Relationships

Direct Proportion

- Two quantities are directly proportional if an increase in one causes an increase in the other.
- Example: $y = 2x$
- Example: $E = hf$
- Example: $F = ma$

Inversely Proportional

- Two quantities are inversely proportional if an increase in one causes a decrease in the other.
- Example: $y = 1/x$
- Example: $I = V/R$

Constant Proportion

- Two quantities have a constant proportion if an increase in one causes no change in the other.
- Example: $y = 6$

Direct Squared Proportion

- Two quantities have a direct squared proportion if an increase in one causes a squared increase in the other.
- Example: $y = x^2$
- Example: $E = mc^2$
- Example: $K.E. = \frac{1}{2} m v^2$

Inverse squared proportion

- Two quantities have an indirecte squared proportion if an increase in one causes a squared decrease in the other.
- Example: y = 1/(x^2)
- Example: Gravitational Force and Electrostatic Force

Graph Position versus Time

- Time is independent variable on the X-Axis in seconds
- Position is dependent variable on the Y-Axis in meters.
- Slope of the line = Velocity
- Slope up to right = positive motion
- Slope up to left = negative, backwards motion
- Flat slope = no motion, stopped

Instantaneous Velocity

- Instantaneous Velocity is the Velocity at a given moment in time. It is the slope of the position versus time graph at the given time.
- Average Velocity is Displacement over the entire interval divided by the entire time.

Graph Velocity vs. Time

- Time is the independent variable on the X-axis

  in seconds

  Velocity is the dependent variable on the Y-axis in m/s

  Slope is Acceleration

  Positive Slope is positive acceleration so increasing Velocity

  Negative Slope is negative acceleration so decreasing Velocity

Area under Curve of Velocity versus Time

- Velocity x time = Displacement
- So, in a graph of Velocity versus time, the area under the curve is Displacement.
- If the figure is above the X-Axis, the Displacement is positive.

  If the figure is below the X-axis, the Displacement is negative.

Acceleration

- Acceleration is change in Velocity divided by change in time.
- Acceleration = (Vfinal – Vinitial)/time
- Units are m/s^2

Example

- The velocity of an object is 47 m/s at 3 seconds and is 65 m/s at 12 seconds. Calculate the acceleration of the object.

- $A = (Vf - Vi)/(tf - ti)$

  $= (65 - 47)/(12 - 3) = 18/9 = 2$ m/s^2