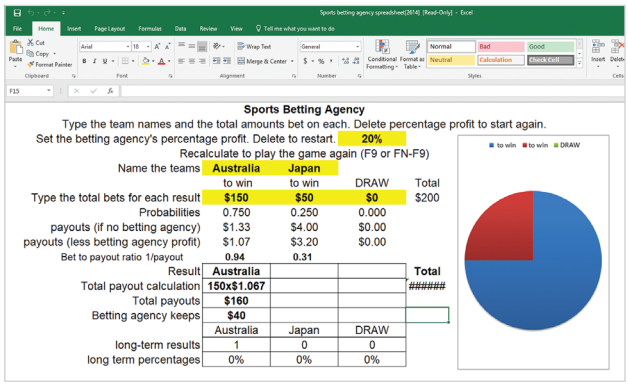
The spreadsheet uses the ratio of the amounts bet on each team to determine the relative chances of winning – the probabilities – just as the sports betting agency does.

As the simulation progresses, look for opportunities to ask how the figures produced by the spreadsheet are related to each other.

Students complete the calculations required on their record sheets. While some may have ended up winning, the overall losses must equal the betting agency's gain, which is 20% of $50 × number of students.

This content is supported by the **'Sports betting agency' spreadsheet**.

A snapshot from the sports betting agency spreadsheet:



Sports Betting Agency

Type the team names and the total amounts bet on each. Delete percentage profit to start again.

Set the betting agency's percentage profit. Delete to restart. 20%

Recalculate to play the game again (F9 or FN-F9)

Name the teams	Australia	Japan		
	to win	to win	DRAW	Total
Type the total bets for each result	$150	$50	$0	$200
Probabilities	0.750	0.250	0.000	
payouts (if no betting agency)	$1.33	$4.00	$0.00	
payouts (less betting agency profit)	$1.07	$3.20	$0.00	
Bet to payout ratio 1/payout	0.94	0.31		

Result	Australia			Total
Total payout calculation	150x$1.067			######
Total payouts	$160			
Betting agency keeps	$40			

	Australia	Japan	DRAW
long-term results	1	0	0
long term percentages	0%	0%	0%

Note: As a betting agency is involved, the payout for an Australian win is $1.07 for each $1 bet. For a winning bet of $10 the amount paid will be $10.70, making a gain of $0.70.

4.2 Individual worksheets

Following on from the simulations using the spreadsheets, have a class discussion to make sure students understand the key messages about the different games and how the simulations work. Also check and explain that students know how they calculate the related betting results and payouts. Hand out Worksheets 7 and 8 to students and ask them to work their way through the questions.

Give students time to work on the worksheets. Monitor their work and help them to relate it to their understanding of the previous whole class activities.

You can invite students to have a go at operating the spreadsheet to see how the simulations work and for them to be able to answer the questions on the worksheets. Students could work in pairs in order to share their knowledge and assist in their understanding.

4.3 Class discussion and reflection

Discuss with the class their answers to the questions on the worksheets and their understandings of how the simulations work and how they replicate what happens in the real world of betting and gambling.

They should be given the chance to provide their answers and explanations. For example:

- Payouts not involving a betting agency for equally likely results are Birds $2 vs Felines $2.
- Payouts not including a betting agency for more likely vs less likely are Less than $2 vs More than $2.
- A team most likely to win would be offered the minimum payout of $1.01.
- A team with little hope of winning would be offered a very high payout – say $10.

Key points

Answers to the questions on the last worksheets can open up debate for the whole class, and provide an opportunity to make sure all students understand the difference between having a betting agency and not having one involved. The key points are:

- Payouts **not** including a betting agency, times probability = 1 or 100%.
- Payout involving a betting agency times probability = less than 100%, say 95% or 85% depending on the amount or percentage retained by the betting agency.
- The average return to the punters will be close to this percentage of all the bets placed.

All students can join in a final discussion of two different betting agencies:

- one which sets the payouts before the event and plans to keep 5% of all bets placed
- one which keeps 15% of all bets placed and distributes payouts after the event

Key message

- Higher payouts are matched with lower probabilities of winning.

Student record sheet
Sports betting simulation

Start with $50 and bet $10 on each match. Decide if Australia will win, lose or draw. Circle your choice before each game simulation.

	My choice (circle one)			Bet	Payout, if any result
Match 1	Win	Lose	Draw	$10	
Match 2	Win	Lose	Draw	$10	
Match 3	Win	Lose	Draw	$10	
Match 4	Win	Lose	Draw	$10	
Match 5	Win	Lose	Draw	$10	
	Total			**$50**	
	Total payout less $50				

Did you win or lose? _____ How much? _____

Application task

Use the spreadsheet with the following set-up: Betting agency percentage is 20%, Australia $200 to win, Japan $400 to win and $200 for the draw.

