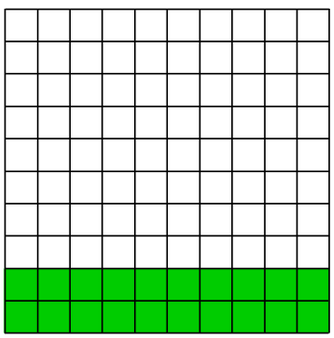
Percent, percentage

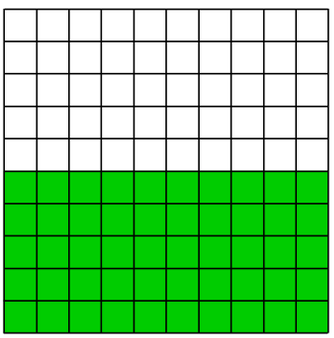
From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

A percentage is a fraction expressed as a number out of 100 followed by the % symbol.

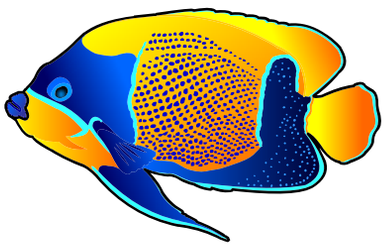
Percent comes from the Latin term 'per centum' meaning per hundred.

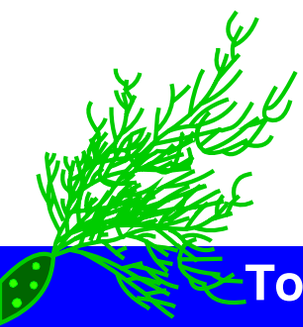


$\frac{20}{100} = 20\%$



$\frac{50}{100} = 50\%$





To convert a fraction or a decimal to a percentage multiply by 100 then add the % symbol.

Fraction

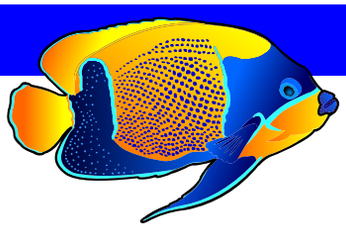
$\frac{1}{4} \times \frac{100}{1} = \frac{100}{4} = 25\%$

Multiply the fraction by 100, simplify, add the % symbol.

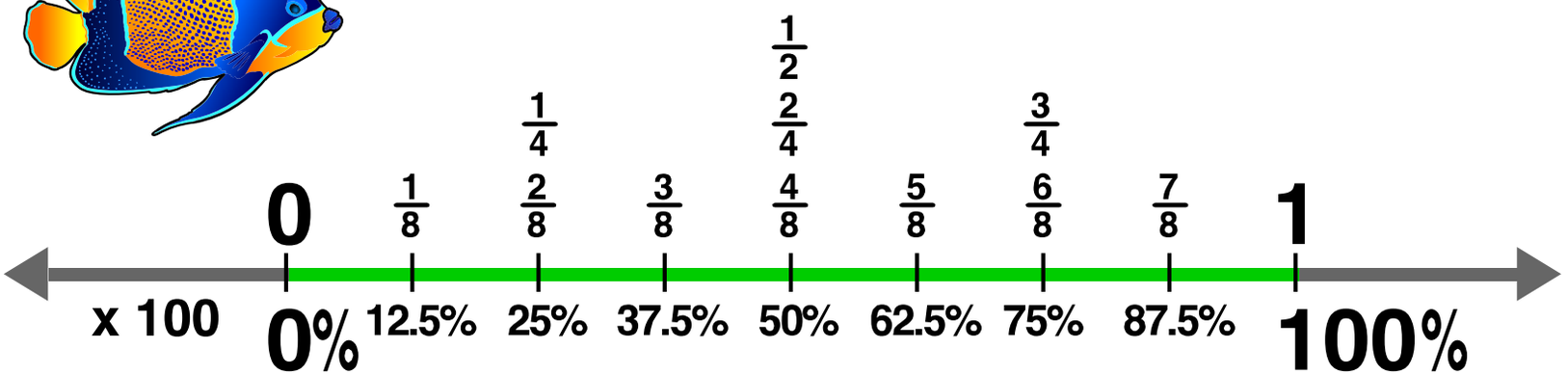
Decimal

$0.25 \times 100 = 25\%$

Multiply by 100, add the % symbol.



Comparing fractions and percentages.

