Vector and Kinematics Notes

3 - Graphs

There is certain information that can be taken from position vs. time (d vs. t) and velocity vs. time (v vs. t) graphs.

For Example:

d vs. t graphs:

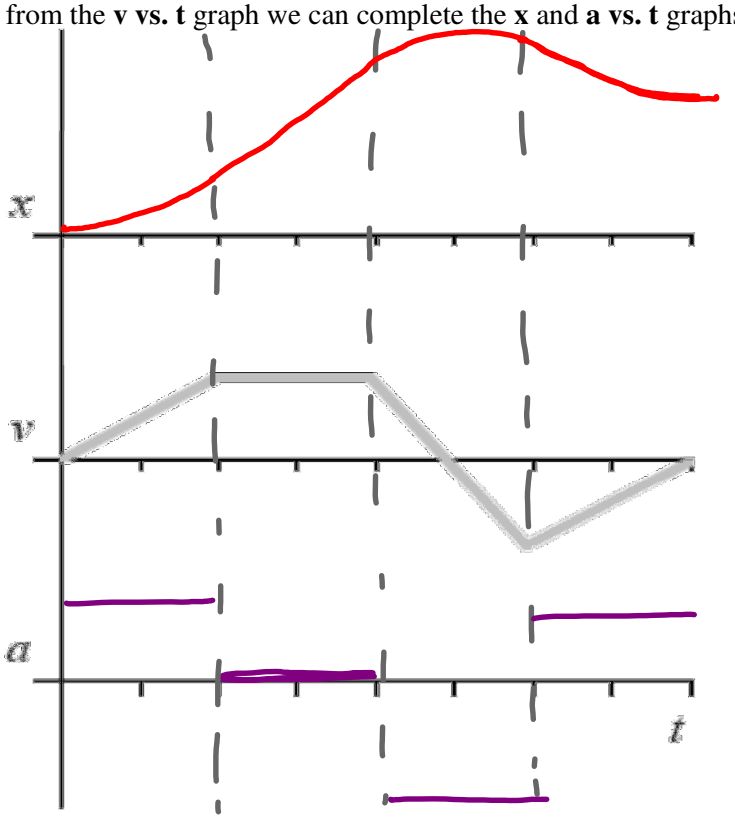
slope = velocity

v vs. t graphs:

slope = acceleration

area under curve = displacement

Given the information from the **v vs. t** graph we can complete the **x** and **a vs. t** graphs



In Physics 12 you will be expected to perform more advanced graphical analysis on tests and in labs. EVERY time you make a graph you should follow the following rules.

- Label the axis
  - Manipulated variable on the x-axis
  - Responding variable on the y-axis
- Give the graph an appropriate title.
- Scale each axis
  - Use… as much grid as possible
  - Choose a scale that is… easy to read
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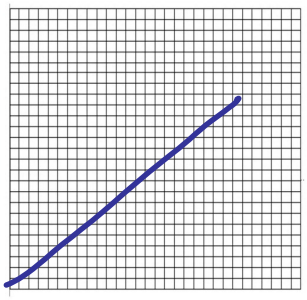
- Plot the points and draw a best fit curve.
- Determine if the curve is linear or not

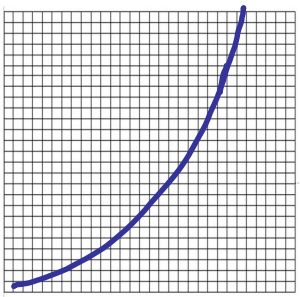
Direct:

$y \propto x$



Quadratic :

$y \propto x^2$

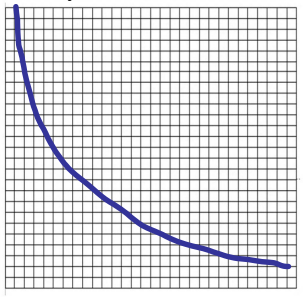


Inverse

$y \propto \frac{1}{x}$

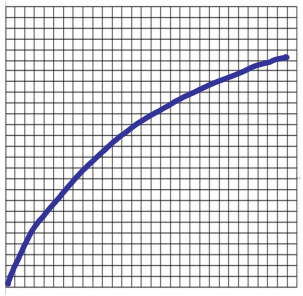
Inverse Square

$y \propto \frac{1}{x^2}$



Square Root:

$y \propto \sqrt{x}$



Finding Slope

To find the slope of a straight line:

- Choose… 2 points
- Choose them as… as far apart as possible
- Use only… points on the line

NO DATA POINTS!

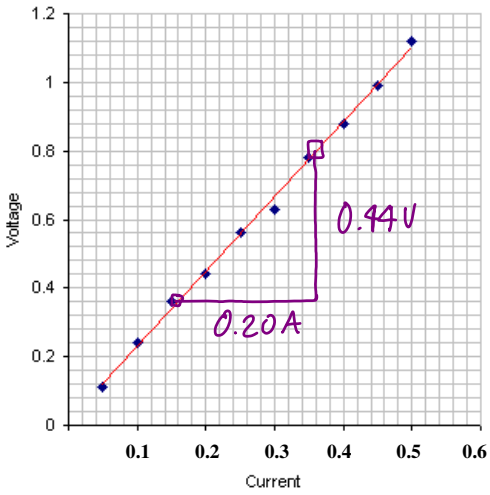
Remember the equation of a line is:

$y = mx + b$

Determine the slope and y-intercept of the graph shown and write the equation describing this line.

slope = $\frac{\text{rise}}{\text{run}}$ = $\frac{0.44\text{V}}{0.20\text{A}}$ = 2.2 V/A

y-int = 0



Curve Straightening

Ex 1: A car starts at a certain speed and accelerates uniformly. A student collects data of velocity at different displacements.

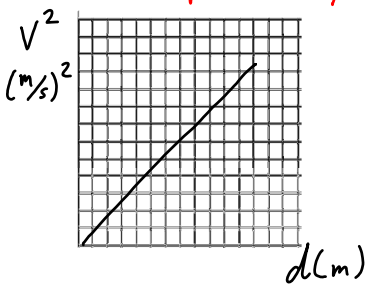
v	d

$v^2 = v_0^2 + 2ad$

so $v^2 \propto d$

$y = mx + b$

$v^2 = 2ad + v_0^2$ (slope: $2a$; y-int: v_0^2)



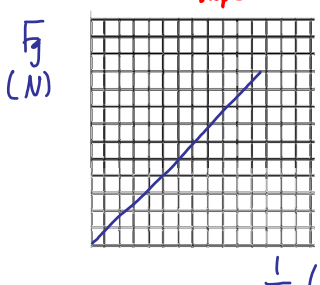
Ex 2: An astronaut standing on an asteroid measures the force of gravity acting on a 10 kg mass at different distances from the center of the asteroid.

F_g	r

$F_g = \frac{Gm_1m_2}{r^2}$ so $F_g \propto \frac{1}{r^2}$

$y = mx + b$

$F_g = Gm_1m_2 \cdot \frac{1}{r^2}$ (slope: Gm_1m_2)



Ex 3: A student pushes a wooden block over a rough surface with different amounts of force and measures the acceleration each time.

F_{app}	a

$F_{app} - F_f = ma$

$F_{app} \propto a$

$y = mx + b$

$F_{app} = ma + F_f$ (slope: m; y-int: F_f)