Predict: How many home team wins will there be in 20 matches? _____

Observe: Carry out 20 simulations of $1 bets on the home team.

How many home team wins were there? _____

Calculate the total payout at $3.20 per win. _____

How much money is won or lost on the 20 x $1 bets? _____

Explain: Was your number of wins reasonably close to what you predicted? Would you prefer this or the alternative of either a big loss or a big win on just one $20 bet?

Worksheet 7 – Sports betting

NAME: _____

1. In a game of heads or tails not involving a betting agency, a person collects $1 from each of two players who are prepared to bet on the toss of a coin.

   a) How much should be paid to the loser? _____

   b) How much should be paid to the winner? _____

   c) Which of these payouts should the person offer? Circle your choice.

      i. Heads $2 vs tails $2

      ii. Heads $1 vs tails $1

2. A person collects $1 from two players who are prepared to bet on a game in which the GWS Giants are three times as likely to win as the Western Bulldogs.

   a) What is the probability that the Western Bulldogs will win? _____

   b) What is the probability that the GWS Giants will win? _____

   c) What should the payouts be?

      GSW Giants $ _____ vs Western Bulldogs $ _____

   d) A betting agency returns only 95% of all bets placed. What would the betting agency's payouts be for this game?

      GSW Giants $ _____ vs Western Bulldogs $ _____

3. A betting agency advertises Giants $1.05 vs Sharks $10.

   a) How much money would you win with a winning $1 bet on the Giants?

      _____

b) How much money would you win with a winning $1 bet on the Sharks?

_____

c) Which team is favoured to win? _____

4. The Reds are only very slightly favoured towards the end of a very close match against the Blues.

a) What payouts would you suggest for a $1 bet that doesn't involve a betting agency?

Reds $ _____ vs Blues $ _____

b) What payouts would an online betting agency be likely to offer in the same situation?

Reds $ _____ vs Blues $ _____

5. A betting agency advertises Gold Coast SUNS $2.82 vs St Kilda $1.41 on a match to be played soon.

a) A player betting $10 on St Kilda would end up either losing $10 or winning a small amount.

How much would that be? _____

b) How much money would a player win if they bet $10 on Gold Coast SUNS, and they ended up winning?

_____

c) Based on these figures, which team is more likely to win the match?

_____

d) If the payout on the match described in question 5 had not involved a betting agency, it would have been Gold Coast SUNS $3.00 vs St Kilda $1.50. What does this tell you about the percentage return that the betting agency has planned for?

_____

_____

6. A person collects $1 from two players who are prepared to bet on a game in which the Giants are three times as likely to win as the Western Bulldogs.

   a) What is the probability that the Western Bulldogs will win? _____

   b) What is the probability that the Giants will win? _____

   c) What should be the payout if the Western Bulldogs win? _____

   d) What should be the payout if the Giants win? _____

   e) A betting agency returns only 95% of all bets placed. What would be the betting agency payout on a Western Bulldogs win?

      _____

7. How are payouts on a game related to the probabilities of each team winning?

_____

_____

_____

_____

Worksheet 8 – Sports betting

NAME: _____

Use the following screenshot from the 'Sports betting agency' spreadsheet to answer the questions on this worksheet.

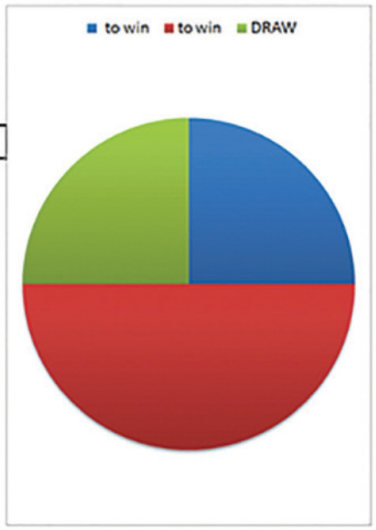
Sports betting agency

Type the team names and the total amounts bet on each. Delete percentage profit to start again.