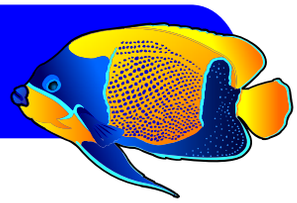


Percentages and amounts

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

To calculate a percentage of an amount, write the percent as a fraction and multiply by the amount.

$$\frac{\text{percent}}{100} \times \text{amount} =$$



$$11\% \text{ of } 40 = \frac{11}{100} \times 40 = \frac{440}{100} = 4.4$$

Sometimes, it is easier to simplify the fraction before multiplying.

$$25\% \text{ of } 160 = \frac{25}{100} \times 160 = \frac{1}{4} \times 160 = \frac{160}{4} = 40$$

$$200\% \text{ of } 35 = \frac{200}{100} \times 35 = \frac{2}{1} \times 35 = \frac{70}{1} = 70$$

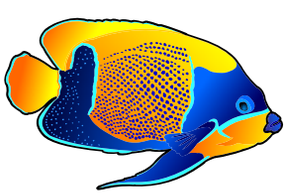
With a decimal percentage, first multiply the numerator and the denominator by 10 until the numerator is a whole number.

$$33.3\% \text{ of } \$90 = \frac{333}{1000} \times 90 = \frac{29970}{1000} = \$29.97$$

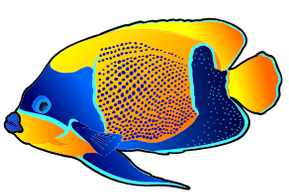
To calculate an amount as a percentage of a total, write the amount over the total as a fraction and multiply by 100.

$$\frac{\text{amount}}{\text{total}} \times 100 =$$

In a fish tank holding 20 fish there are 4 yellow fish and 16 gold fish. What percentage of fish are yellow?



$$\frac{4}{20} \times 100 = \frac{400}{20} = 20\%$$



Out of 360 students at the school 324 are present today. What percentage of students are absent ?

(360 - 324 = 36)
324 present so
36 are absent

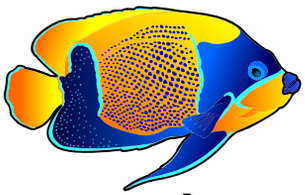
$$\frac{36}{360} \times 100 = \frac{3600}{360} = 10\%$$

There are 10% of students absent.

Sales tax

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

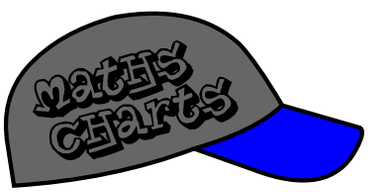
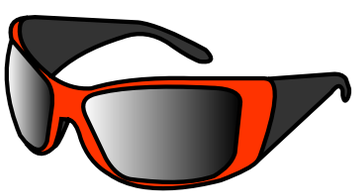
Sales tax is a tax that is added to the price of particular goods and services, usually as a percentage of the purchase price.



$$\text{sales tax} = \left(\frac{\text{percent}}{100} \times \text{price}\right)$$

Sales tax may be called by various names, for example, Goods and Services Tax (GST) or Value Added Tax (VAT).

Examples of different rates of sales tax.

Item and Price	Sales Tax and Total Cost			
Before Sales Tax	10%	15%	20%	25%
 $10.00	$1.00 $11.00	$1.50 $11.50	$2.00 $12.00	$2.50 $12.50
 $50.00	$5.00 $55.00	$7.50 $57.50	$10.00 $60.00	$17.50 $67.50
 $100.00	$10.00 $110.00	$15.00 $115.00	$20.00 $120.00	$25.00 $125.00

Discounts and markdowns

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

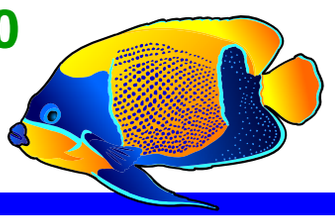
To calculate the cost of an item when a percentage discount (or markdown) is offered, write the percent as a fraction, multiply by the price, then subtract that amount from the original price.

$$\text{discount} = \left(\frac{\text{percent}}{100} \times \text{price}\right) \qquad \text{cost} = \text{price} - \text{discount}$$

In a 15% off everything sale, how much would a pair of $20.00 shoes cost?

$$\text{Discount} = \frac{15}{100} \times 20 = \frac{300}{100} = \$3.00$$

$$\text{Cost} = \$20.00 - \$3.00 = \$17.00$$



The $20.00 shoes will cost $17.00.

