# Linear Relationship

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A linear relationship is one where increasing or decreasing one variable n times will cause a corresponding increase or decrease of n times in the other variable too. In simpler words, if you double one variable, the other will double as well.



## Some Examples of Linear Relationships

First, let us understand linear relationships. These relationships between variables [1] are such that when one quantity doubles, the other doubles too.

For example:

- For a given material, if the volume of the material is doubled, its weight will also double. This is a linear relationship. If the volume is increased 10 times, the weight will also increase by the same factor.
- If you take the perimeter of a square and its side, they are linearly related. If you take a square that has sides twice as large, the perimeter will also become twice larger.
- The cost of objects is usually linear. If a notebook costs $1, then ten notebooks will cost $10.
- The force of gravity between the earth and an object is linear in nature. If the mass of the object doubles, the force of gravity acting on it will also be double.

As can be seen from the above examples, a number of very important physical phenomena

can be described by a linear relationship.

Apart from these physical processes, there are many correlations [2] between variables [3] that can be approximated by a linear relationship. This greatly simplifies a problem at hand because a linear relationship is much simpler to study and analyze than a non-linear one [4].

# Constant of Proportionality

The constant of proportionality is an important concept that emerges from a linear relationship. By using this constant, we can formulate the actual formula that describes one variable in terms of the other.

For example, in our first example, the constant of proportionality between mass and volume is called density. Thus we can mathematically write:

Mass = density x volume

The constant of proportionality, the density, is defined from the above equation - it is the mass per unit volume of the material.

If you plot these variables on a graph paper, the slope of the straight line is the constant of proportionality.

In this example, if you plot mass on the y-axis and volume on the x-axis, you will find that the slope of the line thus formed gives the density.

Linear relationships are not limited to physical phenomena but are frequently encountered in all kinds of scientific research and methodologies. An understanding of linear relationships is essential to understand these relationships between variables.

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**Links**
[1] https://explorable.com/relationship-between-variables
[2] https://explorable.com/statistical-correlation
[3] https://explorable.com/research-variables
[4] https://explorable.com/non-linear-relationship