Set the betting agency's percentage profit **20%**

Recalculate to play the game again (F9 or FN-F9)

Name the teams	**Australia**	**Japan**		
	to win	to win	DRAW	Total
Type the total bets for each result	**$200**	**$400**	**$200**	$800
Probabilities	0.250	0.500	0.250	
Payouts (if no betting agency)	$4.00	$2.00	$4.00	
Payouts (less betting agency profit)	$3.20	$1.60	$3.20	
Bet-to-payout ratio 1/payout	0.31	0.63	0.31	1.25
Result			**draw**	Total
Total payout calculation			**200x$3.2**	
Total payouts			**$640**	
Betting agency keeps			**$160**	
	Australia	Japan	DRAW	
Long-term results	19	32	15	
Long-term percentages	29%	48%	23%	



1. Based on the bets placed, which team is more likely to win? _____

2. The bets are used to calculate the probabilities and the payouts. How did they get 0.250 (¼) for the probability of a draw?

3. If there is no betting agency involved, how is a payout of $4.00 for a draw calculated?

4. If there is a betting agency involved, how is a payout of $3.20 for a draw calculated?

5. Josie and Lin each started with $50. Josie bet $10 on Australia and Lin bet $10 on Japan. How much money would they each have left at the end of the match, based on the result of a draw as shown in the spreadsheet?

   Josie $ _____ Lin $ _____

6. In the next game, the bets placed were $200 for a win, $500 for a loss and $300 for a draw. Under the same arrangements, with the same result, what will the betting agency keep?

7. This betting agency must always win while most of the players will lose. Explain why.

LESSON 5

Horseracing

Learning outcomes

Students will understand:

- betting products provided by gaming venues and betting agencies are designed to make profits from players
- gaming venues make money because there are more losses and fewer winnings over the long- term
- higher payouts are matched with lower probabilities of winning.

Students will be able to:

- calculate the probability of winning and the 'bet- to-payout ratio'
- recognise that gaming venues make money when the bet-to-payout ratio is greater than the probability of winning.

Resources

- A set of cards printed with each of the 2017 Melbourne Cup horses' names (see printable sheet provided overleaf). Students are given one horse card each. In classes of more than 24, ask students to share horse cards.
- A video clip of the 2017 Melbourne Cup. This should be available online. One such video is at: **https://www.youtube.com/watch?v=3OW-2UpG2IM**
- A container to be used for random selection of horse name cards. Alternatively, cards can be well shuffled and then dealt out to students.
- 48 suitable objects to be used as prizes (e.g., counters, blocks, stickers).
- **'Melbourne Cup' spreadsheet**.
- **'A day at the races' spreadsheet**.
- Copies of worksheets 9, 10 or 11 'The sweep' for students.

Tuning in

Recap with students the following terms that will be used throughout this lesson:

- **gambling/betting/wagering** (these terms can be used interchangeably, see Appendix 1 and/or word-match activities from Lesson 1)
- **betting agencies** (also known as bookmakers, or 'bookies')
- **payout**
- **player** (or punter, gambler)
- **sweep**.

Discuss examples of sports and race betting advertising that they have seen recently.

Consider the purpose of this advertising and how it only paints betting/gambling in a positive light (i.e., as a normal, fun, social and harmless activity). Discuss the potential influence of this advertising on how students think about betting/gambling and the importance of understanding the limited chances of winning and the risks involved.

5.1 Class simulations

There will be two simulations, allowing each student to have two bets.

Simulation 1: Sweep with no betting agency

- Students can decide how the 'prizes' will be distributed. The important requirement is that all the bets are distributed to the students (players) and not to a betting agency, which is not included in this first simulation.
- Distribute two prizes to each student to be used for their bets, one in each simulation.
- Explain that this first sweep will not involve a betting agency. Ask students to predict how this will affect their potential winnings.
- Ask students to place their bets. Collect one prize from each student and give them a horse card selected at random.

- Using the **'Melbourne Cup' spreadsheet**, choose a horse for 1st, 2nd, 3rd, and last places.
- Distribute the prizes as agreed.
- Calculate the average payout per student.

Simulation 2: Sweep with a betting agency

- Explain to students that this time the sweep will involve a betting agency. Ask them to predict how this will affect their potential winnings.

Run another sweep by repeating the instructions above, this time using the **2017 Melbourne Cup video clip** to decide 1st, 2nd, 3rd and last places. As the betting agency, take away half of the prizes available for students to win. Distribute the remaining prizes as agreed.

Discuss how involving a betting agency reduces the potential winnings for players because, as a business, a betting agency will seek to make a profit.

This content is supported by the 'Melbourne Cup' spreadsheet and the Teacher resource: 'Field for the 2017 Melbourne Cup'.

5.2 Individual worksheets

Allow students to work in three groups with each group having one of Worksheets 9, 10 or 11 'The sweep' to work on. Give students time to work on the worksheets.

These explore some of the issues to be considered in the discussion.

5.3 Class discussion and reflection

For the first sweep:

- What was the average payout per student?

There are two ways to answer this. Let the students decide how they will work it out.

