Percentages

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What is a percentage?

Percentage just means parts per hundred, for example 20% stands for 20 parts per hundred. 20% is a short way of writing 20 over a hundred. When using a percentage in a calculation it must always be written as a fraction.

You will need a calculator

$$20\% = \frac{20}{100}$$

Percentage of a quantity

To find the value of a certain percentage of a quantity, multiply the quantity by the percentage required. Remember to write the percentage as a fraction.

For example: Calculate 20% of 300.

$$\frac{20}{100} \times 300 = 60$$

Try this

1. Calculate the following quantities

A) 15% of 70 = Working

B) 80% of 6,000 = Working

C) 52% of 150 = Working

One quantity as a percentage of another

To calculate quantity A as a percentage of quantity B. First divide quantity A by quantity B and then multiply by 100.

For example: Barry has taken 20 penalty kicks over the course of a season. He has scored 15 of these. What percentage of his penalty kicks has he scored from?

$$\frac{15}{20} \times 100 = 75\%$$

Percentages

Try this

2. Calculate the following percentages

A) 30 people signed up for a swimming competition, but only 17 turned up. What percentage of the people who signed up came on the day?

(to 2 d.p.) Working

B) James had a hole in his pocket. He put 5 marbles into his pocket but lost 2 on his way to school. What percentage of his marbles did he lose?

(to 2 d.p.) Working

C) Susan was given 45 pounds by her Grandma. She gave 5 pounds of this money away to charity. What percentage of her money does she have **left**?

(to 2 d.p.) Working

Increasing an amount by a percentage

For example: Lucy wants to buy herself a new stereo, it is priced at £300, **exclusive of VAT** (currently 17.5%). How much is the stereo with VAT included?

A) You must first calculate the 17.5% of £300. This gives us the value of the VAT.

$$\frac{17.5}{100} \times 300 = £52.50$$

Now to get the price of the stereo with VAT included you must add the value of the VAT (as calculated above) to the marked price of the stereo (£300).

£300 + £52.5 = £352.50

B) In the above method you calculated 17.5% of the original price and then added it onto £300 (which is 100% of the original price). Instead you could add the percentage increase (17.5%) to 100%, which gives 117.5%. The new price will be therefore be 117.5% of the original price.

$$\frac{117.5}{100} \times 300 = £352.50$$

You may notice that the fraction that represents 117.5% has a larger number above the line than below the line. This is because it is representing a percentage greater than 100%. This is called a top heavy fraction. Using a top heavy fraction makes no difference to the calculations.

Decreasing an amount by a percentage

The same methods can be used for a percentage decrease. For example, an item in the sale is reduced by 20%. The reduced price can be calculated by:

A) working out 20% of the original price and then subtracting that 20% from the original price.

B) by calculating 80% (100% - 20%) of the original price.

Try this

3. Calculate the following percentages

A) A bicycle was priced at £550 excluding VAT. How much would it be with VAT included, i.e. with 17.5% of its price added on?

(to 2 d.p.)

Working

B) There is a toy car in the shop window that Daniel wants. It is priced at £30 but it has 35% off because it is in the sale. How much does it cost now?

(to 2 d.p.)

Working

C) Mary is paid £14,000 per year. This year she received a pay rise of 3%. How much will she get paid next year?

Working

Percentages

A repeated percentage change

For example: Gary bought a car three years ago for £4,000. It has depreciated (decreased in value) by 15% each year. How much is it worth now?

There are two ways to do this:

1. The first method is to work out the value it has after the first year and then use this to work out the value it has in the second year and so on.

$\frac{85}{100}$ X 4,000 = £3,400 (Value after first year)

$\frac{85}{100}$ X 3,400 = £2,890 (Value after second year)

$\frac{85}{100}$ X 2,890 = £2,456.50 (Value after third year)

2. The second method uses a shortcut and makes it much quicker.
   The first thing to do is to work out what is called the **scale factor**. The scale factor is what you are multiplying the sum of money by.

   In this case it is: $\frac{85}{100}$ = 0.85 (the scale factor)

   We could perform the same calculation above using the scale factor e.g.

   0.85 X 4,000 = £3,400 (Value after first year)

   0.85 X 3,400 = £2,890 (Value after second year)

   0.85 X 2,890 = £2,456.50 (Value after third year)

   In the above calculation we have multiplied by the scale factor (0.85) 3 times.
   This could be re written as: 0.85 X 0.85 X 0.85 X 4,000 = £2,456.50

   Or more simply as: 0.85^3 x £4,000 = £2,456.50

   If Gary bought his car 4 years ago, we would have multiplied by the scale factor (0.85) 4 times and so in the formula above it would be to the power 4 (0.85^4).

Note: If the repeated change is a percentage increase then you will be calculating using a percentage greater than 100% or using a scale factor of greater than 1.

Percentages

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Try this:

4. Calculated the following repeated percentage changes

A) Donna wants to sell her car. She bought it for £10,000 2 years ago and it has depreciated at a rate of 20% per year. How much is it worth now?

Working

B) Ian has deposited £80 in an account with a rate of interest of 3% per annum (this means per year). How much will he have in 3 years time?

Working

(to 2 d.p.)

C) Heather has deposited her £80 in an account with an interest rate of only 1.5%, but she leaves it there for 6 years. How much will she have at the end of this period?

Working

(to 2 d.p.)

Note: This type of interest - where the interest from each year is included in the total used to calculate the interest in future years - is called **compound interest**.

Percentages

Reverse percentages

Percentage decrease: There is a bike in the bike shop that is priced £300 after a 25% reduction in price. What was the price of the bike before the reduction?

The bike has been reduced by 25%. 100% - 25% = 75% so the current price is 75% of the original price. If we divide the current price by 75% we will get the original price.

$$300 \div \frac{75}{100} = £400$$

In this calculation the percentage fraction of 75/100 has to be calculated first. If you do this you get the 0.75 which is the scale factor. So the above can be written as the formular below.

$$300 \div 0.75 = £400$$

Percentage increase: The formula is exactly the same if you wish to calculate what the original quantity was before a percentage increase. For example, a pair of trainers cost £58.75 after VAT (at 17.5%) had been added. 100% + 17.5% = 117.5% therefore the new price is 117.5% of the original price. This gives a scale factor of 1.175. You need to divide the new price by this scale factor to get the original price.

$$58.75 \div 1.175 = £50$$

Try this

5. Calculate the original quantities

A) David has £200 in his current account which has an interest rate of 5%, how much did he have a year ago?

(to 2 d.p.)

Working

B) Ondia has bought a camera for £960, she bought it in a sale at 20% off, how much did she save?

Working

www.clericalmedical.co.uk/Business/Tools/BudgetCalculator.asp