

Student Name _____	Class _____	Score _____
Parent Signature _____	Date _____	

6:01 | The Language of Probability

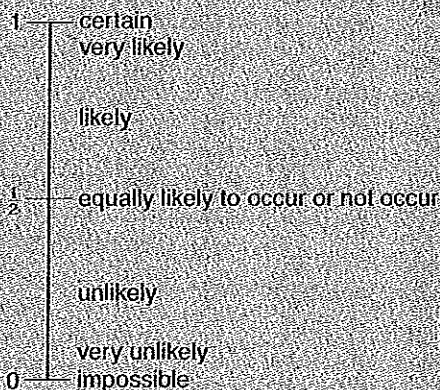
Outcome NS 4.4

Probability is all about using mathematics to describe **chance**—how likely events are to occur.

We express probabilities of events as numbers between 0 and 1.

- An event that has no chance of happening has a probability of 0.
- An event that is equally likely to occur or not occur has a probability of $\frac{1}{2}$ or 0.5.
- An event that is certain to occur has a probability of 1.

This scale shows how the probability of a range of events can be described.

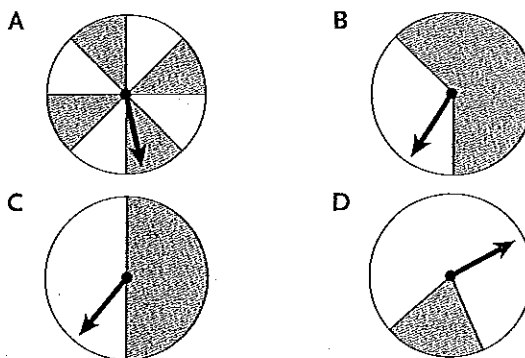


- 1** Say whether each of these events is 'certain to happen', 'likely to happen', 'unlikely to happen' or 'impossible'.
- You will live in the same house for the rest of your life. _____
 - You will toss a dice once and get a 'six'. _____
 - The sun will set in the west tonight. _____
 - It will be colder where you live in February than in April. _____
 - The mail will be delivered in your street tomorrow. _____
 - It will rain where you live sometime next month. _____
 - Your maths teacher next year will have been born last century. _____

2 Complete these sentences. Choose from these options: 'is certain to', 'is unlikely to' or 'will never'.

- 'An event with a probability of 0 _____ occur'.
- 'An event with a probability of 1 _____ occur'.
- 'An event with a probability of 0.1 _____ occur'.

3 Each diagram shows a spinner that must stop on either grey or white.



- Which spinner(s) would be equally likely to stop on grey or white? _____
- Which spinner is most likely to stop on white? _____

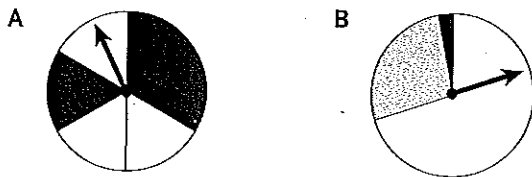
4 Complete each statement.

- An event that is unlikely to occur has a probability of less than _____.
- An event that is very likely to occur has a probability close to _____.

5 Give an event of your own for each of these four possibilities.

- 'certain to happen' _____
- 'likely to happen' _____
- 'unlikely to happen' _____
- 'impossible' _____

- 6** The diagram shows two discs, each of which has a spinner that can stop anywhere on the disc.

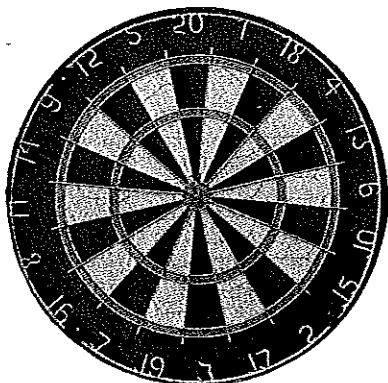


- a Which spinner is equally likely to stop on a black or a white sector? _____
- b Complete these sentences.
- It is likely that spinner _____ will stop on a _____ sector.
 - It is very unlikely that spinner _____ will stop on a _____ sector.
- c Describe an event that is *unlikely* to happen with one of these spinners.
- _____
- _____

- 7** Recently, Gail put on a blind-fold and threw a dart at a dartboard a number of times. She hit the board nine times altogether, and missed with her other throws.

