**Pupils should be taught to:**

**Understand percentage as the number of parts per 100; recognise the equivalence of fractions, decimals and percentages; calculate percentages and use them to solve problems**

**As outcomes, Year 7 pupils should, for example:**

**Understand percentage as the number of parts in every 100, and express a percentage as an equivalent fraction or decimal.** For example:

Convert percentages to fractions by writing them as the number of parts per 100, then cancelling. For example:

- 60% is equivalent to $\frac{60}{100} = \frac{3}{5}$;
- 150% is equivalent to $\frac{150}{100} = \frac{3}{2} = 1\frac{1}{2}$.

Convert percentages to decimals by writing them as the number of parts per 100, then using knowledge of place value to write the fraction as a decimal. For example:

- 135% is equivalent to $135 \div 100 = 1.35$.

**Recognise the equivalence of fractions, decimals and percentages.**

Know decimal and percentage equivalents of simple fractions.

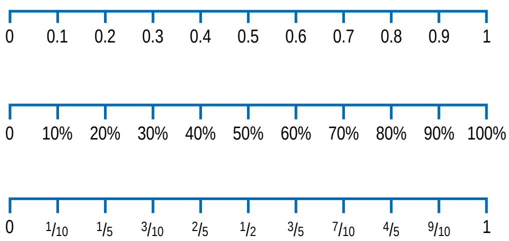
For example, know that $1 \equiv 100\%$. Use this to show that:

- $\frac{1}{10} = 0.1$ which is equivalent to 10%;
- $\frac{1}{100} = 0.01$ which is equivalent to 1%;
- $\frac{1}{8} = 0.125$ which is equivalent to $12\frac{1}{2}\%$;
- $1\frac{3}{4} = 1.75$ which is equivalent to 175%;
- $\frac{1}{3} = 0.333\ldots$ which is equivalent to $33\frac{1}{3}\%$.

Express simple fractions and decimals as equivalent percentages by using equivalent fractions. For example:

- $\frac{3}{5} = \frac{60}{100}$ which is equivalent to 60%;
- $\frac{7}{20} = \frac{35}{100}$ which is equivalent to 35%;
- $2\frac{3}{4} = \frac{275}{100}$ which is equivalent to 275%;
- $0.48 = \frac{48}{100}$ which is equivalent to 48%;
- $0.3 = \frac{30}{100}$ which is equivalent to 30%.

Use number lines to demonstrate equivalence.




**See Y456 examples (pages 32–3).**

**Link the equivalence of fractions, decimals and percentages to the probability scale (pages 278–9), and to the interpretation of data in pie charts and bar charts (pages 268–71).**

**As outcomes, Year 8 pupils should, for example:**

**Understand percentage as the operator 'so many hundredths of'.**
For example, know that 15% means 15 parts per hundred, so 15% of $Z$ means $^{15}/_{100} \times Z$.

Convert fraction and decimal operators to percentage operators by multiplying by 100.
For example:

- 0.45 $0.45 \times 100\% = 45\%$
- $^{7}/_{12}$ $(7 \div 12) \times 100\% = 58.3\%$ (to 1 d.p.)

**Link the equivalence of fractions, decimals and percentages to the probability scale (pages 278–9), and to the interpretation of data in pie charts and bar charts (pages 268–71).**

**As outcomes, Year 9 pupils should, for example:**

**Pupils should be taught to:**

**Understand percentage as the number of parts per 100; recognise the equivalence of fractions, decimals and percentages; calculate percentages and use them to solve problems (continued)**

**As outcomes, Year 7 pupils should, for example:**

**Calculate percentages of numbers, quantities and measurements.**

Know that 10% is equivalent to $\frac{1}{10}$ = 0.1, and 5% is half of 10%.

Use **mental methods**. For example, find:

- 10% of £20 by dividing by 10;
- 10% of 37 g by dividing by 10;
- 5% of £5 by finding 10% and then halving;
- 100% of 5 litres by knowing that 100% represents the whole;
- 15% of 40 by finding 10% then 5% and adding the results together.

Use **informal written methods**. For example, find:

- 11% of £2800 by calculating 10% and 1% as jottings, and adding the results together;
- 70% of 130 g by calculating 10% and multiplying this by 7 as jottings; or by calculating 50% and 20% as jottings and adding the results.

Use a **calculator**, without the % key, to work out percentages of numbers and measures. For example:

- What is 24% of 34?
- Find 14.5% of 56 litres.

Know that there is more than one way to find a percentage using a calculator. For example, to find 12% of 45:

Convert a percentage calculation to an equivalent decimal calculation.

12% of 45 $\quad 0.12 \times 45$

[.] [1] [2] [×] [4] [5] [=]

Convert a percentage calculation to an equivalent fraction calculation.

12% of 45 $\quad \frac{12}{100} \times 45$

[1] [2] [÷] [1] [0] [0] [×] [4] [5] [=]

Recognise that this method is less efficient than the first.

Understand a calculator display when finding percentages in the context of money. For example:

- Interpret 15% of £48, displayed by most calculators as 7.2, as £7.20.