The long way: Get the payout received by each student, add them and divide by the number of students.

The short way: Because all the money bet is returned to someone in the student group, the total is 100% of what they bet, so the average payout is 100% of the amount each student bet.

Therefore, the average payout is one prize per student.

For the second sweep:

- What was the average payout per student?

Because the betting agency (you) took half the money bet, the total amount returned to the students was half of the total that was bet.

Therefore, the average payout is only half a prize per student.

The average payout for commercial gambling activities (activities that involve a betting agency) is approximately 85% of the total amount bet.

Key message

- The amount paid back to the players is less when a betting agency is involved.

Teacher resource

Field for the 2017 Melbourne Cup

This set of cards with horses' names from the 2017 Melbourne Cup can be copied. Cut out the cards and give one card to each student.

17 LIBRAN	5 MARMELO	20 WALL OF FIRE	2 ALMANDIN
23 AMELIE'S STAR	3 HUMIDOR	14 US ARMY RANGER	24 CISMONTANE
6 RED CARDINAL	7 JOHANNES VERMEER	18 NAKEETA	8 BONDI BEACH
4 TIBERIAN	15 BOOM TIME	19 SINGLE GAZE	16 GALLANTE
9 MAX DYNAMITE	21 THOMAS HOBSON	12 WICKLOW BRAVE	1 HARTNELL
13 BIG DUKE	22 REKINDLING	10 VENTURA STORM	11 WHO SHOT THE BARMAN

Cut out the cards and distribute them randomly to 24 students. (Note: Who Shot The Barman was scratched on the day of the race, after most sweeps were organised.)

If the class has fewer than 24 students, the teacher can 'buy' the other tickets. If the class is over 24, ask students to share horses.

The results of the 2017 Melbourne Cup are:

1st: Rekindling **2nd:** Johannes Vermeer **3rd:** Max Dynamite **Last:** Gallante

Worksheet 9 – The sweep

NAME: _____

The table below shows the entries in a major horserace on which you will run sweeps.

1 Dunaden	2 Green Moon	3 Red Cadeaux	4 Sea Moon	5 Brown Panther
6 Fiorente	7 Foreteller	8 Dandino	9 Ethiopia	10 Fawkner
11 Mourayan	12 Seville	13 Super Cool	14 Masked Marvel	15 Mount Athos
16 Royal Empire	17 Voleuse De Coeurs	18 Hawkspur	19 Simenon	20 Ibicenco
21 Verema	22 Dear Demi	23 Tres Blue	24 Ruscello	

1. Suppose you have collected $2 for each of the 24 entries in the sweep and have agreed that all the money collected will be shared as prizes as follows:
   - one half for 1st place
   - then one half of the remaining money for 2nd place
   - then one half of the remaining money for 3rd place
   - the rest of the money for last place.

   a) How much would each of these prizes be for your class?

   1st: _____ 2nd: _____ 3rd: _____ Last: _____

   b) In advertising the sweep, you say that, on average, people will get their $2 back. Is this true? Explain.

   _____

   _____

2. Now you decide to keep $4 of the $24 collected to cover the costs of organising the sweep.

   a) How much would each of the four prizes be?
   (Use the same rules as above.)

   1st: _____ 2nd: _____ 3rd: _____ Last:_____

   b) What is the average amount paid to each of the 24 participants?
   (Remember to include the 20 zero payments in your calculation.)

Worksheet 10 – The sweep

NAME: _____

1. Each of 24 people in an office puts $10 in a sweep. Each gets a horse with a chance to win. This is the 'prize pool'.

   a) If the betting agency does not take out any expenses, half the pool goes to the winner, one quarter to 2nd and one eighth to each of 3rd and last places. Calculate the prizes.

   b) Now the betting agency takes $120 for expenses. What percentage is this of the total bets?

   c) Calculate the new prizes.

   d) What percentage of the total bets has been returned to the gamblers?

2. Imagine you started with $100 and bet $10 on a sweep in which the gamblers lost half their money, day after day. How long do you think your $100 might last?

Worksheet 11 – The sweep

NAME: _____

1. Imagine you started with $1,000 and bet all your remaining money on a sweep in which players lost half their money, day after day. How long do you think your $1,000 might last?