Complete these sentences. Choose from: 'likely', 'unlikely', 'almost certain', 'very unlikely'.

- If she had thrown the dart 50 times and hit nine times, her next throw is _____ to hit the board.
- If she had thrown the dart 15 times and hit nine times, her next throw is _____ to hit the board.
- If she had thrown the dart 1000 times and hit nine times, her next throw is _____ to hit the board.
- If she had thrown the dart nine times and hit nine times, her next throw is _____ to hit the board.



6:02 | The Probability of Simple Events (Part I)

Outcome NS 4.4

When outcomes are equally likely, we can work out probabilities using this fraction:

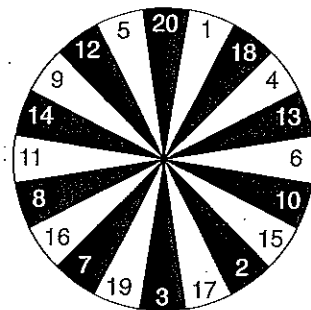
$$\text{Probability} = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$

Example: What is the probability of getting a multiple of 6 if a dart is equally likely to hit any number on a dartboard?

Answer: The favourable outcomes are 6, 12 and 18.

$$\frac{\text{the number of possible favourable outcomes}}{\text{the total number of possible outcomes}} = \frac{3}{20}$$

1



A dart is thrown at random at the above dartboard and hits it. What is the probability:

- that it hits a black part? _____
- of getting a multiple of 5? _____
- of getting a number less than 13? _____

- 2** If one letter is chosen at random from the letters of the word {m a t h s} what is the probability that it is:

- the letter a? _____
- the letter z? _____

- 3** An egg container holds 12 eggs. Three of them have been hard boiled. If one of the eggs is chosen at random, what is the probability it is hard boiled?
- _____

- 4** 'Thirty days hath September, April, June and wild November. All the rest have 31, excepting February alone; which has 28 days clear—and 29 in each leap year.'

A month is chosen at random. What is the probability that it has:

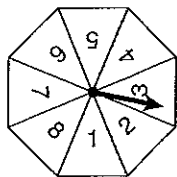
- 30 days? _____
- 31 days? _____

Student Name _____	Class _____	Score _____
Parent Signature _____	Date _____	

6:02 | The Probability of Simple Events (Part 2)

Outcome NS 4.4

- Give an example of a situation in which an event has a probability of:
 - $\frac{1}{6}$ _____
 - $\frac{2}{5}$ _____
- A packet of jellybeans is almost empty. It has two black, seven red, four orange and five red ones left. If one is chosen at random, what is the probability it is black? _____
- This spinner is marked with numbers from 1 to 8. Each number is equally likely.



Write as a fraction the probabilities of getting these results.

- a 5 _____
 - an odd number _____
 - a 9 _____
 - a number less than 6 _____
 - a number greater than 1 _____
 - a number that is divisible by 3 _____
- A magician has a packet of letters that spell the word ABRACADABRA. One of the letters is removed at random. What is the probability that it is:
 - the letter A? _____
 - the letter R? _____
 - before M in the alphabet? _____
 - the letter Q? _____

6:03 | Complementary Events

Outcome NS 4.4

The events **E** and **not E** are called complementary events. The sum of their probabilities is 1.

Example: The probability you have to change a light-bulb in your house next week is $\frac{1}{10}$.
The probability that you do not have to do this is $1 - \frac{1}{10} = \frac{9}{10}$.

- Write down the complement of each event.
 - My car will have a flat battery.

 - A coin will come up 'heads' when next tossed.

 - I will not get an Easter egg next Easter.

- If the probability that the next bus is full is $\frac{3}{8}$, what is the probability that the next bus is not full?