**See Y456 examples (pages 32–3).**

**As outcomes, Year 8 pupils should, for example:**

**Calculate percentages of numbers, quantities and measurements.**

Continue to use **mental methods**. For example, find:

- 65% of 40 by finding 50%, then 10% then 5% and adding the results together.
- 35% of 70 ml by finding 10%, trebling the result and then adding 5%;
- 125% of £240 by finding 25% then adding this to 240.

Use **written methods**. For example:

Use an equivalent fraction, as in:

- 13% of 48 $\frac{13}{100} \times 48 = \frac{624}{100} = 6.24$

Use an equivalent decimal, as in:

- 13% of 48 $0.13 \times 48 = 6.24$

Use a unitary method, as in:

- 13% of 48 1% of 48 $= 0.48$
  13% of 48 $= 0.48 \times 13 = 6.24$

Use a **calculator**, without the % key, to work out percentages of numbers and measures.

Use an equivalent decimal calculation.

12% of 45 $0.12 \times 45$

[ . ] [ 1 ] [ 2 ] [ × ] [ 4 ] [ 5 ] [ = ]

Use a unitary method; that is, find 1% first.

12% of 45 1% is 0.45, so 12% is $0.45 \times 12$

[ . ] [ 4 ] [ 5 ] [ × ] [ 1 ] [ 2 ] [ = ]

Recognise that these methods are equally efficient.

Extend understanding of the display on the calculator when using percentages of money. For example:

- Interpret the answer to 33⅓% of £27, displayed by some calculators as 8.999999, as £9.

**As outcomes, Year 9 pupils should, for example:**

**Pupils should be taught to:**

**Understand percentage as the number of parts per 100; recognise the equivalence of fractions, decimals and percentages; calculate percentages and use them to solve problems (continued)**

**As outcomes, Year 7 pupils should, for example:**

Use, read and write, spelling correctly:
*change, total, value, amount, sale price, discount, decrease, increase, exchange rate, currency, convert...*

**Use the equivalence of fractions, decimals and percentages to compare two or more simple proportions and to solve simple problems.**

Discuss percentages in everyday contexts. For example:

- Identify the percentage of wool, cotton, polyester... in clothes by examining labels.
- Work out what percentage of the pupils in the class are boys, girls, aged 11, have brown eyes...
- Discuss the use of percentages to promote the sales of goods, e.g. to indicate the extra amount in a packet.

Answer questions such as:

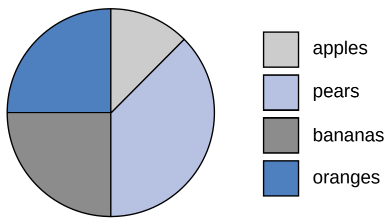
- Estimate the percentage of this line that is blue.

- 12% of a 125 g pot of yoghurt is whole fruit.
  How many grams are not whole fruit?

- 48% of the pupils at a school are girls.
  25% of the girls and 50% of the boys travel to school by bus.
  What percentage of the whole school travels by bus?

Use proportions to interpret pie charts. For example:

- Some people were asked which fruit they liked best.
  This chart shows the results.




Estimate:
a. the percentage of the people that liked oranges best;
b. the proportion that liked apples best;
c. the percentage that did not choose pears.

**Link to problems involving percentages (pages 2–3).**

**As outcomes, Year 8 pupils should, for example:**

Use vocabulary from previous year and extend to:
*profit, loss, interest, service charge, tax, VAT…*
*unitary method…*

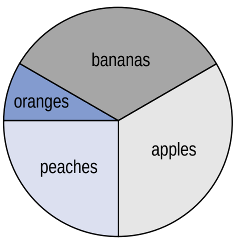
**Use the equivalence of fractions, decimals and percentages to compare simple proportions and solve problems.**

Apply understanding of simple percentages to other contexts, such as:

- the composition of alloys in science: for example, a 2p coin is 95% copper, 3.5% tin and 1.5% zinc;
- the age distribution of a population in geography;
- the elements of a balanced diet in nutrition;
- the composition of fabrics in design and technology: for example, a trouser fabric is 83% viscose, 10% cotton, 7% Lycra.

Answer questions such as:

- There is 20% orange juice in every litre of a fruit drink. How much orange juice is there in 2.5 litres of fruit drink? How much fruit drink can be made from 1 litre of orange juice?
- This chart shows the income that a market stall-holder got last week from selling different kinds of fruit.




  The stall-holder got £350 from selling bananas.
  Estimate how much she got from selling oranges.

- 6 out of every 300 paper clips produced by a machine are rejected.
  What is this as a percentage?
- Rena put £150 in her savings account.
  After one year, her interest was £12.
  John put £110 in his savings account.
  After one year, his interest was £12.
  Who had the better rate of interest, Rena or John? Explain your answer.