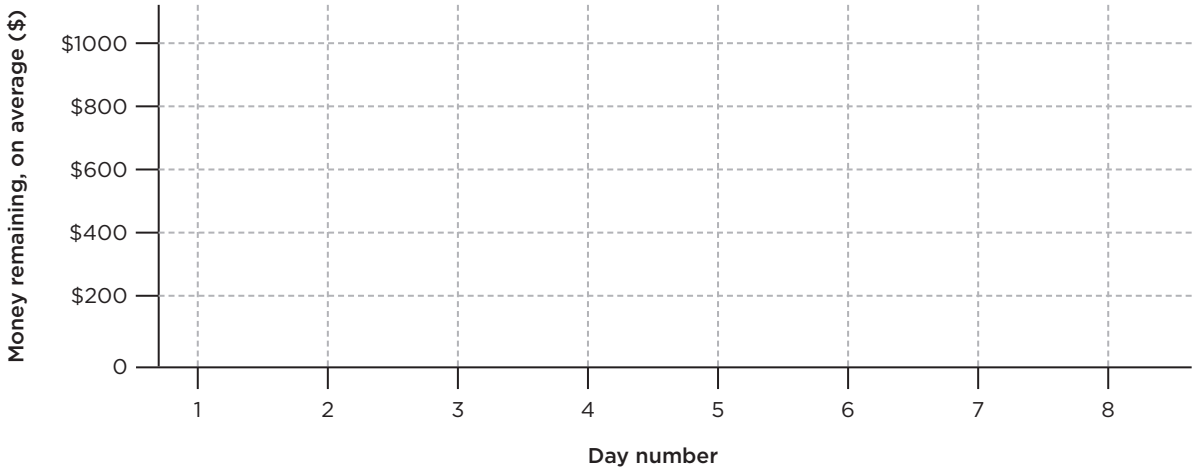
_____

_____

2. Assuming that, on average, you lose half your money each day, complete the table below using only whole numbers.

Day number	1	2	3	4	5	6	7	8
Money remaining, on average ($)	1,000	500						

3. Use the graph below to show the numbers in the table. Mark each day as a point and join the points with a line in one colour.



4. In some Australian gambling situations, 85% of the money must be repaid to gamblers (on average) at each gamble. This means the betting agency may only take 15%.

   At this rate, how long do you think your $1,000 might last?

5. Assuming that, on average, you lose 15% of your money each day, complete the table below using only whole numbers.

Day number	1	2	3	4	5	6	7	8
Money remaining, on average ($)	1,000	850						

6. Using a different colour this time, show the numbers in the table on the graph in question 3.

5.4 A day at the races

Resources

- A six-sided die
- Name tags numbered 1 to 6
- Play money: 30 × $5 notes (printable sheet provided)
- **'A day at the races' spreadsheet**
- Copies of student record sheet 'A day at the races'
- Copies of worksheets 12, 13 and 14 'A day at the races'

Tuning in

Ask students what they know about horseracing and betting.

Show them the payouts (or 'prices') offered for races on practically any day online or in a newspaper.

Explain that the purpose of this lesson is to understand the full story about horserace betting, especially how agencies design their products to maximise their profits at the expense of players and that, the higher the potential payout, the lower the chances of winning.

5.5 Class simulations

Simulation 1: Using a die with equal payouts

- Conduct this simulation using $5 play money notes for eight races. Each race has six horses (numbered 1 to 6) with equal payouts of $25 on a $5 bet. Roll a die to decide the result of each race.
- Students use the Student record sheet 'A day at the races' to fill in their choice of horse numbers for each race, and fill in their payouts and balances as the simulation continues.
- Organise six students at the front of the room, with name tags indicating which horse they will bet on for each of the eight races. Each of these students starts with five $5 play money notes.
- Collect one $5 note from each of the six students ($30 in total) then toss a die to determine the result of each race. A payout of $25 is then handed to the winner, with the bookie keeping $5.
- Conduct eight race simulations, with students dropping out once they have lost all their initial $25.
- At the end, students report their overall wins or losses – an average loss of one-sixth of all bets placed. The bookie reports the amount they have gained from the six students.

Simulation 2: Using the 'A day at the races' spreadsheet

- Run the 'A day at the races' spreadsheet 20 times with **equal** payouts of $5. Students record the results in a table and on a number line, then analyse them to compare average losses with any predictions they have been able to make.
- Run the spreadsheet 20 times with **unequal** payouts, such as those used in Worksheet 12 'A day at the races'. Students record and analyse the results as above.

Horse	1	2	3	4	5	6
Payouts	$3	$4	$5	$10	$4	$6

5.6 Individual worksheets

Hand out to students copies of worksheets 12, 13 and 14 'A day at the races' for them to work through. They can work individually or in pairs. Circulate to check on how students are progressing and assist in explaining what is expected. It is important to leave sufficient time for a full discussion afterwards.

5.7 Class discussion and reflection

Hold a class discussion and give students the chance to discuss their experiences and findings conducting the simulations and offer their answers and explanations.

