GCSE Maths – Number

Fractional and Percentage Operators

Notes

WORKSHEET

Percentage (%) as an Operator

The **percentage** sign can be interpreted as 'out of 100'. Mathematically, to find a number as a percentage of a total we must divide by the total, then multiply by 100:

Example: What is 36 as a percentage of 48?

1. Find 36 as a proportion of 48 by division.

$$36 \div 48 = 0.75$$

2. Convert the proportion into a percentage.

$$0.75 \times 100 = 75\%$$
$$\mathbf{36\ is\ 75\%\ of\ 48}$$

If we want to find what a percentage of a number is, we must use a **multiplier**. We can find this **multiplier** by taking the percentage we are asked for and dividing it by 100:

Example: What is 80% of 64?

1. Find the multiplier.

$$80 \div 100 = 0.8$$

2. Apply the multiplier to the desired value.

$$0.8 \times 64 = 51.2$$
$$\mathbf{51.2\ is\ 80\%\ of\ 64}$$

Another way of finding 80% of a number is to find 20% and then find 80% by subtraction:

Example: What is 80% of 64?

1. Find 10% of 64

$$64 \div 10 = 6.4$$

2. Double it to find 20%

$$6.4 \times 2 = 12.8$$
$$12.8 \text{ is } 20\% \text{ of } 64$$

3. Subtract 20% to find 80%

$$64 - 12.8 = 51.2$$
$$\mathbf{51.2} \text{ is } 80\% \text{ of } 64$$

Example: What is 1.45% of 0.9?

1. Find the multiplier.

$$1.45 \div 100 = 0.0145$$

2. Apply the multiplier to the desired value.

$$0.0145 \times 0.9 = 0.01305$$
$$\mathbf{0.01305\ is\ 1.45\%\ of\ 0.9}$$

Percentages Over 100%

You need to be able to find percentages of a number which are greater than 100%. Finding multipliers works in the same way as before:

Example: What is 134.5% of 28?

1. Find the multiplier.

$$134.5 \div 100 = 1.345$$

2. Apply the multiplier to the desired value.

$$28 \times 1.345 = 37.66$$

Example: What is a 10% price increase on a £1.20 bar of chocolate?

1. Identify the multiplier.

10% *price* ***increase*** *is* 110% *of the original price so the multiplier is*

$$110 \div 100 = 1.1$$

2. Apply the multiplier to the desired value.

$$£1.20 \times 1.10 = £1.32$$

A 10% price **increase** makes the new price $\mathbf{£1.32}$

Percentage Change

It is quite common to find the **percentage change** between two numbers. This is often asked in the form 'What is the percentage change from x to y?' where x and y are given numbers.

To do this, we have a formula:

$$Percentage\ change = \frac{Change}{Original\ number}$$

Example: What is the percentage change from 40 to 60?

$$Percentage\ change = \frac{Change}{Original\ number} \times 100$$

$$Change = 60 - 40 - 20$$

$$Original\ number = 40$$

So, $Percentage\ change = \frac{20}{40} \times 100 = 50\%$

Fractions $\left(\frac{a}{b}\right)$ as Operators

A fraction is another way of writing a **division** operation. However, fractions can also be used as **operators**: for example, we could be asked what $\frac{3}{5}$ of 150 is.

When multiplying by a fraction, we multiply the **numerators** together and the **denominators** together:

Example: What is $\frac{3}{5}$ of 150?

Multiply the given number by the fraction:

$$150 \times \frac{3}{5} = \frac{150}{1} \times \frac{3}{5} = \frac{450}{5} = 90$$

This method can still be applied with **improper** (top-heavy) fractions:

Example: What is $\frac{9}{7}$ of 6?

Multiply the given number by the fraction:

$$6 \times \frac{9}{7} = \frac{6}{1} \times \frac{9}{7} = \frac{54}{7} = 7.71$$

The answer can be left either as an **improper fraction** or in **decimal form** unless the question tells you to write it in a specific way.

Fractional and Percentage Operators - Practice Questions

1. What is 1.5% of £75?

2. What is 43% of 40 miles?

3. Which is larger? $\frac{1}{2}$ of 280 or $\frac{3}{8}$ of 400?

4. On weekdays it costs £5.50 per hour to rent a golf club. On Tuesdays the cost is 35% more. How much does it cost to rent a club for 3 hours on a Tuesday?

5. Sarah has a collection of spiders. For every 34 spiders she has, 3 of them will have 9 legs instead of 8. Sarah has a total of 170 spiders. How many have 8 legs? How many have 9 legs?

Worked solutions for the practice questions can be found amongst the worked solutions for the corresponding worksheet file.