

GCSE Maths – Ratio, Proportion and Rates of Change

Percentage Change

Notes

WORKSHEET



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Percentage Change

Percentage change allows us to understand how much something has changed relative to what we started with.

$$\text{Percentage Change} = \frac{\text{Change}}{\text{Original}} \times 100$$

Example: A library used to contain 300 books. After new purchases and returns, it now contains 375 books. Calculate the percentage change in the number of books.

1. **Calculate** the change in the number of books by subtracting the original amount from the new amount.

$$\begin{aligned} \text{change} &= 375 - 300 \\ \text{change} &= 75 \end{aligned}$$

2. **Substitute** this into the equation for percentage change and **solve** the equation.

$$\text{Percentage Change} = \frac{75}{300} \times 100 = 25\%$$

Example: Ingredients for one batch of cakes costs £2.56. Katy makes 4 batches and sells each batch for £5. Work out how much profit Katy makes as a percentage change.

1. **Calculate** how much Katy spent on ingredients.

$$4 \times \text{£}2.56 = \text{£}10.24$$

2. **Calculate** how much money she made from selling the cakes and find the difference between this and the money spent.

$$\begin{aligned} 4 \times \text{£}5 &= \text{£}20 \\ \text{£}20 - \text{£}10.24 &= \text{£}9.76 \end{aligned}$$

3. **Substitute** the difference and money spent into the formula for percentage change and **solve**.

$$\text{Percentage Change} = \frac{\text{Change}}{\text{Original}} \times 100 = \frac{\text{£}9.76}{\text{£}10.24} \times 100 = 95\%$$

(to nearest %)

Alternatively, you could solve this problem by basing the calculation off the prices of one batch only. Since the answer is a percentage, and not the actual profit, the percentage change will be the same:

$$\text{Percentage Change} = \frac{\text{Change}}{\text{Original}} \times 100 = \frac{\text{£}5 - \text{£}2.56}{\text{£}2.56} \times 100 = 95\% \text{ (to nearest \%)}$$



Increase and Decrease

Percentage **increases and decreases** are a particular way of representing **percentage change**.

$$\text{Percentage Increase} = \frac{\text{New} - \text{Old}}{\text{Original}} \times 100$$

$$\text{Percentage Decrease} = \frac{\text{Old} - \text{New}}{\text{Original}} \times 100$$

We can manipulate percentages to show **percentage increase/decrease**, so that we use the right decimal multiplier in questions.

- A percentage increase of 15% is 115% of the original value

$$\text{Decimal multiplier} = \frac{115}{100} = 1.15$$

Example: The number 34 increases by 23%. What is the new number?

1. **Interpret** an increase of 23% as a **decimal multiplier**.

An increase of 23% is 123% of the original value.

$$123 \div 100 = 1.23$$

2. **Multiply the starting value by the decimal multiplier** you have calculated.

$$1.23 \times 34 = 41.82$$

- A percentage decrease of 15% is 85% of original value

$$\text{Decimal multiplier} = \frac{85}{100} = 0.85$$

Example: The number 180 decreases by 6%. What is the new number?

1. **Interpret** a decrease of 6% as a **decimal multiplier**.

A decrease of 6% means that the final amount is 94% of the original amount.

$$94 \div 100 = 0.94$$

2. **Multiply the starting value by the decimal multiplier** you have calculated.

$$180 \times 0.94 = 169.2$$



Example: Angela buys a house for £145000 and renovates it. After three months, the house is worth £180000. What is the percentage increase in price?

1. **Substitute** the new and old price into the equation for percentage increase.

$$\text{Percentage Increase} = \frac{\text{New} - \text{Old}}{\text{Original}} \times 100 = \frac{£180000 - £145000}{£145000} \times 100$$

2. **Solve** the equation.

$$\text{Percentage Increase} = \frac{£35000}{£145000} \times 100 = 24.1379... \% = \mathbf{24.1\% (3sf)}$$

Example: A shop is having a 35% sale off everything. The sale price of a pair of sunglasses is £61.75. What was the original full price of the sunglasses?

1. **Calculate** what percentage, of the original value, the sale items are on for.

$$100 - 35 = 65\%$$

The sale price is 65% of the original price.

2. Use the knowledge that the sale price is 65% of the original to **calculate what 1% of the price would be.**

$$65\% = £61.75$$

$$1\% = £61.75 \div 65 = £0.95$$

3. **Multiply** the value that equals 1% by 100, to find the original price.

$$100\% = £95$$

Example: The population in a small village is depleting. Over the last year, it has experienced a 15% decrease and now has 340 residents. How many people lived in the town one year ago?

1. **Substitute** the values we have into the equation for **percentage decrease** to form an equation.

Let the population of the town at the start of the year be x .

$$\text{Percentage Decrease} = \frac{\text{Old} - \text{New}}{\text{Original}} \times 100$$

$$15 = \frac{x - 340}{x} \times 100$$

2. **Solve** the equation, by collecting the x terms on one side.

$$0.15 = \frac{x - 340}{x}$$

$$0.15x = x - 340$$

$$0.85x = 340$$

$$x = 400$$

The population of the town one year ago was 400.



Percentage Change - Practice Questions

1. A house increases in value by 17%. A month later, it decreased in value by 8%. What is the overall percentage change in price of the house?
2. The population of koalas in a forest one year ago was 48. In the same forest, one year ago there were 114 snakes. Now there are 40 koalas and 150 snakes. Which species has experienced the greatest percentage change in population?
3. Angela buys a house for £160000 and renovates it. After three years, the house is worth £213500. What is the percentage increase in price?
4. A farmer is monitoring his population of chickens and calculates that every year, the number of chickens increases by approximately 30%. At the start of 2008, he forgot to count the number of chickens but in 2009 he did and found that there were 156. Estimate the number of chickens at the start of 2008.
5. A brand of orange juice develops a special edition of its best-selling juice bottle. Is buying the new bottle more cost-effective? Explain your answer.

Classic	special edition
£1.99	40% extra juice!
	£2.99

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

