D2.5 Working out probabilities

objectives

- Understand and use the probability scale from 0 to 1.
- Find simple fractions of whole-number quantities.

starter

Vocabulary
probability
random

Resources
mini-whiteboards

Ask pupils to answer your questions using their whiteboards.

Tell them that you have a pencil case with 12 pens in it, and you are going to take out one of the pens at random. Explain that this means that every pen has an equal chance of being chosen. Write on the board:

12 pens: 6 black, 3 red, 2 blue, 1 green

Q What is the probability that the pen I take out:
- **is black?** ($\frac{1}{2}$)
- **is red?** ($\frac{1}{4}$)
- **is blue?** ($\frac{1}{6}$)
- **is green?** ($\frac{1}{12}$)

Say that you also have a packet of 15 fruit gums and are going to take one of them at random. Write on the board:

15 fruit gums: 5 orange, 3 lemon, 6 lime, 1 raspberry

Q What is the probability that the fruit gum I choose:
- **is orange?** ($\frac{1}{3}$)
- **is lemon?** ($\frac{1}{5}$)
- **is lime?** ($\frac{2}{5}$)
- **is raspberry?** ($\frac{1}{15}$)

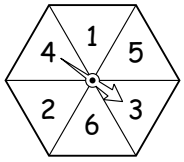
After each answer to the questions above ask pupils to explain their reasons.

main activity

Vocabulary
spinner

Resources
OHTs D2.5a, D2.5b
Resources D2.5c, D2.5d

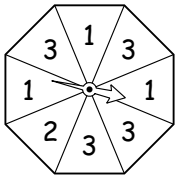
Tell the class that games are sometimes played using a spinner instead of a dice. Draw this diagram on the board.



Explain that this spinner is similar to a dice. When it is spun, the pointer is equally likely to stop on each of the six sections 1 to 6.

Q What is the probability of getting 4? ($\frac{1}{6}$)

Now draw this diagram on the board.



Point out that on this spinner some of the numbers are repeated. There is an equal chance that the pointer will stop on each of the eight sections of the spinner. The probability of the spinner stopping on 1 is $\frac{3}{8}$, since there are 3 chances out of 8.

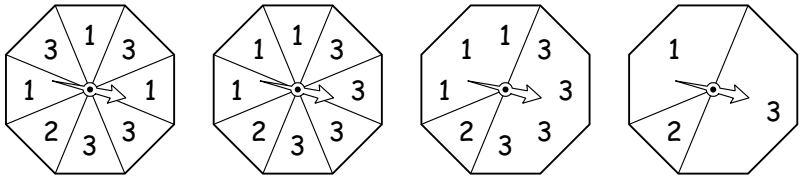
Q What is the probability of the spinner:
- **stopping on 2?** ($\frac{1}{8}$)
- **stopping on 3?** ($\frac{4}{8}$ or $\frac{1}{2}$)

Show **OHT D2.5a**. Work through the probability of getting a 4 on spinner A ($\frac{1}{8}$), then discuss on which spinner Lee is more likely to get 1. Make sure that pupils understand that the chance of getting a 1 on spinner A is $\frac{3}{8}$, and the chance of getting a 1 on spinner B is $\frac{2}{4}$ or $\frac{1}{2}$. There is a better chance on spinner B since $\frac{1}{2}$ is greater than $\frac{3}{8}$.

Show pupils what to write in the section for giving a reason – for example: 'The chance of 1 on A is $\frac{3}{8}$. The chance of 1 on B is $\frac{1}{2}$. It is more likely on B because $\frac{1}{2}$ is greater than $\frac{3}{8}$.'

Discuss the likelihood of getting a 2 on each of the spinners. Show pupils how to explain why Lee's statement is correct – for example: 'The chance of 2 on A is $\frac{2}{8}$ or $\frac{1}{4}$. The chance of 2 on B is $\frac{1}{4}$. These are equally likely.'

Refer back to the second diagram on the board. Draw more diagrams next to it.



Explain that these diagrams all represent the same spinner. All that has happened is that the numbers have been rearranged to group the same numbers together. The probability of getting 1 is still $\frac{3}{8}$, and of getting 3 is still $\frac{1}{2}$.

Show **OHT D2.5b**.

Count the number of small sections for 1, 2, 3 and so on. Ask pupils to discuss in pairs which number the pointer is most likely to stop on and how they would write the reason. Invite a pupil to the projector to write an explanation – for example: '3 is most likely because the chance of getting 3 is $\frac{4}{12}$, of getting 1 is $\frac{3}{12}$, of getting 2 is $\frac{2}{12}$, of getting 4 is $\frac{2}{12}$ and of getting 5 is $\frac{1}{12}$.'

Give copies of **Resources D2.5c** and **D2.5d** to each pupil. Ask the class to complete the questions. Encourage them to produce clear written explanations.

Bring the class together and invite different pupils to read out their explanations. Discuss how to improve them. Emphasise that marks in tests are awarded for good written explanations.

other tasks

Springboard 7
Unit 7

Unit 7 section 3: Working out probabilities

plenary

Resources
ten cubes (three yellow, two green, one blue, four red)
an open box
mini-whiteboards

Show the class the box and three yellow cubes, two green and one blue. Tell pupils that you did an experiment. You took a cube from the box, recorded its colour, then replaced it, and you did this 30 times.

Explain that an estimate of the probability of your taking out a yellow cube is 3 in every 6, or $\frac{1}{2}$. This is equivalent to 15 out of 30, since one half of 30 is 15. Write on the board:

$\frac{3}{6} = \frac{1}{2} = \frac{15}{30}$

Q Estimate how many times out of 30 I took out a blue cube.

Invite a pupil to explain that the probability is 1 in every 6, or $\frac{1}{6}$, which is 5 out of every 30. Write on the board:

$\frac{1}{6} = \frac{5}{30}$

Q Estimate how many times out of 30 I took out a green cube.

Invite another pupil to explain that the probability is 2 in every 6, or $\frac{1}{3}$, which is 10 out of 30. Write on the board:

$\frac{2}{6} = \frac{1}{3} = \frac{10}{30}$

Add four red cubes to the three yellow, two green and one blue. Say that you did another experiment, this time repeating it 40 times. Ask pupils to answer your questions using their whiteboards.

Q Estimate how many times out of 40:
- **I took out a yellow cube.**
  (3 in every 10, which is equivalent to 12 out of 40)
- **I took out a green cube.**
  (2 in every 10, or 8 out of 40)
- **I took out a blue cube.**
  (1 in every 10, or 4 out of 40)
- **I took out a red cube.**
  (4 in every 10, or 16 out of 40)

Remember

- A probability scale has 0 at one end (impossible) and 1 at the other end (certain).
- Probabilities are usually written as fractions, as decimals, and sometimes as percentages. A one in five chance is written as a probability of $\frac{1}{5}$, 0.2 or 20%.
- If an object is chosen at random from a group of objects, it means that every object in the group has an equal chance of being chosen.