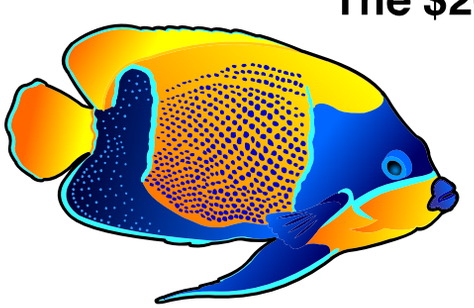
To calculate the percentage discount of an item when a dollar discount (or markdown) is offered, write the discount as a fraction of the original price then multiply by 100.

$$\%\ \text{discount} = \left(\frac{\text{discount}}{\text{price}} \times 100\right)$$

Another shoe shop is offering a $4.00 discount on shoes over $15.00. What is the percentage discount on a pair of $20.00 shoes?

$$\%\ \text{Discount} = \frac{4}{20} \times 100 = \frac{400}{20} = 20\%$$

The $20.00 shoes are discounted by 20%.



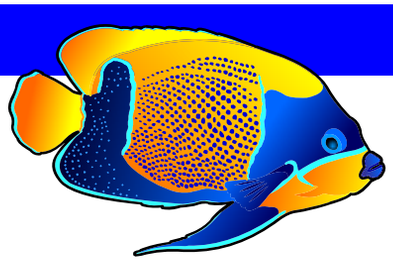
Percentages can help find the best deal.

Simple interest

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

Interest is a fee paid for borrowing money or other assets.
The amount borrowed is called the principal.
The interest is expressed as a percentage rate of the principal for a given time interval.

Simple Interest Formula



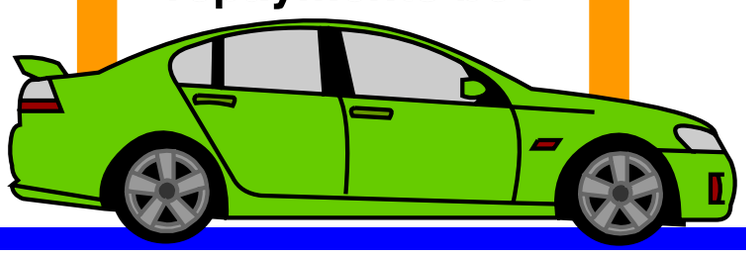
$$I = P \times R \times T$$

I = Interest
P = Principal
R = Rate
T = Time

NOTE: Convert the percentage to a fraction or a decimal fraction.
For example, if the rate is 5%, then use 5/100 or 0.05 in the formula.

Examples

To buy a new car I need to borrow $30,000.00 for 3 years at a rate of 12.5% per annum. What will my total repayments be?



$$I = P \times R \times T$$
$$= \$30,000 \times 0.125 \times 3$$
$$= \$11,250$$

$$\text{Total} = P + I$$
$$= \$30,000 + \$11,250$$
$$= \$41,250$$

My total repayments will be $41,250.00.

NOTE
per annum means per year

The bank interest rate for term deposits is currently 5.75% per annum. How much interest would an investment of $10,000.00 for 6 months earn?

NOTE
6 months = 0.5 of a year

$$I = P \times R \times T$$
$$= \$10,000 \times 0.0575 \times 0.5$$
$$= \$287.50$$

The investment would earn $287.50.

Calculating profit and loss

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

Profit is when an item is sold for more than it cost to buy. Profit in a business occurs when the business earns more money than it spends on business expenses.

Calculating profit

On a single item

Profit = sale price - cost price

$$\text{Percentage profit} = \frac{\text{profit}}{\text{cost}} \times 100$$

Example: A house was bought for $400,000 and sold 5 years later for $450,000.

$450,000 - $400,000 = $50,000 profit

$$\frac{\$50,000}{\$400,000} \times 100 = 12.5\% \text{ profit}$$

In a business

Profit = earnings - expenses

$$\text{Percentage profit} = \frac{\text{profit}}{\text{earnings}} \times 100$$

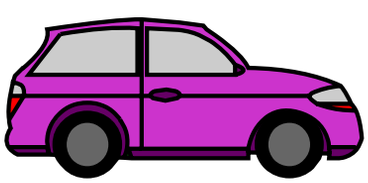
Example: A clothing business earned $60,000 in a year. Total expenses were $35,000.

$60,000 - $35,000 = $25,000 profit

$$\frac{\$25,000}{\$60,000} \times 100 = 41.6\% \text{ profit}$$

Calculating loss

On a single item



Loss = cost price - sale price

$$\text{Percentage loss} = \frac{\text{loss}}{\text{cost}} \times 100$$

Example: A car cost $10,000 and sold for $4,000.

