Equation Finder and Reminders for Kinematics

The following rules are used with the Equation Finder:

1. Identify the "knowns" in the problem.
2. Identify the "unknown" in the problem.
3. Find an equation that has all knowns and the one desired unknown. (The M –missing – indicates which variable is NOT in the equation.)
4. Solve the correct equation for the unknown.
5. Insert the knowns into the solved equation and calculate value and units of the unknown.

Equation Finder:

Equation	$\vec{x}_i$	$\vec{x}_f$	$\vec{v}_i$	$\vec{v}_f$	$\vec{a}$	t
$\vec{v}_f = \vec{v}_i + \vec{a}\Delta t$	M	M				
$\vec{x}_f = \vec{x}_i + \vec{v}_i\Delta t + \frac{1}{2}\vec{a}t^2$				M		
$\vec{x}_f = \vec{x}_i + \frac{\vec{v}_i + \vec{v}_f}{2}t$					M	
$\vec{v}_f^2 - \vec{v}_i^2 = 2\vec{a}\Delta\vec{x}$						M

Understand these definitions:

$\vec{v} = \frac{\Delta\vec{x}}{\Delta t}$	$\vec{v}_{average} = \frac{\vec{v}_i + \vec{v}_f}{2}$ only if constant acceleration	$\vec{v}_{average} \neq \frac{\vec{v}_i + \vec{v}_f}{2}$ if different rates over equal intervals
$\Delta t = t_f - t_i$	$\Delta\vec{x} = \vec{x}_f - \vec{x}_i$	$\Delta\vec{v} = \vec{v}_f - \vec{v}_i$
$\vec{a} = \frac{\Delta\vec{v}}{\Delta t}$	$s_{average} = \frac{d_{total}}{t}$	$\vec{v}_{average} = \frac{\vec{D}}{t}$

Meany means:

When finding averages rate (e.g., speed or velocities) when an object is in constant (non accelerating motion), use the Harmonic mean

$$H = \frac{n}{\frac{1}{r_1} + \frac{1}{r_2} + \cdots + \frac{1}{r_n}}$$

Understand these relationships:

- $y = mx + b$ where $m = \Delta y/\Delta x = (y_2-y_1)/(x_2-x_1)$ and b equals the y-intercept
- The area under the "curve" of a position-time graph is meaningless.
- The area under the "curve" of a velocity-time graph is displacement.
- The area under the "curve" of an acceleration-time graph is velocity.

Distinguish scalars and vectors:

- Scalars are "magnitude" only such as distance and speed. $d = |\vec{D}|$
- Vectors are "magnitude and direction" such as displacement and velocity. $s = |\vec{v}|$