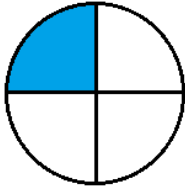


Percentages %

The term percentage comes from the Latin 'per centum' meaning 'per hundred'. Percentages express numbers or ratios as a fraction with the denominator of 100. The symbol for percentage is %.

Percentages and fractions



How much of the figure on the left is coloured in? Your answer would correctly be $\frac{1}{4}$.

But what if the question was: What percentage of the figure on the left is coloured in? Just as the answer can be expressed as a fraction, it can also be expressed as a percentage. This is true for any fraction. The only difference is that in order to express it as a percentage, the denominator (the bottom number in the fraction) has to be converted to 100. So how many percent is $\frac{1}{4}$?

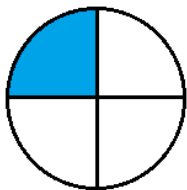
To do this you:

1. Convert the denominator to 100. $\frac{1}{4} = \frac{?}{100}$.
2. Because we have effectively just multiplied something with 4 to get 100 as the denominator, we need to multiply the numerator (the top number in the fraction) with the same factor.
3. Figure out what factor multiplied with 4 makes 100. (This is the same as dividing 100 by 4!) In this case, $4 \times 25 = 100$, ($100 \div 4 = 25$). So the factor is 25!
4. Multiply your numerator with the factor. In this case it is $1 \times 25 = 25$
5. The product you just calculated is your percentage. We can now say that 25% of the circle is shaded.

Percentages and decimals

Converting decimal numbers to percentages, and vice versa, is really easy! A decimal number is any number between 0 and 1. For example, 0.2, 0.02, and 0.73 are all decimal numbers. Referring to the circle shown above, we can think of the whole circle as 1, and every piece is a number between 0 and 1. To get a percentage from this number, we simply multiply any decimal number with 100. Hence, 0.2 becomes 20%, 0.02 becomes 2%, and 0.73 becomes 73%. Similarly, if we have a percentage and want to express it as a decimal number, we divide the percentage by 100. For example, 55% becomes 0.55 (out of 1).

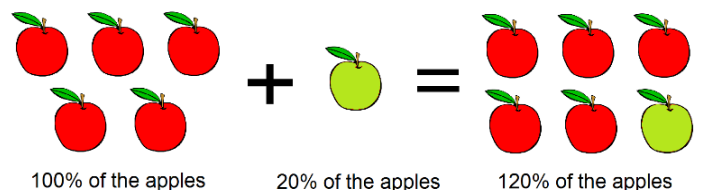
Coming back to our circle, we have now learnt that we can express this as:



- a) $\frac{1}{4}$
- b) 0.25
- c) 25%

Can you have more than 100%?

Even though 100% is all of whatever it is you are measuring (for example 5 out of 5 apples), you can express things as more than 100%. This is especially true when using percent changes or comparisons. Let's say for example, that you have 5 apples out of a total of 5, which is 100% of the apples. However, if you gain another apple, you will now have 120% of your original amount of apples.



Calculating percentages using 100s 10s, and 1s

Sometimes it can be tricky to calculate percentages, especially if you are not using whole numbers. For example, imagine you are shopping, and the jacket you want to buy has 35% off the full price. The full price is \$460. How would you go about calculating the discount? You can do this more easily by separating the 100s, the 10s and the 1s!



First of all, remember that 100% equals the full price of the jacket (\$460). 10%, being one-tenth of 100%, is the same as dividing 460 into 10. $\frac{460}{10} = 46$.

So we know that 10% of 460 is 46.

Now, we start by finding the '10s'. The '10s' portion out of 35% is 30%. 30% of 460 is the same as 3 tens, or 10%+10%+10%. We calculated above that 10% = 46, hence 30% = 46+46+46=138. We have just calculated that 30% of the price of the jacket is \$138.

Now we have 5% 'left', which is our '1s'. There are two ways of going about this particular problem:

1. The first method involves first finding 1% of our total price of \$460. Just as 10% is the same as one-tenth or $\frac{460}{10}$, 1% is one-hundredth of 100%, and therefore equal to $\frac{460}{100}$, which is 4.6.

Therefore, 1% of \$460 is \$4.6.

We now multiply this number by the number of % we have 'left over' after using up the 10s. In this case, 5% remains; we have 5 '1s' left over (5% left from our original 35%, and 5% is the same as $5 \times 1\%$), meaning we need to multiply our 1% value of 4.6 by 5. $4.6 \times 5 = 23$.

Now we add the 30% (\$138) and the 5% (\$23) to get a total of $\$138 + \$23 = \$161$. The discount is \$161!

2. The second method, and easier method in this case, is thinking of 5% as half of 10%. We know that 10% is 46, hence 5% would be half of 46, namely 23.

We then add the 30% (\$138) and the 5% (\$23) to get a total of $\$138 + \$23 = \$161$.

Activity

Calculate the percentage:

1. What is 45% of 350?
2. What is 82% of 720?

Other helpsheets available

- Rearranging Equations
- Units & Unit Conversion
- Fractions

1. First calculate the 10s: 40% (which is $10\% \times 4$) of 350. $35 \times 4 = 140$. Then calculate the 1s: 5% of 350, which is the same as half of 10%. $35 \div 2 = 17.5$. The final answer is $140 + 17.5 = 157.5$.
2. First calculate the 10s: 80% of 720. The easiest way of doing this is calculating 20% of 720, and then subtracting this from the 100%. $20\% \text{ of } 720 = 144$. $720 - 144 = 576$. Then calculate the 1s: 2% of 720. 1% of 720 is 7.2. $7.2 \times 2 = 14.4$. Now add the 10s and the 1s: $576 + 14.4 = 590.4$.