

D1.1

Introducing probability

objectives

- Use vocabulary and ideas of probability, drawing on experience.
- Understand and use the probability scale from 0 to 1.

starter

Vocabulary

chance
likelihood
possible, impossible
probable, improbable
certain, uncertain
likely, unlikely
equally likely
even chance
fifty-fifty chance
probability scale

Resources

OHT D1.1a

Discuss with the class *chance* and *likelihood*. Explain that some things never happen: they are *impossible*. Some things probably won't happen, but just might: they are *unlikely*. Some things probably will happen, but just might not: they are *likely*. Some things will definitely happen: they are *certain*.

Q What is impossible/unlikely/possible/likely/certain to happen in school this week?

Q What everyday events are certain to happen/are likely to happen/are unlikely to happen/will never happen this year?

Draw on the board a long line labelled as shown below.



Invite pupils to position the following words on the line and to write the word. Say that they may want to put more than one word in the same position. Read out the list one by one: possible, probable, uncertain, likely, unlikely, very likely, equally likely, even chance, good chance, poor chance, no chance, fifty-fifty chance.

When all the words are in place, point to one or two of them and ask pupils in pairs to think of an example to illustrate the meaning of the word.

Say that a line on which the probability of an event is indicated is called a *probability scale*. Show **OHT D1.1a**. Explain that the statements have to be arranged in order and positioned on the probability scale. Read through the statements and ask the class to consider in pairs:

Q Which of the statements is certain?

Take responses and invite a pupil to write the relevant letter in the appropriate place on the scale. Continue in a similar way by asking:

Q Which of the statements is impossible?

Q Where would the other statements go?

main activity

Vocabulary

probability scale

Resources

5 red cubes and 5
blue cubes
open box to hold the
cubes

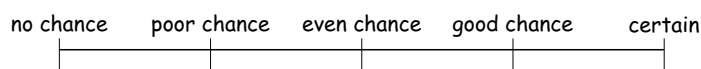
Secretly put five red and five blue cubes in an open box. Hold the box so that the class cannot see the contents and tell them that it contains ten cubes, some red and some blue.

Draw on the board a table to record the results of the experiment that you are about to do.

Red	
Blue	

Invite a pupil to the board to act as recorder. Take out one cube, show the class, and ask the pupil to make a tally mark in the correct row. Put the cube back, shake the box, take out another cube and record its colour. Do this ten times in all.

Put the box to one side and draw a probability scale on the board.



Ask pupils to look at the recorded findings of the experiment.

Q What do you think the probability is of taking out a red cube next time?

Agree a point on the line and mark it. Invite another pupil to act as recorder and repeat the experiment ten more times, drawing out a cube, recording its colour and putting it back.

Q What do you think the probability is now of taking out a red cube next time?

Agree a new point if necessary and mark it on the probability scale.

Empty out the cubes from the box and show the class that it had contained five red cubes and five blue cubes. Discuss what the probability was (in theory) of drawing out a red cube – it was a fifty-fifty chance, or an even chance.

Q Imagine taking a cube out of the box another ten times, so that we have removed a cube 30 times in all. What would you predict the results of our experiment to be? (15 red, 15 blue or something close to this)

Stress to the class that the more times they draw a cube from the box, the closer the match will be between the theoretical probability and the results of the experiment.

Q Imagine adding another ten cubes to the five red and five blue cubes already in the box. How could we fix it so that there is still an even chance of taking out a red cube? (add five more red cubes and five more blue cubes)

Q How could we change the contents of the box so that we have a good chance of getting a red cube? (take out some of the blue cubes and replace them with red cubes)

Q How could we change the contents of the box so that we are certain to get a red cube? (replace all the blue cubes with red cubes)

other tasks

Unit 7 section 1: How likely?

1 Certain, uncertain or impossible (a practical activity)

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Star challenge 1: Fair game?

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Star challenge 2: Order of likelihood

page 254

Springboard 7

Unit 7

plenary

Resources

OHTs D1.1b, D1.1c

Show **OHT D1.1b**.

Draw pupils' attention to the contents of each bag. Ask them to work in pairs and to study the statements. They should match each of the statements to one of the bags. Allow time for discussion and then invite different pupils to say which statement matches which bag.

Show **OHT D1.1c**.

Give the pairs time to discuss the first problem, then take responses. Stress that any number of black beads greater than five will satisfy the condition. Six black beads is the minimum number of beads that will do.

Read through the second problem and give the pairs time to discuss it. Take responses. Stress that if it is equally likely that a black bead or a white bead will be drawn, there must be equal numbers of them in the bag. Since there is a total of 20 beads, 10 must be black and 10 must be white.

Remember

- Probability is the way of measuring the chance or likelihood of the outcome of an event.
- The outcome of an actual event may not match the probability you have worked out.
- The more experiments that you do, the more the outcome will match the probability.

D1.2

The probability scale

objectives

- Understand and use the probability scale from 0 to 1.
- Find and justify probabilities based on equally likely outcomes in simple contexts.

starter

Vocabulary

equally likely
chance

Resources

a dice
mini-whiteboards

Hold up the dice. Tell the class that you are going to throw it 30 times and see how many times you get a one, a two, a three, a four, a five and a six. Ask pupils to use their whiteboards to answer your questions.