The key results relating to the last two questions are:

- Probability times payout = ⅙ × $5 = $0.83 or 83% of bets placed.
- This 83% is the expected (or predicted average) return to the punters on all bets placed. It means that the betting agency (e.g., the TAB) expects to take 17% of all bets placed.

Ask students:

- Imagine you had been allowed to spend more than $5 on any of the eight races. Would you still expect to go home with about $20.75 of your original $25?

Support students to explain the key results:

- The sum of the bet-to-payout ratios is greater than one.
- The expected (or predicted average) return to the punter can be calculated by comparing this sum to the sum of the probabilities, which must be 1.

Ask students to confirm these conclusions using their different figures.

Key message

- Higher payouts are matched with lower probabilities of winning. The only party that is guaranteed to make money at the races is the bookmaker, at the expense of players.

5.8 Assessment: report and presentation

To meet the requirements of the VCE Vocational Major Numeracy study design, students need to communicate and report on the outcomes of their work and investigations. This is Stage 4 of the problem-solving cycle.

At the end of their work on the lessons and activities throughout this resource, ask students to compile a report documenting their journey and for them to reflect on what they have done and what they have learnt. This report should include the following:

- Appendix 2 'Student self- assessment record'
- Appendix 3 'Student reflection activity'
- Promotional material about gambling based on their work across the Unit (see below).

Development of promotional materials

Based on the activities and worksheets undertaken across the whole unit, students should create a brochure, poster, fact sheet, video, or any multimedia advertisement encouraging people to be aware of the risks of gambling. The criteria could be that the advertisement needs to:

- address common misconceptions/beliefs
- use mathematics to explain the misconceptions, giving examples of payout figures etc
- discuss the different forms of gambling mentioned in these lessons be engaging.

Feedback

Provide feedback to students via conferencing, reflecting on the key elements they achieved and areas for future development and focus.

Teachers familiar with websites such as Kahoot, Plickers or Quizzes can use these to complete the reflection activity and/or self-assessment record.

Play money: 15 × $5 notes
A day at the races

Student record sheet
A day at the races

NAME: _____

1. Fill in your choices and results for the dice simulation of a day at the races.

Race number	My horse	My bet	My win or loss	Balance $25 at the start
1		$5		
2		$5		
3		$5		
4		$5		
5		$5		
6				
7				
8				

2. Fill in the table as you play the **'A day at the races' spreadsheet** game 20 times with payouts of $5 for each horse.

   Use positive numbers for wins and negative numbers for losses. Then plot the results for each race/trial on the number line below and complete the calculations.

Trial number	Win (+$) or lose (–$)	Trial number	Win (+$) or lose (–$)	Trial number	Win (+$) or lose (–$)	Trial number	Win (+$) or lose (–$)
1		6		11		16	
2		7		12		17	
3		8		13		18	
4		9		14		19	
5		10		15		20	

Sum of losses = $ _____

Sum of wins = $ _____

Difference = $ _____

Average loss per game = $ Average return on the $100 bet = $ _____

3. Fill in the table as you play the 'A day at the races' spreadsheet game 20 times with the following unequal payouts.

Horse	1	2	3	4	5	6
Payouts	$5	$2.50	$5	$10	$2.50	$5

Use positive numbers for wins and negative numbers for losses. Then plot the results for each race/trial on the number line below and complete the calculations.

Trial number	Win (+$) or lose (–$)	Trial number	Win (+$) or lose (–$)	Trial number	Win (+$) or lose (–$)	Trial number	Win (+$) or lose (–$)
1		**6**		**11**		**16**	
2		**7**		**12**		**17**	
3		**8**		**13**		**18**	
4		**9**		**14**		**19**	
5		**10**		**15**		**20**	

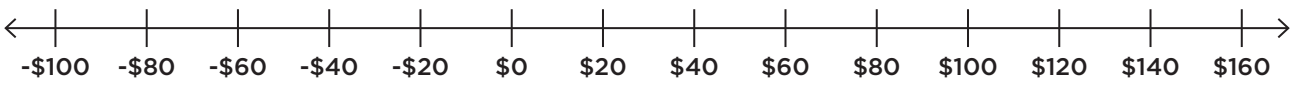
Sum of losses = $ _____

Sum of wins = $ _____

Difference = $ _____

Average loss per game = $ _____

Average return on the $100 bet = $ _____



Worksheet 12 – A day at the races

NAME: _____

This worksheet is based on the following screenshot from the 'A day at the races' spreadsheet.

