Acceleration

What is Acceleration?

- **Acceleration**
  - **the change in an object's velocity over time.**
- **What are 2 ways that an object's velocity can change?**
  - **change in speed**
  - **change in direction**

Change either one and there is an acceleration

Average Acceleration

- **To find the acceleration, we can use the following equation:**

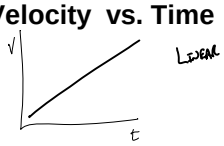
$$\text{average acceleration} = \frac{\text{change in velocity}}{\text{time to make the change}}$$

or

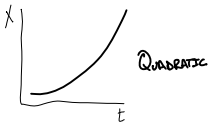
$$\bar{a} = \frac{\Delta v}{\Delta t} = \frac{v - v_0}{t - t_0}$$

Graphing Acceleration

- **Velocity vs. Time**



- **Displacement vs. Time**



Other Equations

- **When acceleration is constant, we can find other information about the object's motion using the following equations:**

$$v = v_0 + at$$

$$x = v_0 t + \frac{1}{2} a t^2$$

$$v^2 = v_0^2 + 2ax$$

Falling Objects

- **Gravity acts on all falling (and rising) objects.**
- **Down is considered to be in the negative direction. Up is positive.**
- **Acceleration due to gravity is 9.80 m/s^2 downward (-9.80 m/s^2)**

Helpful Hints

- **List the variables that are given and the one you are looking for**
- **Look for the words “from rest” and “stop”**
- **Choose the equation with all variables in it.**
- **Remember all direction conventions**

Sample Problem

- **A cat accelerates from rest at a constant rate of 2.30 m/s^2 for 6.3 seconds.**

  What is the speed of the cat at the end of the time?

  How far does the cat travel in this time?

Sample Problem

$v = v_0 + at$

$= 0\ m/s + (2.30\ m/s^2)(6.30\ s) = 14.5\ m/s$

$d = v_0 t + \frac{1}{2} a t^2$

$= (0\ m/s)(6.30\ s) + \frac{1}{2}(2.30\ m/s^2)(6.30\ s)^2 = 45.6\ m$

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