Write WALT and Success Criteria in your book

WALT understand probability
Success Criteria I know ….

- Probability gives us a way to describe how much more like event is than another
- A probability is a number between 0 and 1
- 0 means 'impossible' and 1 means 'certain'
- If the outcomes are equally likely, we find the probability of an event by counting the ways it can happen and dividing the total number of outcomes.
-

Let's start: Estimating probabilities

Try to estimate the probability of the following events, giving a number between 0 and 1. Compare your answers with other students in the class and discuss any differences.

1 Flipping a 'tail' on a 50-cent coin.
2 An albino whale is born.
3 Rolling three 6s in a row on a fair die.
4 Correctly guessing a number between 1 and 10.
5 Tomorrow being a rainy day.
6 Seeing a wombat in the Australian bush.

Are there some events for which there is more than one correct answer?

A few of the probability terms you need to know - **You may copy this down in your notebook**

1. **Trial -** A trial could be flipping a coin, rolling a die or spinning a spinner. So basically **it's one run of an experiment.**
2. **Outcome -** There are multiple outcomes that could occur for any tial. Example 'rolling 6 on a die' or 'flipping tails on the coin'
3. **Event -** An event is a collection of outcomes.
4. **Probability -** The probability of an event is a number between 0 and 1 that represents the chance that the event occurs. It all the outcomes are equally likely.

   Pr Event)= Number of outcomes where the event occurs/total number of outcomes

5. **Sample space-** The list of all the possible outcomes of an event
6. Compliment - A set containing the elements that not in a given set.

Now let's start the work

1 Write the missing word from each statement.

a An example of a __________ is flipping a coin.

b After rolling a die the possible __________ are 1, 2, 3, 4, 5 and 6.

c The set of all possible outcomes from a trial is called the __________ __________.

d The __________ of an event is the opposite of that event.

e If an event is called A then the complement is written as __________.

2 Match each experiment with the set of possible outcomes.

a Flipping a coin

b Choosing a number between 1 and 5

c Choosing a letter of the word MATHS

d Rolling a die

A 1, 2, 3, 4, 5, 6 **B** Heads, Tails **C** 1, 2, 3, 4, 5 **D** M, A, T, H, S

3 The following events are shown with their probabilities.

Event A: 0 Event B: 0.9 Event C: 1 Event D: 0.5

Impossible events are sure not to occur.

a Which of the four events is most likely to occur?

b Which of the four events is sure not to occur?

c Which is more likely – event B or event D?

d Which event is sure to occur?

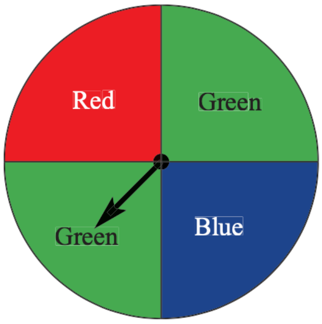
4 The spinner is spun and could land with the pointer on any of the four sections. Answer true or false:

a Red and blue are equally likely outcomes.

b Green is less likely to occur than blue.

c The probability of it landing orange is 0.

d Red is less likely to occur than green.



Working with probabilities

Teacher discussion

The letters of the word PRINCE are written onto 6 equally-sized cards and one is chosen at random.

a State the sample space.

b Find Pr(the letter N is chosen).

c What is the sample space of the event V = choosing a vowel?

d Find Pr(V).

e State the sample space of the complement of choosing a vowel, written V'.

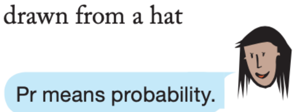
f Hence find Pr(V').

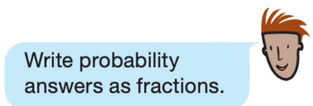
Solution with explanation

	Solution	Explanation
a	P, R, I, N, C, E	The sample space is all the possible outcomes when a single card is chosen. In this case each of the letters in the word.
b	$\Pr(N) = \frac{1}{6}$	There are 6 equally likely cards and 1 of them has the letter N.
c	I, E	The sample space V includes all the vowels in the word PRINCE.
d	$\Pr(V) = \frac{2}{6}$ $= \frac{1}{3}$	There are 2 cards with vowels, so probability $= 2 \div 6$.
e	V' includes P, R, N, C	The complement of V (V') is all the outcomes that are not in V, i.e. all the letters that are not vowels.
f	$\Pr(V') = \frac{4}{6}$ $= \frac{2}{3}$	There are 4 cards that do not have vowels, so $\Pr(V') = 4 \div 6$.

