# Percentages

Study Development Factsheet

## Calculating a percentage of another number

Sometimes you will want to know what a percentage of another number is. For example, you could be shopping and see that there is a 15% off sale. You may want to calculate the new price of the item before deciding if you'd like to buy it.

In order to perform a calculation of the form 'what is s% of t?', we use the following method:

1. Divide s by 100.
2. Multiply this by t. (s ÷ 100) × t is the answer.

**Example:**

What is 85% of £35?

**Answer:**

1. 85 ÷ 100 = 0.85.
2. 0.85 × £35 = £29.75.

The calculation we have just completed is the same one that we would complete if a shop was having a 15% off sale on an item that costs £35. This is because £35 is 100% of the cost, and we do not pay for 15%, so we only pay for 85% of the cost.

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## Increasing and decreasing by a percentage

### Decreasing

Another way that you could find the sale price of an item is by decreasing the price by a percentage. So, rather than finding 85% of the price, we decrease the price by 15%.

For a question such as ‘what is s decreased by t%?’ we would use the following method:

1. Divide t by 100.
2. Multiply this by s, to get (t ÷ 100) x s = r.
3. Calculate s – r. This is the answer to the question.

**Example:**

What is £120 decreased by 25%?

**Answer:**

1. 25 ÷ 100 = 0.25.
2. 0.25 x £120 = £30.
3. £120 - £30 = £90.

### Increasing

If we say that the price of something increased by a certain percentage due to inflation, and we know the original price, we can calculate the new price.

For a question such as ‘what is s increased by t%?’ we would use the following method:

1. Divide t by 100.
2. Multiply this by s, to get (t ÷ 100) x s = r.
3. Calculate s + r. This is the answer to the question.

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**Example:**

A news story states that when a panda was 1 week old, it weighed 1.2kg. When the panda was 2 weeks old, its weight had increased by 30% from 1.2kg.

**Answer:**

1. 30 ÷ 100 = 0.3.
2. 0.3 x 1.2kg = 0.36kg.
3. 1.2kg + 0.36kg = 1.56kg.

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## Reversing a percentage increase or decrease

Sometimes a value has been altered and you may wish to know the original value. For example, if an item is listed on sale, and the sale will end before you are going to buy it, you could calculate the original price.

### Reversing a decrease

We would answer a question such as ‘a value was decreased by s%, and the value is now t. What was the original value?’ using the following method:

1. Calculate 100 – s. This is the percentage of the original value that the new value is.
2. Calculate t ÷ (100 – s) = r.
3. Multiply r by 100. This is the original value.

**Example:**

An item was put in a 35% off sale, and now costs £20. What was the original price of the item?

**Answer:**

1. 100 – 35 = 65%. Therefore £20 is 65% of the original price.
2. £20 ÷ 65 = 0.3076923.
3. 0.3076923 × 100 = £30.76923. We round this to £30.77, since we do not use currency that is less than 1p. This is the original price of the item.

### Reversing an increase

For a question such as ‘a value was increased by s% and is now t. What was the original value?’ we would use the following method:

1. Calculate 100 + s. This is the percentage of the original value that the new value is.
2. Calculate t ÷ (100 + s) = r.
3. Multiply r by 100. This is the original value.

**Example:**

A child measures their own height. They are told that their height has increased by 25% since they last measured a few years ago, and they are now 5 feet tall. How tall was the child when they last measured?

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1. 100 + 25 = 125.
2. 5 feet ÷ 125 = 0.04 feet.
3. 0.04 feet x 100 = 4 feet.

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## Percentage change

Sometimes we may wish to know a new percentage change. This is a way of comparing a new value to an original value, and express the change in size as a percentage.

For a question such as ‘s has now increased/decreased to t. What is the percentage change?’ we would use the following method:

1. Calculate t – s. This is the difference between the new value and the original value.
2. Calculate (t – s) ÷ s = r.
3. Calculate r x 100. This is the percentage change.

**Example:**

A person’s weight has increased from 110kg to 125kg. What is the percentage change in their weight?

**Answer:**

1. 125kg – 110kg = 15kg. This is the difference between the new weight and original weight.
2. 15kg ÷ 110kg = 0.13636.
3. 0.13636 x 100 = 13.636%

We can express the new value as being 113.636% (= 100% + 13.636%) of the original value.

**Example 2:**

The price of an item has changed from £15 to £12. What is the percentage change in the price?

**Answer 2:**

1. £12 - £15 = -£3.
2. - £3 ÷ £15 = -0.2.
3. -0.2 x 100 = -20.

Therefore, the percentage change is -20%, meaning the price has been reduced by 20%. We can express the new value as being 80% (= 100% - 20%) of the original value.

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## One value as a percentage of another

Sometimes you may wish to express a value as a percentage of another.

For example, you may receive a score on a test as 18/20, and you know that you needed 80% to pass. In order to figure out if you have passed the test, you need to express the fraction as a percentage.

For a question such as ‘express s as a percentage of t’, we would use the following method:

1. Calculate (s ÷ t) × 100. This is the answer.

**Example:**

A student scores 54 on a test that has 75 marks available. They need to get 60% to pass. Has the student passed the test?

**Answer:**

1. (54 ÷ 75) × 100 = 0.72 × 100 = 72%.

Therefore, the student has passed their test!

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