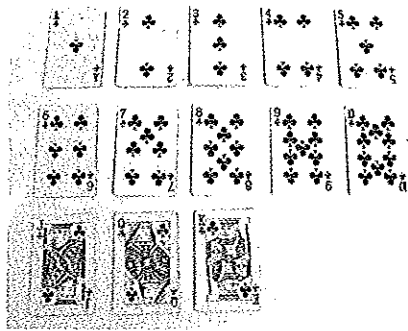
- If the probability of your favourite soccer team winning its next match is 0.4 and the probability that it draws is 0.15, what is each of these probabilities?
 - P (does not win next match) _____
 - P (loses next match) _____
- Here are some probabilities for flights you can choose that fly across the Tasman from Sydney to Auckland.
P (Air New Zealand) = 0.34, P (Qantas) = 0.33
P (Thai Airways) = 0.07, P (Lan Chile) = 0.02
You choose a flight at random. Write down the probability that the flight is:
 - not Qantas _____
 - not Thai Airways _____
 - not Lan Chile _____
 - Qantas or Air New Zealand _____
 - not Qantas or Air New Zealand _____

- 5** A standard pack of cards has 52 cards. These include four 'suits':

Hearts	♥
Diamonds	♦
Clubs	♣
Spades	♠

Each suit has 13 cards: ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, jack, queen and king.

The photo shows all the 13 'clubs' cards:



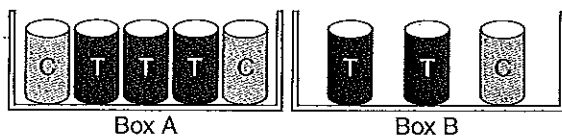
A card is drawn at random from a standard pack of cards. What is the probability that it is:

- a 4? _____
- the jack of clubs? _____
- a queen? _____
- a spade? _____
- not a diamond? _____
- a red card? _____
- a picture card? _____
- a card with a number less than 5?
(Note: count an ace as 1.) _____

6:04 | Using Probability

Outcome NS 4.4

- 1** Each of these two boxes holds a number of tins of soup—chicken (C) and tomato (T).

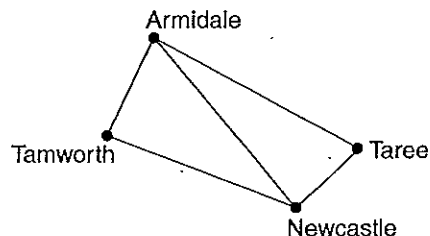


- What is the probability of taking out a tin of tomato soup from box A? _____
- What is the probability of taking out a tin of tomato soup from box B? _____
- Which box should you go to if you want to take out a tin of tomato soup (without looking)? Explain. _____

- 2** Stuart keeps six socks in a drawer. They are identical except for their colour, and have all been mixed together.

The socks are: one red pair, one grey pair, one brown sock and one blue sock.

- What fraction of the socks are red? _____
 - Stuart chooses one sock at random from the drawer. What is the probability it is either blue or red? _____
 - Stuart takes socks from the drawer one at a time. How many will he need to take to make sure he gets a pair that are the same colour? _____
 - How many possible pairs of socks are there that are not the same colour? _____
- 3** This diagram shows some different ways for tourists to travel from Armidale to Newcastle.



- Make a list of all the possible ways of going from Armidale to Newcastle without going through any of these places more than once.

- If a group of tourists choose a route at random for the Armidale to Newcastle journey, what is the probability they go through Tamworth?

- 4** There is no obvious relationship between earthquakes and the time of the day or day of the week on which they occur. What is the probability that the next severe earthquake to hit Wellington, NZ:

- occurs on a Monday? _____
- occurs at the weekend (Saturday/Sunday)? _____
- occurs between 4 p.m. and 8 p.m.? _____
- hits during business hours (8 a.m.–6 p.m.) on a weekday? _____

Student Name _____	Class _____	Score _____
Parent Signature _____	Date _____	

6:01 | The Language of Probability

Outcome NS 4.4

Probability is all about using mathematics to describe chance – how likely events are to occur.

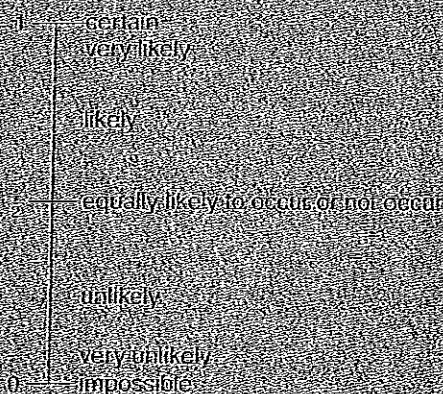
We express probabilities of events as numbers between 0 and 1.

• An event that has no chance of happening has a probability of 0.

• An event that is equally likely to occur or not occur has a probability of $\frac{1}{2}$ or 0.5.

• An event that is certain to occur has a probability of 1.

This scale shows how the probability of a range of events can be described.