Use the example given and answer the questions

5 The letters of the word PIANO are written on 5 cards and then one card is drawn from a hat at random.



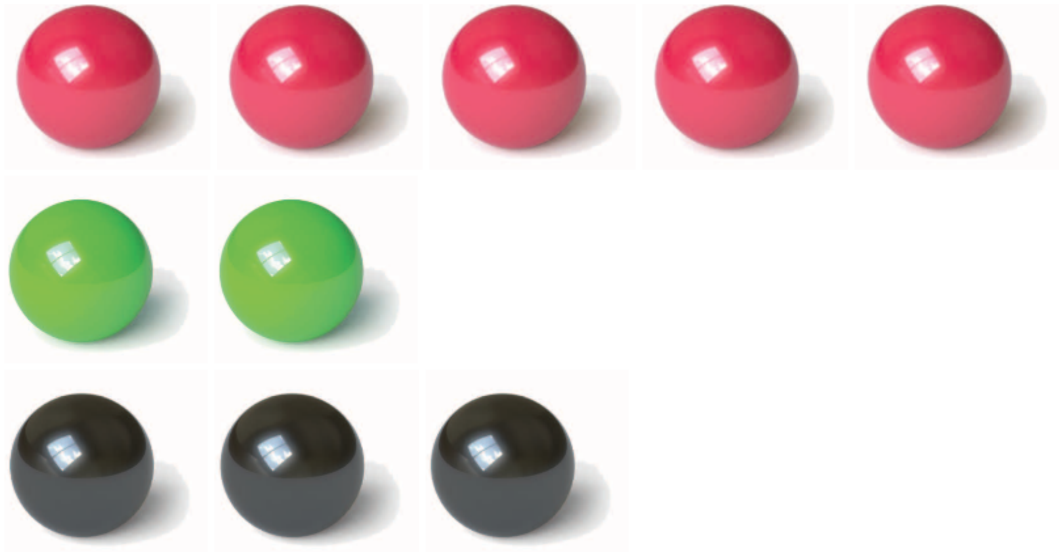


- **a** List the sample space.
- **b** Find Pr(the letter A is chosen).
- **c** Find Pr(a vowel is chosen).
- **d** Find Pr(a consonant is drawn).
- **e** Find Pr(the letter chosen is not an N).
- **f** State the sample space of the complement of choosing a vowel, written V'.
- **g** Hence find (Pr(V')

6 A fair die is rolled.

- **a** List the sample space.
- **b** Find Pr(5). That is, find the probability that a 5 is rolled.
- **c** Find Pr(even number).
- **d** State the sample space of the complement of 'rolling a 5'.
- **e** State the probability that a 5 is not rolled.
- **f** What is the probability of rolling a 14?

7 There are five red marbles, two green marbles and three black marbles. The 10 marbles are placed into a hat and one is picked out.



a What is Pr (red)? That is, what is the probability that the picked marble is red?
b Find Pr (green).
c Find Pr (black).
d Find Pr (a black or a red marble is drawn).
e Find Pr (red′), that is find the probability of the complement of choosing a red marble.
f Find Pr (black′).
g Give an example of an event that has a probability of 0.

8 The numbers 1 to 10 are written on cards. A card is chosen at random.
a List the sample space.
b Find the probability of choosing a 5.
c Find Pr (7 or 9).
d Find Pr (a multiple of 3 is chosen).
e Find Pr (prime number).
f Find Pr (a factor of 24).

A factor of 24 divides into 24 with no remainder. A prime has 2 factors. 1 is not prime.

Problem-solving and Reasoning

9 A spinner has the arrangement of colours as shown.
a List the sample space when this spinner is spun.
b Find Pr (red).
c State Pr (green).
d Find Pr (blue).
e List the sample space of the complement of 'spinner landing on blue'.
f What is Pr (not blue)?
g Find Pr (red or green or blue).
h What is an event that is equally likely to 'spinning red'?
i Give an example of an event that has a probability of 0.