$10,000 - $4,000 = $6,000 loss

$$\frac{\$6,000}{\$10,000} \times 100 = 60\% \text{ loss}$$

In a business

Business Loss = expenses - earnings

Percentage Business Loss = (loss ÷ earnings) x 100

Example: Bakery earnings $30,000; expenses $34,000.

$34,000 - $30,000 = $4,000 or 13.3% loss

Percentages, decimals, fractions

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

Percent	Decimal	Fraction	Equivalent Fractions				
1%	0.01	$\frac{1}{100}$	$\frac{2}{200}$	$\frac{3}{300}$	$\frac{4}{400}$	$\frac{5}{500}$	$\frac{10}{1000}$
10%	0.1	$\frac{1}{10}$	$\frac{2}{20}$	$\frac{3}{30}$	$\frac{4}{40}$	$\frac{5}{50}$	$\frac{10}{100}$
12.5%	0.125	$\frac{1}{8}$	$\frac{2}{16}$	$\frac{3}{24}$	$\frac{4}{32}$	$\frac{10}{80}$	$\frac{20}{160}$
16.7%	$0.1\overline{6}$	$\frac{1}{6}$	$\frac{2}{12}$	$\frac{3}{18}$	$\frac{4}{24}$	$\frac{10}{60}$	$\frac{20}{120}$
20%	0.2	$\frac{1}{5}$	$\frac{2}{10}$	$\frac{3}{15}$	$\frac{4}{20}$	$\frac{10}{50}$	$\frac{20}{100}$
25%	0.25	$\frac{1}{4}$	$\frac{2}{8}$	$\frac{3}{12}$	$\frac{4}{16}$	$\frac{10}{40}$	$\frac{25}{100}$
30%	0.3	$\frac{3}{10}$	$\frac{6}{20}$	$\frac{9}{30}$	$\frac{12}{40}$	$\frac{15}{50}$	$\frac{30}{100}$
33.3%	$0.\overline{3}$	$\frac{1}{3}$	$\frac{2}{6}$	$\frac{3}{9}$	$\frac{4}{12}$	$\frac{10}{30}$	$\frac{30}{90}$
37.5%	0.375	$\frac{3}{8}$	$\frac{6}{16}$	$\frac{9}{24}$	$\frac{12}{32}$	$\frac{30}{80}$	$\frac{60}{160}$
40%	0.4	$\frac{4}{10}$	$\frac{8}{20}$	$\frac{12}{30}$	$\frac{16}{40}$	$\frac{20}{50}$	$\frac{40}{100}$
50%	0.5	$\frac{1}{2}$	$\frac{2}{4}$	$\frac{3}{6}$	$\frac{5}{10}$	$\frac{10}{20}$	$\frac{50}{100}$
60%	0.6	$\frac{3}{5}$	$\frac{6}{10}$	$\frac{9}{15}$	$\frac{12}{20}$	$\frac{30}{50}$	$\frac{60}{100}$
62.5%	0.625	$\frac{5}{8}$	$\frac{10}{16}$	$\frac{15}{24}$	$\frac{20}{32}$	$\frac{50}{80}$	$\frac{100}{160}$
66.6%	$0.\overline{6}$	$\frac{2}{3}$	$\frac{4}{6}$	$\frac{6}{9}$	$\frac{8}{12}$	$\frac{20}{30}$	$\frac{60}{90}$
70%	0.7	$\frac{7}{10}$	$\frac{14}{20}$	$\frac{21}{30}$	$\frac{28}{40}$	$\frac{35}{50}$	$\frac{70}{100}$
75%	0.75	$\frac{3}{4}$	$\frac{6}{8}$	$\frac{9}{12}$	$\frac{12}{16}$	$\frac{30}{40}$	$\frac{75}{100}$
80%	0.8	$\frac{4}{5}$	$\frac{8}{10}$	$\frac{12}{15}$	$\frac{16}{20}$	$\frac{40}{50}$	$\frac{80}{100}$
83.3%	$0.8\overline{3}$	$\frac{5}{6}$	$\frac{10}{12}$	$\frac{15}{18}$	$\frac{20}{24}$	$\frac{50}{60}$	$\frac{100}{120}$
90%	0.9	$\frac{9}{10}$	$\frac{18}{20}$	$\frac{27}{30}$	$\frac{36}{40}$	$\frac{45}{50}$	$\frac{90}{100}$
100%	1	$\frac{1}{1}$	$\frac{100}{100}$	$\frac{200}{200}$	$\frac{300}{300}$	$\frac{500}{500}$	$\frac{1000}{1000}$
150%	1.5	$1\frac{1}{2}$ or $\frac{3}{2}$	$\frac{150}{100}$	$\frac{300}{200}$	$\frac{450}{300}$	$\frac{750}{500}$	$\frac{1500}{1000}$
200%	2	$\frac{2}{1}$	$\frac{200}{100}$	$\frac{400}{200}$	$\frac{600}{300}$	$\frac{1000}{500}$	$\frac{2000}{1000}$

