

# Percent Notes

## What is percent?

Percent means **out of 100**. The symbol is **%**. For example, 35% means 35 out of 100, or  $\frac{35}{100}$ .

- $50\% = 0.5 = \frac{1}{2}$
- $25\% = 0.25 = \frac{1}{4}$
- $10\% = 0.1 = \frac{1}{10}$
- $1\% = 0.01 = \frac{1}{100}$

## Finding a percent of an amount

To find a percent of an amount, change the percent to a decimal and multiply.

**Formula:** percentage amount = percent as a decimal  $\times$  original amount

**Example:** Find 15% of 80.

$$15\% = 0.15$$

$$0.15 \times 80 = 12$$

So, 15% of 80 is **12**.

Without a calculator, it is easier to find 10% and then 5%

$$10\% \text{ of } 80 = 8$$

$$5\% \text{ of } 80 = 4$$

$$\text{Therefore, } 12\% \text{ of } 80 = 12$$

**Useful mental strategies:** 10% means divide by 10, 5% is half of 10%, and 1% means divide by 100.

## Writing an amount as a percent of another amount

To write one amount as a percent of another, divide the first amount by the second amount, then multiply by 100.

**Formula:** percent = (part  $\div$  whole)  $\times$  100

**Example:** 18 out of 24 students passed a test.

$$(18 \div 24) \times 100 = 75$$

So, **75%** of the students passed.

Without a calculator; convert the fraction to a decimal and then multiply by 100

$$\frac{18}{24} = \frac{3}{4} = 0.75 = 75\%$$

## Percent increase and decrease

A percent increase makes an amount bigger. A percent decrease makes an amount smaller.

- **Increase by p%:** multiply by  $1 + \frac{p}{100}$
- **Decrease by p%:** multiply by  $1 - \frac{p}{100}$

**Example 1:** Increase 60 by 20%.

$$\text{Multiplier} = 1.20 \quad (\text{i.e. } 1 + \frac{20}{100} = 1 + 0.2 = 1.2)$$

$$60 \times 1.20 = 72$$

So, the new amount is **72**.

Without a calculator:

Find 20% (by dividing by 5) and then add it on

$$60 \div 5 = 12$$

$$60 + 12 = 72$$

**Example 2:** Decrease 60 by 20%.

Multiplier = 0.80

$$60 \times 0.80 = 48$$

So, the new amount is **48**.

Without a calculator;

Find 20% (by dividing by 5) and then subtract it

$$60 \div 5 = 12$$

$$60 - 12 = 48$$

## Percent Change

**To find the percentage change:** percent change = (change  $\div$  original amount)  $\times$  100

**Example 3:** A price changes from \$40 to \$50.

Change = 10

$$(10 \div 40) \times 100 = 25$$

So, this is a **25% increase**.

Without a calculator;

Turn the change  $\div$  original into a fraction, and then decimal, and then percent.

$$\frac{10}{40} = \frac{1}{4} = 0.25 = 25\%$$

## Repeated percent change

Repeated percent change means a percentage increase or decrease happens multiple times. Use the multiplier each time.

**Formula:** final amount = original amount  $\times$  multiplier<sup>number of times</sup>

**Example:** A town's population is 5000 and increases by 3% each year for 2 years.

Multiplier = 1.03

$$5000 \times 1.03 \times 1.03 = 5304.5$$

So, the population after 2 years is about **5305**.

**Important:** For repeated percentage change, do not just add the percentages. Multiply by the percentage multiplier each time.

## Finding the original amount after a percent increase or decrease

Sometimes you know the **final amount** after a percentage increase or decrease and need to work backwards to find the **original amount**. To do this, divide by the percentage multiplier.

- **After an increase of p%:** original amount = final amount  $\div$   $(1 + \frac{p}{100})$
- **After a decrease of p%:** original amount = final amount  $\div$   $(1 - \frac{p}{100})$

**Example 1:**

A price is \$72 after a 20% increase. Find the original price.

Multiplier = 1.20

$$\text{Original price} = 72 \div 1.20 = 60$$

So, the original price was **\$60**.

**Example 2:**

A jumper is on sale for \$48 after a 20% decrease. Find the original price.

Multiplier = 0.80

$$\text{Original price} = 48 \div 0.80 = 60$$

So, the original price was **\$60**.

**Important:** When working backwards, do not just subtract or add the percentage. Divide by the multiplier instead.

### Finding the whole amount when a percent is known

Sometimes you know that a value is a certain **percent of an amount** and need to find the **whole amount**. To do this, change the percent to a decimal and divide.

**Formula:** whole amount = part  $\div$  percent as a decimal

**Example:** 18 is 30% of a number. Find the number.

$$30\% = 0.30$$

$$\text{Number} = 18 \div 0.30 = 60$$

So, the whole amount is **60**.

Without a calculator;

$$18 \div 0.3 = 180 \div 3 = 60$$

**Important:** Make sure you divide by the **decimal form** of the percent, not by the percent number itself.

### Tips and common mistakes

- Always check whether the question wants the **percentage** or the **final amount**.
- Use the **original amount** when finding percentage change.
- Increase means add more, so the multiplier is bigger than 1.
- Decrease means subtract some, so the multiplier is less than 1.