Horse	1	2	3	4	5	6	Totals
payouts	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	
bet to payout ratios	0.20	0.20	0.20	0.20	0.20	0.20	1.200
probability	0.17	0.17	0.17	0.17	0.17	0.17	1 of course

Race	Balance	Bet	horse	winner	win/lose	
1	$100	$5	1	4	-$5	
2	$95	$5	2	2	$25	W
3	$120	$5	1	2	-$5	
4	$115	$5	3	1	-$5	
5	$110	$5	1	2	-$5	
6	$105	$5	4	6	-$5	
7	$100	$5	1	1	$25	W
8	$125	$5	6	2	-$5	
Final balance	$120			Your win/loss	$20	

Set the payouts.
Then choose your horse for each race

To run the 8 races or tap F9.

You can change the payouts
but make the total bet to payout ratios more than 1.

Expected return = 83.3%

1. The player placed eight bets of $5 each, a total of $40, and had two winning bets that each paid $25. How much did they end up winning or losing?

2. Were two wins out of eight better or worse than you would expect to get by random selection of one of the six horses? Explain your answer.

3. How much would the player have won or lost if they had bet on horse 6 in every race?

4. What is the probability that horse 4 will win race 1 next time?

5. Calculate the payout × probability for horse 1.

6. The expected return is 83.3% (⅚ as a fraction). What does that mean?

Worksheet 13 – A day at the races

NAME: _____

A player participated in the 'A day at the races' game 20 times with the following payouts per $1. They start with $25 in total to bet each time.

Horse	1	2	3	4	5	6
Payouts	$5	$2.50	$5	$10	$2.50	$5

Their results are shown in this table.

	Wins	Losses
	$20	$10 $22.50 $22.50
	$50	$25 $10 $10
	$50	$25 $25 $25
	$7.50	$25 $10 $22.50
	$7.50	$22.50 $25 $25
Total	**$135**	

1. Find the total losses. Then compare the total losses to the total wins.

   Total losses = $ _____

   Losses – wins = $ _____

2. How many times out of 20 did they lose all the initial $25? _____

3. How much of the 20 × $25 = $500 did the player keep? _____

4. What percentage of their $500 did the player keep? _____

5. Use a calculator to confirm that the sum of the bet-to-payout ratio is 1.5.

   $1/5 + 1/2.5 + 1/5 + 1/10 + 1/2.5 + 1/5$ = _____

In the long run the player can expect an average of a 66.7% (⅔) return on the bets placed. How close was this to your answer to question 4?

Worksheet 14 – A day at the races

NAME: _____

With payouts per $1 as shown below, a player bet on horse number 4 in every one of the eight races. They start with $25 in total to bet each time.

Horse	1	2	3	4	5	6
Payouts	$3	$4	$5	$10	$4	$6

1. The largest amount the player could lose is $25, and this is quite likely. Explain why.

_____

_____

2. How much money would the player win if horse number 4 was the winner in every race?

_____

3. Use a calculator to confirm that the sum of the bet-to-payout ratios is 1.5.

   ⅓ + ¼ + ⅕ + 1/10 + ¼ + ⅙ = _____

4. The probability that horse 4 will win the first race is less than 1/10. Explain why.

_____

5. Calculate probability × payout for horse 4.

_____

6. On average, the player should expect to end up keeping about $19.75 of the original $25. Explain why.

7. If horse 1 was scratched at the last minute, the player would have a better chance of winning than the bookie. Explain why.

8. Make up a set of six payouts for which the player could expect to break even on wins and losses in the long term. Enter these in the table below. (There is more than one answer to this question.)

Horse	1	2	3	4	5	6
Payout						

Definitions

Defining gambling/betting

Gambling/betting requires a person to risk losing something of value (usually money) for the chance of winning more, which is dependent on an uncertain outcome such as a particular horse coming first in a race, a particular team winning a sporting match or having a certain combination of cards in a card game.

Common gambling terms

Gaming venue is the business that provides gambling products, often associated with poker machines. Examples of gaming venues include clubs and hotels. As with betting agencies, these businesses seek to make a profit at the expense of players.

Betting agency (bookmaker, bookie) is the business that provides the betting product or opportunity to bet/gamble. This term is often associated with sports or race betting. Like any business, betting agencies seek to make a profit at the expense of the players.

Expenditure is the expression used to describe the amount lost by a player or players from their gambling. It is calculated by deducting winnings paid out from the amount wagered (turnover).

Gambler is the person placing the bet.

Payout is the amount returned to the person for a winning bet, commonly understood to be for a bet of $1.

Pokies or poker machine is the popular name for an electronic gaming machine. These are found in Victorian hotels and clubs. They use random numbers to decide on wins and losses.