A horizontal bar over a digit in a decimal means that digit repeats forever, eg, $0.\overline{3}$ = 0.333333333 ....

Percentages, decimals, fractions ... conversions.

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

Fraction to Decimal

Divide the numerator by the denominator.

$$\frac{1}{4} \qquad 4\overline{)1.00} = 0.25$$

Decimal to Fraction

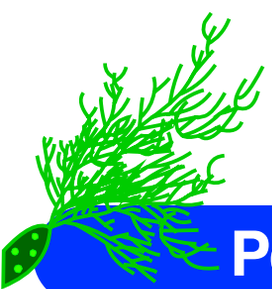
Write the decimal over the number of its place value, then simplify (reduce).

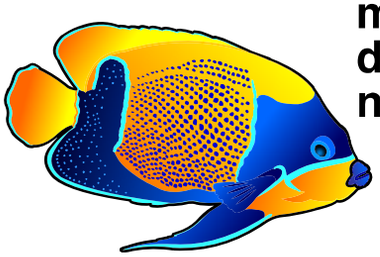
$$0.25 = \frac{25}{100} = \frac{1}{4}$$

Fraction to Percent

Multiply the fraction by 100, simplify (reduce), add the % symbol.

$$\frac{1}{4} \times \frac{100}{1} = \frac{100}{4} = 25\%$$





Percent to Fraction

Remove the % symbol, write as a fraction with a denominator of 100, then simplify (reduce).

$$25\% = \frac{25}{100} = \frac{1}{4}$$

With a decimal percentage, first multiply the numerator and the denominator by 10 until the numerator is a whole number.

$$2.5\% = \frac{25}{1000} = \frac{1}{40}$$

Percent to Decimal

Remove the % symbol, divide the number by 100.

$$25\%$$

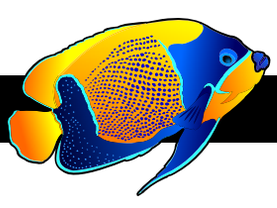
$$25 \div 100 = 0.25$$

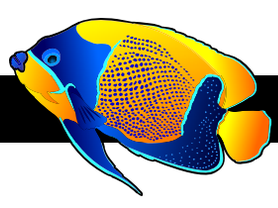
Decimal to Percent

Multiply by 100, add the % symbol.

$$0.25$$

$$0.25 \times 100 = 25\%$$

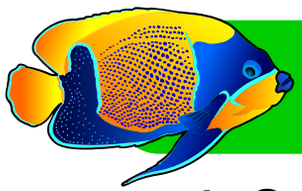




Percentage error

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

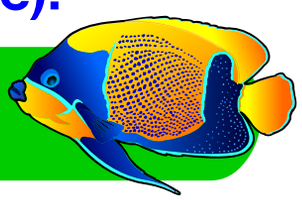
The percentage error or percent error is the difference between an approximate value (estimate or guess) and the exact value, expressed as a percentage of the exact value.



Calculating:

1. Subtract the exact value from the approximate value.
2. Divide this by the exact value.
3. Multiply by 100 and add the % symbol to get the percentage or percent error.

The error may be either positive or negative, e.g. 5% (overestimate); -5% (underestimate).

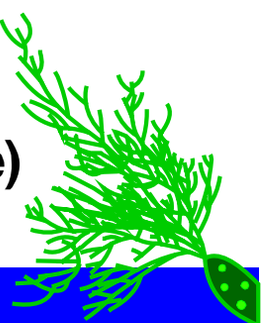


Example:

I estimated there would be 20 fish in the aquarium, but there were actually 25.

