Percentage Difference

T. . centage difference is:

The **difference** between two values divided by the **average** of the two values. Shown as a **percentage**.

Difference means to subtract one value from another:

> Example: Alex sold 15 tickets, and Sam sold 25
>
> The difference between 25 and 15 is: **25 − 15 = 10**

Average is the value halfway between:

$$\text{average} = \frac{\text{first value} + \text{second value}}{2}$$

> Example continued
>
> The average of 25 and 15 is: (25 + 15) / 2 = 40/2 = 20

And then the difference as a **Percentage** of the average:

> Example continued
>
> - Difference is 25 − 15 = **10**
> - Average is (25 + 15) / 2 = **20**

10 as a percentage of 20 is:

$$\frac{10}{20} \times 100\% = \textbf{50\%}$$

The percentage difference between 25 and 15 is 50%

Here is the answer, in one line:

Example continued

$$\frac{25 - 15}{(25 + 15)/2} \times 100\% = \textbf{50\%}$$

Now let's find out when, why and how to use it ...

When Should it be Used?

Percentage Difference is used when both values **mean the same kind of thing** (for example the heights of two people).

- But if there is an **old** value and a **new** value, we should use Percentage Change
- Or if there is an **approximate** value and an **exact** value, we should use Percentage Error

Why do we Average the Two Values?

Because there is no obvious way of choosing which value is the "reference" value.

Example continued

- If we use "15" we get 10/15 = **66.6...%**
- If we use "25" we get 10/25 = **40%**

But which one should we use? And if someone else did the calculations which one would *they* use?

So it is best to choose a value halfway between so there is no confusion.

What if the Difference is Negative?

We can't say which value is more important, so we can't say if the difference is "up" (positive) or "down" (negative) ... so we simply ignore any minus sign.

Example: Alex works 6 hours, and Sam works 9 hours

Difference = 6 − 9 = **−3**

But in this case we ignore the minus sign, so we say the difference is simply **3**

(We could have done the calculation as 9 − 6 = **3** anyway,
as Sam and Alex are equally important!)

The Average is (6+9)/2 = **7.5**

Percentage Difference = (3/7.5) x 100% = **40%**

How to Calculate

Step 1: Calculate the **difference** (subtract one value from the other) **ignore any negative sign**
Step 2: Calculate the **average** (add the values, then divide by 2)
Step 3: **Divide** the difference by the average
Step 4: Convert that to a **percentage** (by multiplying by 100 and adding a "%" sign)

Examples

Example: Juice costs $4 in one shop and $6 in another shop, what is the percentage difference?

- Step 1: The difference is 4 − 6 = −2, ignore the minus sign: difference = **2**
- Step 2: The average is (4 + 6)/2 = 10/2 = **5**
- Step 3: Divide: 2 by 5: 2/5 = **0.4**
- Step 4: Convert 0.4 to percentage: 0.4×100 = **40%.**

The percentage difference is 40%

Another Example: There were 160 smarties in one box, and 116 in another box, what is the percentage difference?

160 to 116 is a difference of 44.

Average is (160+116)/2 = 276/2 = 138

44/138 = 0.319 (rounded to 3 places) = **31.9%**

The percentage difference is 31.9%

The Formula

You can also put the values into this formula:

$$\left| \frac{\text{First Value} - \text{Second Value}}{(\text{First Value} + \text{Second Value})/2} \right| \times 100\%$$

(The "|" symbols mean absolute value *, so any negatives become positive)*

Example: "Best Shoes" gets 200 customers, and "Cheap Shoes" gets 240 customers:

$$\left| \frac{240 - 200}{(240 + 200)/2} \right| \times 100\% = |40/220| \times 100\% = \textbf{18.18...\%}$$

An interesting thing about this formula is that it doesn't matter which is the 1st or 2nd Value:

Put the values the other way around:

$$\left| \frac{200 - 240}{(200 + 240)/2} \right| \times 100\% = |-40/220| \times 100\% = \textbf{18.18...\%}$$

The answer is the same (because we take the absolute value).

Question 1   Question 2   Question 3   Question 4   Question 5
Question 6   Question 7   Question 8   Question 9   Question 10