1 Say whether each of these events is 'certain to happen', 'likely to happen', 'unlikely to happen' or 'impossible'. unlikely to happen ✓

a You will live in the same house for the rest of your life. _____

b You will toss a dice once and get a 'six'. Unlikely to happen ✓

c The sun will set in the west tonight. Certain to happen ✓

d It will be colder where you live in February than in April. unlikely to happen ✓

e The mail will be delivered in your street tomorrow. Certain to happen ✓

f It will rain where you live, sometime next month. likely to happen ✓

g Your maths teacher next year will have been born last century. impossible ✓

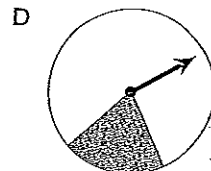
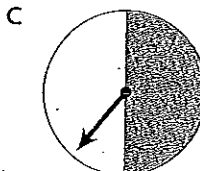
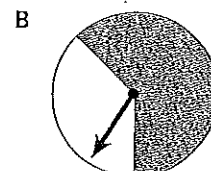
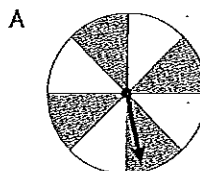
2 Complete these sentences. Choose from these options: 'is certain to', 'is unlikely to' or 'will never'.

a 'An event with a probability of 0 will never occur'.

b 'An event with a probability of 1 is certain to occur'.

c 'An event with a probability of 0.1 is unlikely occur'.

3 Each diagram shows a spinner that must stop on either grey or white.



a Which spinner(s) would be equally likely to stop on grey or white? A, C ✓

b Which spinner is most likely to stop on white? D ✓

4 Complete each statement.

a An event that is unlikely to occur has a probability of less than 0.5 ✓.

b An event that is very likely to occur has a probability close to 1 ✓.

5 Give an event of your own for each of these four possibilities.

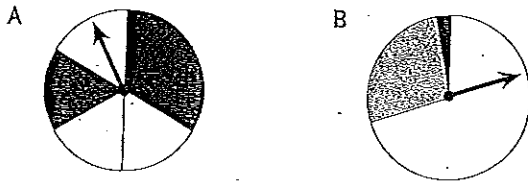
a 'certain to happen' I will answer this question ✓

b 'likely to happen' I will go to school tomorrow ✓

c 'unlikely to happen' I will not go to school tomorrow. ✓

d 'impossible' I will fly to the moon. ✓

6 The diagram shows two discs, each of which has a spinner that can stop anywhere on the disc.

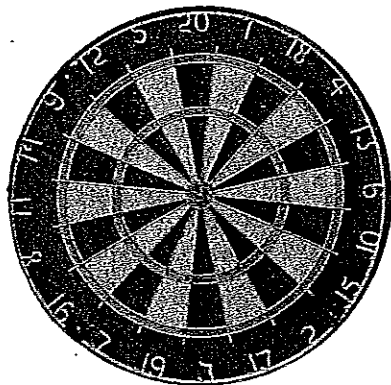


- a Which spinner is equally likely to stop on a black or a white sector? A ✓
- b Complete these sentences.
- i It is likely that spinner B will stop on a white sector.
- ii It is very unlikely that spinner B will stop on a black sector.
- c Describe an event that is unlikely to happen with one of these spinners.
It is unlikely the spinner B will stop of grey/black sector.

7 Recently, Gail put on a blind-fold and threw a dart at a dartboard a number of times. She hit the board nine times altogether, and missed with her other throws.

Complete these sentences. Choose from: 'likely', 'unlikely', 'almost certain', 'very unlikely'.

- a If she had thrown the dart 50 times and hit nine times, her next throw is unlikely to hit the board.
- b If she had thrown the dart 15 times and hit nine times, her next throw is likely to hit the board.
- c If she had thrown the dart 1000 times and hit nine times, her next throw is very unlikely to hit the board.
- d If she had thrown the dart nine times and hit nine times, her next throw is almost certain to hit the board.



6:02 | The Probability of Simple Events (Part I)

Outcome NS 4.4

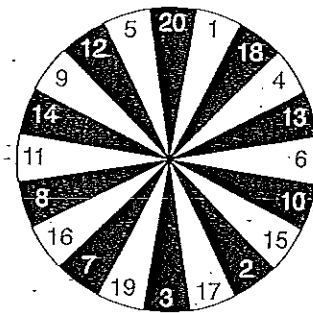
When outcomes are equally likely, we can work out probabilities using this fraction:

$$\text{Probability} = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$

Example: What is the probability of getting a multiple of 6 if a dart is equally likely to hit any number on a dartboard?