Q Make a guess. Which number do you think I will throw most often?

Q How many times in 30 throws do you think I will throw your number?

Draw this table on the board.

Dice	Tally	Total
1		
2		
3		
4		
5		
6		

Choose a pupil to record results, then throw the dice 30 times as quickly as is reasonable. Write in the totals, and discuss the results.

Q Which number had the most throws? Is this what you expected?

Q Imagine throwing the dice another 30 times. Would we get the same results?

Establish that when the dice is thrown, any of the six numbers is equally likely to appear. They all have the same chance. Because there are six numbers on the dice, each number should appear in about one sixth of the throws.

Q What is one sixth of 30? (5)

Stress that in 30 throws, we would expect each number to appear about 5 times.

main activity

Vocabulary

fair, unfair
biased

Resources

mini-whiteboards
dice and counters
OHT D1.2a

Draw this table on the board.

Dice	Tally	Total
odd		
even		

Say that this time you will see how many even numbers you throw.

Q Make a guess. Which do you think I will throw more often: odd numbers or even numbers?

Q Make another guess. How many times in 30 throws do you think that I will throw an even number?

Discuss some of the guesses. Establish that, as half of the numbers on the dice are even, one of them should appear in about one half of the throws.

Ask pupils to copy the table from the board. Give each pair of pupils a dice. Ask one of the pair to roll the dice 15 times and the other to tally the result as 'odd' or 'even'. Then swap over for another 15 throws. Finally, they should count the tally marks to find the total for each of 'odd' and 'even'.

Q How many times in 30 throws did you throw an even number?

Ask pupils what they think a *fair game* is. Establish that it is a game which each player has an equal chance of winning. Explain that a *fair dice* is one for which each number has an equal chance of being rolled, and that a *fair coin* is one that has an equal chance of landing heads up or tails up.

Ask the pairs to play this game three times and to record who wins.

- Each player starts with 9 counters.
- Players take turns to roll the dice.
- The first player wins odds and the second player wins evens.
- If 1 or 3 or 5 is rolled, evens has to give to odds that number of counters.
- If 2 or 4 or 6 is rolled, odds has to give to evens that number of counters.
- The winner is the first to gain all the counters.

Q How many games did odds win? How many games did evens win? Is this a fair game? Why not?

Establish that each number on the dice is equally likely to be rolled. In six throws, each number is likely to be rolled once. Odds would win three times, and would win 9 counters. Evens would win three times, and would win 12 counters. The game is *unfair* because it is *biased* in favour of evens.

Explain that, rather than having words on it, a probability scale is usually numbered with 0 at one end (impossible) and 1 at the other end (certain). A probability is usually written as a fraction (and sometimes as a decimal or percentage).

Show **OHT D1.2a**. With the class, complete the table. For example, in the first row, the possible numbers on the dice are 2, 4 and 6. There are 3 possible numbers, and the probability of throwing one of them is $\frac{3}{6}$ or $\frac{1}{2}$. Invite a pupil to the projector to locate the probability on the probability scale.

Repeat with the other rows.

Q Someone throws a dice 24 times. How many times would you expect them to get a 5? (1 in every 6, or 4 times)

Q How many times would you expect them to get an even number? (1 in every 2, or 12 times)

Q How many times would you expect them to get a number bigger than 4? (2 in every 6, or 8 times)

other tasks

Springboard 7 Unit 7

Unit 7 section 2: Measuring probability

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| 1 The probability scale | page 255 |
| 2 Balloons | page 256 |
| Star challenge 3: Fruit drops | page 257 |

Unit 7 section 3: Working out probabilities

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| 1 Simple probabilities | page 258 |
| 2 More probabilities | page 259 |

plenary

Resources

OHTs D1.2b, D1.2c

Show **OHT D1.2b**. Discuss the bags of balls and the probability of choosing a black one.

Q What is this probability as a fraction? As a decimal?

Invite a pupil to mark the probability on the scale.

Show **OHT D1.2c**. Refer to the first problem and discuss the six faces of the dice.

Q How many faces does the dice have altogether? (6) How many show a 2? (4) How many show a 5? (2)

Q What is the probability of rolling a 5? ($\frac{2}{6}$ or $\frac{1}{3}$) Of rolling a 2? ($\frac{4}{6}$ or $\frac{2}{3}$)

Invite another pupil to mark this probability on the scale.

Refer to the second problem and discuss the sectors of the spinner. Point out that they are not all equal. Some have a better chance than others.

Q What is the chance of the pointer landing in sector C? (about 1 in 4, or $\frac{1}{4}$)

Invite another pupil to mark this probability on the scale.

Q What is the chance of the pointer landing in sector E? Is it more than one half, or less than one half? (less than one half)

Invite a pupil to mark this probability on the scale.

Repeat for sector A.

Remember

- Probability means how likely something is to happen.
- A probability scale has 0 at one end (impossible) and 1 at the other (certain).
- Probabilities are usually written as fractions or decimals, and sometimes as percentages. An even chance, or a one in two chance, is written as a probability of $\frac{1}{2}$, 0.5 or 50%.
- A fair game is one in which each player has an equal chance of winning.