**Link to problems involving percentages (pages 2–3).**

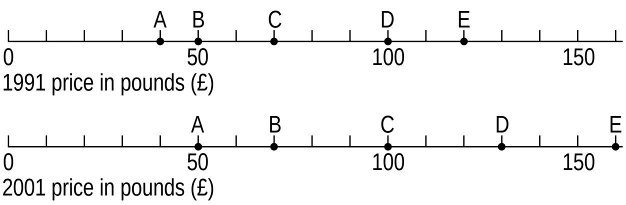
**As outcomes, Year 9 pupils should, for example:**

Use vocabulary from previous years and extend to:
*cost price, selling price, compound interest…*

**Recognise when fractions or percentages are needed to compare proportions and solve problems.**

Answer questions such as:

- A slogan on a tube of mints says that it is 23% bigger. It contains 20 mints.
  How many mints are there in the normal tube?
- Which is the better buy:
  a 400 g pack of biscuits at 52p, or
  a pack of biscuits with 400 g + 25% extra, at 57p?
- In a phone bill, VAT at 17.5% is added to the total cost of calls and line rental.
  What percentage of the total bill is VAT?
- In 1999, about 50% of the world's tropical rain forests had been destroyed.
  About 180 000 square kilomentres are now destroyed each year.
  This represents about 1.2% of the remainder.
  Estimate the original area of the tropical rain forests.
- The prices of five items A, B, C, D and E in 1991 and 2001 are shown on these scales.




  Which of the items showed the greatest percentage increase in price from 1991 to 2001?

**Link to problems involving percentages (pages 2–3).**

| Pupils should be taught to: | As outcomes, Year 7 pupils should, for example: |
|---|---|
| **Understand percentage as the number of parts per 100; recognise the equivalence of fractions, decimals and percentages; calculate percentages and use them to solve problems (continued)** | |

## As outcomes, Year 8 pupils should, for example:

**Find the outcome of a given percentage increase or decrease.**

Understand that:

- If something increases by 100%, it doubles.
- If something increases by 500%, it increases by five times itself, and is then six times its original size.
- A 100% decrease leaves zero.
- An increase of 15% will result in 115%, and 115% is equivalent to 1.15.
- A decrease of 15% will result in 85%, and 85% is equivalent to 0.85.
- An increase of 10% followed by a further increase of 10% is not equivalent to an increase of 20%.

For example:

- An increase of 15% on an original cost of £12 gives a new price of
  £12 × 1.15 = £13.80
  or
  15% of £12 = £1.80   £12 + £1.80 = £13.80
- A decrease of 15% on the original cost of £12 gives a new price of
  £12 × 0.85 = £10.20
  or
  15% of £12 = £1.80   £12 – £1.80 = £10.20

Investigate problems such as:

- I can buy a bicycle for one cash payment of £119, or pay a deposit of 20% and then six equal monthly payments of £17.
  How much extra will I pay in the second method?
- A price is increased by 10% in November to a new price. In the January sales the new price is reduced by 10%. Is the January sale price more, less or the same as the price was in October? Justify your answer.
- At the end of a dinner the waiter added VAT of 17.5% and then a 12.5% service charge. The customer argued that the service charge should have been calculated first.
  Who was correct?
  Give mathematical reasons for your answer.

**Link to enlargement and scale (pages 212–17), and area and volume (pages 234–41).**

## As outcomes, Year 9 pupils should, for example:

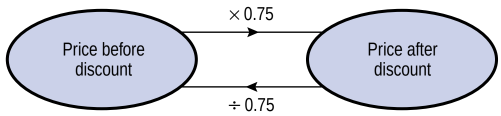
**Use percentage changes to solve problems,** choosing the correct numbers to take as 100%, or as a whole.

For example:

- There was a 25% discount in a sale.
  A boy paid £30 for a pair of jeans in the sale.
  What was the original price of the jeans?

  Using a unitary method
  £30 represents 75%.
  £30 ÷ 75 represents 1%.
  £30 ÷ 75 × 100 represents 100%.

  Using inverse operations
  Let $p$ be the original price.
  $p \times 0.75 = 30$, so $p = 30 \div 0.75 = 40$




- An unstretched metal spring is 20 cm long.
  It is stretched to a length of 27 cm.
  Find the percentage change in its length.

  The increase is $\frac{7}{20} = \frac{35}{100}$ or 35%.

Solve problems such as:

- A jacket is on sale at £45, which is 85% of its original price. What was its original price?
- I bought a fridge freezer in a sale and saved £49. The label said that it was a ‘20% reduction’. What was the original price of the fridge freezer?
- A stereo system has been reduced from £320 to £272. What is the percentage reduction?
- The number of people going to a cinema increased from 52 000 in 1998 to 71 500 in 2001. Calculate the percentage increase in the number of people going to the cinema from 1998 to 2001.
- 12 500 people visited a museum in 2000. This was an increase of 25% on 1999. How many visitors were there in 1999?
- When heated, a metal bar increases in length from 1.25 m to 1.262 m. Calculate the percentage increase correct to one decimal place.
- *A woman deposits £75 in a bank with an annual compound interest rate of 6%. How much will she have at the end of 3 years? (The calculation $75 \times (1.06)^3$ gives the new amount.)*

**Link to proportionality (pages 78–9), enlargement and scale (page 212–17), and area and volume (pages 234–41).**