# Unit 1 - Kinematics

## Section 3

Mathematical Analysis

# INVISIBLE MOTION

**http://richannel.org/invisible-motion-in-video**

# Checklist -Word Problems

1. List variables and their values.
2. Convert values if necessary.
3. Choose and write an appropriate equation.
4. Rearrange the equation if necessary.
5. Substitute values into the equation.
6. State the answer with appropriate SDs and units.
7. Write a word statement.

# Kinematic Equations

## Uniform Motion — constant velocity

$$\vec{v} = \frac{\vec{d}}{t}$$

"Evil Formula"

$\vec{v}$ -> velocity (m/s)
$\vec{d}$ -> displacement (m)
t -> time (s)

($\Delta\vec{d}$)

## Uniformly Accelerated Motion

The following equations apply only to situations in which the acceleration is constant.

From velocity-time graphs: $\vec{a} = \frac{\Delta\vec{v}}{\Delta t}$ $m = \frac{\Delta y}{\Delta x}$

$$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t}$$

$\vec{a}$ -> acceleration ($m/s^2$)
$\vec{v}_f$ -> final velocity (m/s)
$\vec{v}_i$ -> initial velocity (m/s)
t -> time (s)

rearranged version.

* $\vec{v}_f = \vec{v}_i + \vec{a}t$ *

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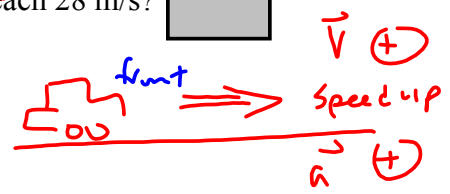
Example: If a car accelerates from rest at a constant acceleration of 5.5 m/s$^2$, how long will it take to reach 28 m/s?

$\vec{v}_i = 0\ m/s$

$\vec{a} = +5.5\ m/s^2$

$t = ?$

$\vec{v}_f = +28\ m/s$

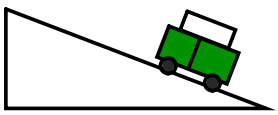



$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t}$

$t = \frac{\vec{v}_f - \vec{v}_i}{\vec{a}}$

$t =$ 0 out 6

Example: A stalled car starts to roll backward down a hill. At the instant that it has a velocity of 4.0 m/s down the hill, the driver is able to start the car and start accelerating back up the hill. After accelerating for 3.0 s, the car is travelling uphill at 3.5 m/s. Determine the car's acceleration once the driver got it started.



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Attachments

P112 - C3 Motion Problems- Freefall.doc