Answer: The favourable outcomes are 6, 12 and 18.

$$\frac{\text{the number of possible favourable outcomes}}{\text{the total number of possible outcomes}} = \frac{3}{20}$$



A dart is thrown at random at the above dartboard and hits it. What is the probability:

- a that it hits a black part? equally likely $\frac{1}{2}$ ✓
- b of getting a multiple of 5? $\frac{4}{20} = \frac{1}{5}$ ✓
- c of getting a number less than 13? $\frac{12}{20}$ ✓ = $\frac{3}{5}$

2 If one letter is chosen at random from the letters of the word (m a t h s) what is the probability that it is:

- a the letter a? $\frac{1}{5}$ ✓
- b the letter z? 0 ✓

3 An egg container holds 12 eggs. Three of them have been hard boiled. If one of the eggs is chosen at random, what is the probability it is hard boiled?

$$\frac{3}{12} = \frac{1}{4}$$

4 'Thirty days hath September, April, June and wild November. All the rest have 31, excepting February alone; which has 28 days clear—and 29 in each leap year.'

A month is chosen at random. What is the probability that it has:

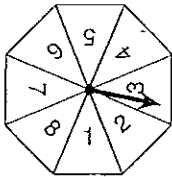
- a 30 days? $\frac{4}{12} = \frac{1}{3}$ ✓
- b 31 days? $\frac{7}{12}$ ✓

Student Name	Class	Score
Parent Signature	Date	

6:02 | The Probability of Simple Events (Part 2)

Outcome NS 4.4

- 1** Give an example of a situation in which an event has a probability of:
- a $\frac{1}{6}$ If there is 1 tennis ball and 5 basketball what is the chances of the tennis ball being chosen.
- b $\frac{2}{5}$ If there is 3 blue pens and 2 red pens, what is the chance of a red pen being selected at random.
- 2** A packet of jellybeans is almost empty. It has two black, seven red, four orange and five red ones left. If one is chosen at random, what is the probability it is black? $\frac{2}{18} = \frac{1}{9}$
- 3** This spinner is marked with numbers from 1 to 8. Each number is equally likely.



Write as a fraction the probabilities of getting these results.

- a a 5 $\frac{1}{8}$
- b an odd number $\frac{4}{8} = \frac{1}{2}$
- c a 9 0
- d a number less than 6 $\frac{5}{8}$
- e a number greater than 1 $\frac{7}{8}$
- f a number that is divisible by 3 $\frac{2}{8} = \frac{1}{4}$
- 4** A magician has a packet of letters that spell the word ABRACADABRA. One of the letters is removed at random. What is the probability that it is:
- a the letter A? $\frac{5}{11}$
- b the letter R? $\frac{2}{11}$
- c before M in the alphabet? $\frac{9}{11}$
- d the letter Q? 0

6:03 | Complementary Events

Outcome NS 4.4

The events **E** and **not E** are called complementary events. The sum of their probabilities is 1.

Example: The probability you have to change a light bulb in your house next week is $\frac{1}{10}$.

The probability that you do not have to do this is $1 - \frac{1}{10} = \frac{9}{10}$.

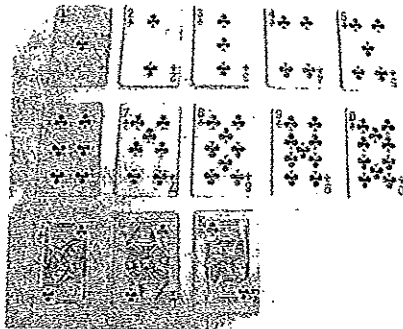
- 1** Write down the complement of each event.
- a My car will have a flat battery.
My car will have a good battery.
- b A coin will come up 'heads' when next tossed.
A coin will come up 'tails' when tossed.
- c I will not get an Easter egg next Easter.
I will not get an Easter egg next Easter.
- 2** If the probability that the next bus is full is $\frac{3}{8}$, what is the probability that the next bus is not full?
 $\frac{5}{8}$
- 3** If the probability of your favourite soccer team winning its next match is 0.4 and the probability that it draws is 0.15, what is each of these probabilities?
- a P (does not win next match) 0.6
- b P (loses next match) 0.6
- 4** Here are some probabilities for flights you can choose that fly across the Tasman from Sydney to Auckland.
- P (Air New Zealand) = 0.34, P (Qantas) = 0.33
P (Thai Airways) = 0.07, P (Lan Chile) = 0.02
- You choose a flight at random. Write down the probability that the flight is:
- a not Qantas 0.67
- b not Thai Airways 0.93
- c not Lan Chile 0.98
- d Qantas or Air New Zealand 0.67
- e not Qantas or Air New Zealand 0.33