List the colour as many times as it is on the spinner.

10 On a game show, a wheel is spun for a prize with the options as shown.

a Joan wants to go on a \$10 000 holiday so she is happy with the cash or the holiday. What is the probability she will get what she wants?

b What is the probability of getting a prize that is not the cash?

c What is Pr (car or motorbike)?

d What is the probability of winning a prize?

11 Jamie has a collection of marbles in his pocket. Four of them are blue, three are green and three are white. He chooses one at random.

a What is the probability that a green marble is chosen?

b What is the probability that he does not choose a white marble?

c He adds two more marbles and now Pr (blue) = $\frac{1}{2}$. What colour were the marbles he added?

d If instead of adding the two marbles he removed two, is it possible for Pr (blue) to become $\frac{1}{2}$? Explain your answer.

12 Six counters coloured red, purple or orange are placed in a pocket. You are told that

Pr (red or orange) = $\frac{1}{2}$ and Pr (red or purple) = $\frac{2}{3}$.

a How many counters of each colour are there?

b State Pr (red).

c Find Pr (purple).

d Find Pr (orange′).

Change the probabilities to have a common denominator.

13 Draw a spinner that has Pr (red) = $\frac{1}{8}$, Pr (blue) = $\frac{5}{8}$ and Pr(green) = $\frac{1}{4}$.

First divide a circle into 8 equal sectors.

Changing probabilities

14 In a large bucket there are 2 red balls and 8 blue balls.

a State Pr(red).

b One of each colour is added. What is the new Pr(red)?

c The procedure of adding a red ball and a blue ball is repeated several times. How many balls are in the bucket when Pr(red) = $\frac{1}{3}$?

d Imagine the procedure is repeated many times. What value does Pr(red) eventually approach as more balls are added? It might be helpful to imagine 1000 balls of each colour are added and use decimals.

Make a table.

Check your answers

1 a trial **b** outcomes **c** sample space
d complement **e** A'

2 a B **b** C **c** D **d** A

3 a Event C **b** Event A **c** Event B **d** Event C

4 a true **b** false **c** true **d** true

5 a P, I, A, N, O **b** $\frac{1}{5}$ **c** $\frac{3}{5}$
d $\frac{2}{5}$ **e** $\frac{4}{5}$ **f** $V' = P, N$ **g** $\Pr(V') = \frac{2}{5}$

6 a 1, 2, 3, 4, 5, 6 **b** $\frac{1}{6}$ **c** $\frac{1}{2}$
d 1, 2, 3, 4, 6 **e** $\frac{5}{6}$ **f** 0

7 a $\frac{1}{2}$ **b** $\frac{1}{5}$ **c** $\frac{3}{10}$ **d** $\frac{4}{5}$
e $\frac{1}{2}$ **f** $\frac{7}{10}$ **g** choosing a purple marble

8 a 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 **b** $\frac{1}{10}$ **c** $\frac{1}{5}$
d $\frac{3}{10}$ **e** $\frac{2}{5}$ **f** $\frac{3}{5}$

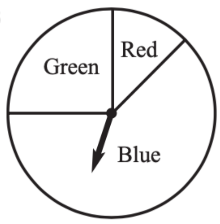
9 a red, green, blue, yellow, purple, blue, green, blue
b $\frac{1}{8}$ **c** $\frac{1}{4}$ **d** $\frac{3}{8}$
e green, green, red, yellow, purple **f** $\frac{5}{8}$
g $\frac{3}{4}$ **h** spinning purple (or spinning yellow)
i spinning orange

10 a $\frac{1}{3}$ **b** $\frac{5}{6}$ **c** $\frac{1}{3}$ **d** $\frac{5}{6}$

11 a $\frac{3}{10}$ **b** $\frac{7}{10}$ **c** Both were blue.
d Yes, for instance if he removed two green marbles.

12 a 1 red, 2 orange, 3 purple **b** $\frac{1}{6}$
c $\frac{1}{2}$ **d** $\frac{2}{3}$

13



14 a $\frac{1}{5}$ **b** $\frac{1}{4}$ **c** 18
d It approaches $\frac{1}{2}$ or 0.5.