# Key Skills and Introductory Notes

August 30, 2015   2:10 PM

Physics is the pursuit of understanding how the universe works. In order to do this it makes use of the universal language, Math. Two main techniques that we will use are graphical analysis and solving linear systems of equations.

Graphical Analysis - Analyze and solve a system based on graphical information.

- Two useful calculations we will apply to solve problems through graphs
  - Find the Area
  - Find the slope
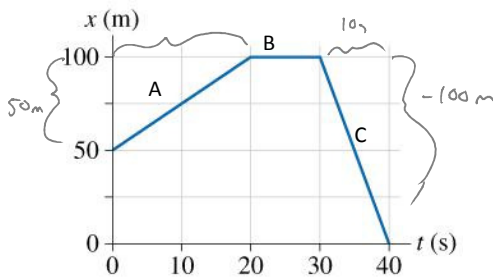
Example (left)
Units:
- Vertical: meters
- Horizontal: Seconds

Calculations:
- Slope A = $2.5 m/s$
- Slope B = $0 m/s$
- Slope C = $-10 m/s$

$$Slope = \frac{rise}{run} = \frac{\Delta y}{\Delta x} = \frac{y_f - y_i}{x_f - x_i}$$

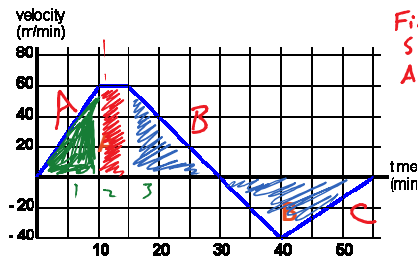$$Slope_A = \frac{50m}{20s} = 2.5 m/s \quad Slope_B = \frac{0m}{10s} = 0 m/s \quad Slope_c = \frac{-100m}{10s} = -10 m/s$$

Area

Example (right)
Units:
- Vertical: m/min
- Horizontal: min

Calculations:
- Area A =
- Area B =
- Area A + B =

Find the Slope of lines A, B, C

$$Slope_A = \frac{\Delta y}{\Delta x} = \frac{60 m/min}{10 min} = 6 m/min^2$$

$$Slope_B = \frac{-100 m/min}{25 min} = -4 m/min^2$$

$$Slope \, C = \frac{40 m/min}{15 min} = 2.\overline{6} m/min^2$$

$$A_{A_1} = \frac{1}{2}bh$$
$$= \frac{1}{2}(10)(60)$$
$$= 300 \frac{m}{min} \cdot min$$
$$= 300m$$

$$A_{A_2} = bh$$
$$= (5)(60)$$
$$= 300 \frac{m}{min} \cdot min$$
$$= 300m$$

$$A_{A_3} = \frac{1}{2}bh$$
$$= \frac{1}{2}(15)(60)$$
$$= 450 \frac{m}{min} \cdot min$$
$$= 450m$$

$$A_B = \frac{1}{2}bh$$
$$= \frac{1}{2}(25)(-40)$$
$$= -500 \frac{m}{min} \cdot min$$
$$= -500m$$

$$A_A = 1050m$$

$$A_A = 1050m$$

Distance Vs. Time Graph

Slope = Velocity of an object

Velocity Vs. Time Graph

Area = Displacement

Slope = acceleration

$$\frac{1}{3} = 0.\overline{3}$$

$$\frac{1}{3} = 0.\overline{3}$$

$$+ \quad \frac{1}{3} = 0.\overline{3}$$

$$\frac{3}{3} = 0.\overline{9}$$

Solving Systems of Equations (Substitution)

Physics requires you to analyse a lot of different information and combine it in order to solve the problem. Mathematically this is simply solving systems of equations.

To be successful at physics you must master this application of math.

Example:
Solve for x

$$y = -3x + 12$$
$$4x - 5y = 48$$

Solve for t

$$t = 3d + 5$$
$$2 \times \quad 4d = \frac{1}{2}t \times 2 \longrightarrow \underline{8d = t}$$

Sub: -3x+12 in for Y

$$4x - 5(-3x + 12) = 48$$
$$4x + 15x - 60 = 48$$
$$19x = 60 + 48$$
$$\frac{19x}{19} = \frac{108}{19}$$
$$x = 5.68$$

$$8d = 3d + 5$$
$$-3d \quad -3d$$
$$5d = 5$$
$$\underline{d = 1}$$

$$8d = t$$
$$\underline{8 = t}$$

$$y = -3(5.68) + 12$$
$$y = -5.05$$