Pre-commitment is a way in which a player can decide beforehand how much they are prepared to lose in a gambling session.

Probability is a way of calculating and describing how likely something is to happen.

Product (in this context) is any opportunity to bet provided by a betting agency.

Turnover is the expression used to describe the amount wagered. It is all the money bet before any winnings are paid out or losses incurred.

Wagering refers to all legal forms of betting/ gambling on racing and sporting events.

Appendix 2

Student self-assessment record

NAME: _____

To be completed by students as a self-assessment and moderated by teachers through a feedback conversation.

How have your thoughts changed as a result of doing this unit, 'What are the odds?'

Key message	Before the unit	After the unit
Chance has no memory; outcomes are impossible to predict.	☐ I knew ☐ I didn't know	☐ I know ☐ I still need practice
Differences in payouts arise when a gaming venue is involved.	☐ I knew ☐ I didn't know	☐ I know ☐ I still need practice
Total payouts are not always 100% of the amount bet.	☐ I knew ☐ I didn't know	☐ I know ☐ I still need practice
Games provided by gaming venues are designed to make a profit.	☐ I knew ☐ I didn't know	☐ I know ☐ I still need practice
Gamblers must lose money in the long run if a gaming venue is involved.	☐ I knew ☐ I didn't know	☐ I know ☐ I still need practice
No matter how much you start out with, you're likely to lose money if you gamble.	☐ I knew ☐ I didn't know	☐ I know ☐ I still need practice
Setting a limit and sticking to it avoids harm from gambling and spending a significant amount of money.	☐ I knew ☐ I didn't know	☐ I know ☐ I still need practice
The amount paid back to the players is less when a betting agency is involved.	☐ I knew ☐ I didn't know	☐ I know ☐ I still need practice
The more a person bets, the greater the likelihood of losing all the money they started with.	☐ I knew ☐ I didn't know	☐ I know ☐ I still need practice
If you keep gambling in the hope of winning back your losses, you are very likely to fail and lose even more.	☐ I knew ☐ I didn't know	☐ I know ☐ I still need practice
Higher payouts are matched with lower probabilities of winning.	☐ I knew ☐ I didn't know	☐ I know ☐ I still need practice

Appendix 3

Student reflection activity

NAME: _____

Rate yourself on the effort scale! 0 means you didn't try at all throughout the lessons and activities and 10 means you tried your best the whole time. Circle the number that best suits how much effort you put into the activities and worksheets throughout this resource on **Odds and Probability**.

0 1 2 3 4 5 6 7 8 9 10

1. Reflect on the work you have done throughout this unit on chance and probability where you had to apply a range of different maths skills and calculations. Indicate if you had to use the following skills or not.

Math skill	Did you use this skill?
Understand and compare different numbers: decimal, fractions and percentages	YES ☐ NO ☐
Undertake calculations such as +, -, ×, and ÷	YES ☐ NO ☐
Work out proportions and ratios of one value compared to another, including to express them as a fraction or percentage.	YES ☐ NO ☐
Estimate, predict and calculate the likelihood of events occurring using decimals, ratios and percentages.	YES ☐ NO ☐
Identify possible outcomes of probability and chance events and represent them in different ways	YES ☐ NO ☐
Compare different real-life events or probabilities	YES ☐ NO ☐
Make decisions based on sets of probability-based, relevant and appropriate data and information	YES ☐ NO ☐
Understand and evaluate risk in relation to relevant and appropriate problems with reference to the chance or likelihood of events occurring.	YES ☐ NO ☐

2. And where you had to use a range of different technologies and use these often for making calculations or investigating different chance events, indicate how often you used and worked out results and outcomes for each of these ways.

Method used for calculating	Did you use this skill?		
In your head	A little ☐	Quite a bit ☐	A lot ☐
Using pen-and-paper	A little ☐	Quite a bit ☐	A lot ☐
Using a calculator	A little ☐	Quite a bit ☐	A lot ☐
Using a spreadsheet	Not at all ☐	A little ☐	Quite a bit ☐
Using other technology or apps – name the technology or application: _____ _____	Not at all ☐ Not at all ☐	A little ☐ A little ☐	Quite a bit ☐ Quite a bit ☐

3. Did the different activities, worksheets and the questions help you to better understand how you use mathematics, especially using spreadsheet software, in our lives and at work? In what areas and ways?

4. In one sentence, explain something that you learnt in from this unit of work.

5. Write below an example of what you learnt.

6. Complete the following sentence.

   Something I'd like to learn more about is _____

VCE VOCATIONAL MAJOR –

NUMERACY

UNIT 4

ODDS AND PROBABILITY