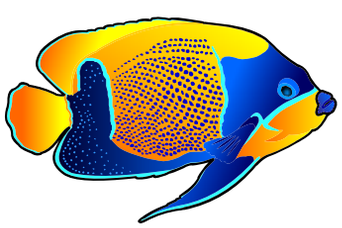
1. 20 - 25 = -5
2. -5 ÷ 25 = -0.2
3. -0.2 x 100 = -20 or -20% error (underestimate)

I underestimated by 20%.



Formula:

$$\% \text{ error} = \frac{\text{approximate value} - \text{exact value}}{\text{exact value}} \times 100$$

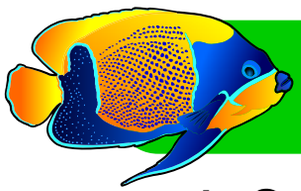


NOTE: Sometimes values are expressed as absolute values. The | symbol means absolute value. The absolute value of a number |x| or |-x| is just the value of the numeral, ignoring the sign.

Percentage change

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

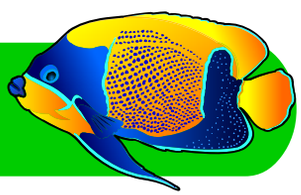
Percentage change or percent change is the relative change between an old value and its new value, expressed as a percentage of the old value.



Calculating:

1. Subtract the old value from the new value.
2. Divide this by the old value.
3. Multiply by 100 and add the % symbol to get the percentage change (percent change).

The change may be either an increase or a decrease, e.g. 5% increase; -5% decrease

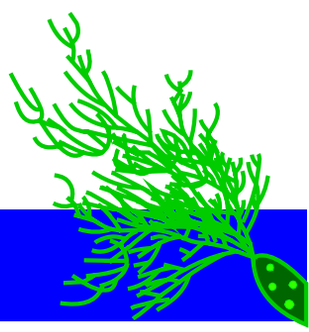


Example:

Tickets to enter the Aquarium were $10.00 but the new ticket price is $9.00. What is the percentage or percent change?

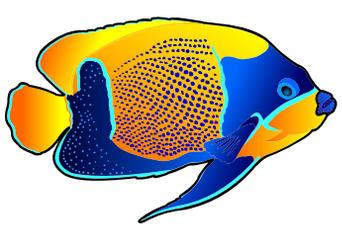
1. 9 - 10 = -1
2. -1 ÷ 10 = -0.1
3. -0.1 x 100 = -10% or 10% decrease.

There is a 10% decrease in ticket cost.



Formula:

$$\% \text{ change} = \frac{\text{new value} - \text{old value}}{\text{old value}} \times 100$$

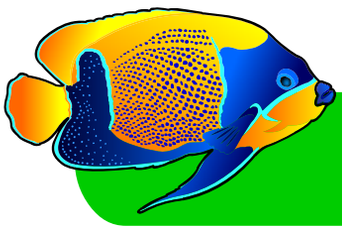


NOTE: Sometimes values are expressed as absolute values. The | symbol means absolute value. The absolute value of a number |x| or |-x| is just the value of the numeral, ignoring the sign.

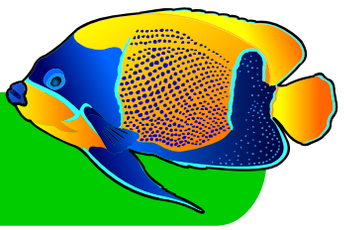
Percentage points

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

Percentage points are used to measure the difference between two percentages.



One percentage point = 1%



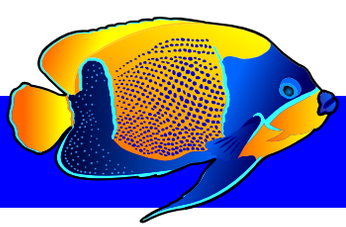
Examples:

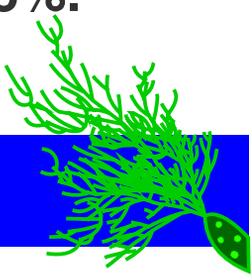
Percentage A	Percentage B	Percentage Point Difference
10%	12%	2 percentage points
5%	10%	5 percentage points
3%	4.5%	1.5 percentage points
2.5%	2.75%	0.25 percentage points

Percentage points are often used to describe increases or decreases in interest rates.

Example 1: The interest rate went up by 2 percentage points yesterday. It was 8% so it is now 10%.

Example 2: The interest rate went down by one half of a percentage point yesterday. It was 6% so it is now 5.5%.





Basis Points

Smaller increases or decreases are often described in financial markets using the term Basis Points.

A Basis Point is one hundredth of a Percentage Point.

100 Basis Points = 1 Percentage Point