- 5 A standard pack of cards has 52 cards. These include four 'suits':

Hearts	♥
Diamonds	♦
Clubs	♣
Spades	♠

Each suit has 13 cards: ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, jack, queen and king.

The photo shows all the 13 'clubs' cards:



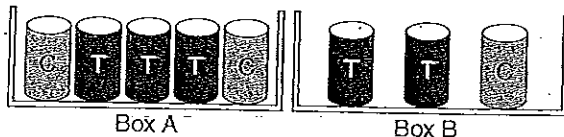
A card is drawn at random from a standard pack of cards. What is the probability that it is:

- a a 4? $\frac{4}{52} = \frac{1}{13}$ ✓
 b the jack of clubs? $\frac{1}{52}$ ✓
 c a queen? $\frac{1}{13}$ ✓
 d a spade? $\frac{13}{52} = \frac{1}{4}$ ✓
 e not a diamond? $\frac{39}{52} = \frac{3}{4}$ ✓
 f a red card? $\frac{26}{52} = \frac{13}{26} = \frac{1}{2}$ ✓
 g a picture card? $\frac{12}{52} = \frac{3}{13}$ ✓
 h a card with a number less than 5? (Note: count an ace as 1.) $\frac{16}{52} = \frac{4}{13}$ ✓

6:04 | Using Probability

Outcome NS 4.4

- 1 Each of these two boxes holds a number of tins of soup—chicken (C) and tomato (T).



- a What is the probability of taking out a tin of tomato soup from box A? $\frac{3}{5} = 0.6$ ✓
 b What is the probability of taking out a tin of tomato soup from box B? $\frac{2}{3} = 0.666$ ✓
 c Which box should you go to if you want to take out a tin of tomato soup (without looking)? Explain. Box B.

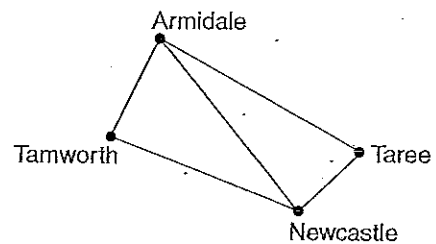
They both have the same probability of taking a tin of tomato or chicken.

- 2 Stuart keeps six socks in a drawer. They are identical except for their colour, and have all been mixed together.

The socks are: one red pair, one grey pair, one brown sock and one blue sock.

- a What fraction of the socks are red? $\frac{2}{6} = \frac{1}{3}$ ✓
 b Stuart chooses one sock at random from the drawer. What is the probability it is either blue or red? $\frac{1}{2}$ ✓
 c Stuart takes socks from the drawer one at a time. How many will he need to take to make sure he gets a pair that are the same colour? 3 ✓
 d How many possible pairs of socks are there that are not the same colour? 6 ✓

- 3 This diagram shows some different ways for tourists to travel from Armidale to Newcastle.



- a Make a list of all the possible ways of going from Armidale to Newcastle without going through any of these places more than once.
Armidale - Newcastle, Arm - Tam - New, Arm - Taree - New ✓
 b If a group of tourists choose a route at random for the Armidale to Newcastle journey, what is the probability they go through Tamworth?
 $\frac{1}{3}$ ✓

- 4 There is no obvious relationship between earthquakes and the time of the day or day of the week on which they occur. What is the probability that the next severe earthquake to hit Wellington, NZ:

- a occurs on a Monday? unlikely ✓
 b occurs at the weekend (Saturday/Sunday)? unlikely ✓
 c occurs between 4 p.m. and 8 p.m.? unlikely ✓
 d hits during business hours (8 a.m.—6 p.m.) on a weekday? likely ✓