

Section 1.5

Uniform Acceleration :

Up to this point we have averaged our calculations, using the assumption that the object in question was always moving at a constant speed. While this can be useful, and comes with the benefit of simplified math, it is time we start increasing the level of application.

Uniform Acceleration : Changing from one velocity to a next at a constant rate.

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

recall in math that Δ is used to represent a change, and we will use the subscripts "f" and "i" to represent the final and initial velocities respectively.

****Note - Acceleration is a vector quantity, and therefore we must pay close attention to the direction of the velocities given in the question ****

Ex. #1

A motorcycle is traveling at 10 m/s [E] and accelerates to 20 m/s [E] in a time of 5 seconds. Determine the acceleration of the motorcycle.

givens

$$\vec{v}_f = 20 \frac{m}{s} [E]$$

$$\vec{v}_i = 10 \frac{m}{s} [E]$$

$$t = 5 \text{ s}$$

$$\vec{a} = \frac{20 \frac{m}{s}[E] - 10 \frac{m}{s}[E]}{5 \text{ s}}$$

$$\vec{a} = \frac{10 \frac{m}{s}[E]}{5 \text{ s}}$$

$$\vec{a} = 2 \frac{m}{s^2} [E]$$

we can only continue to solve the problem if the directions are the same, otherwise we must fix the directions to be the same.

a positive answer means that the velocity was increasing over time

Ex. #2

A motorcycle is traveling at 10 m/s [E], turns and accelerates to 10 m/s [W] in a time of 5 seconds. Determine the acceleration of the motorcycle.

givens

$$\vec{v}_f = 10 \frac{m}{s} [W]$$

$$\vec{v}_i = 10 \frac{m}{s} [E]$$

$$t = 5 \text{ s}$$

$$\vec{a} = \frac{10 \frac{m}{s}[W] - 10 \frac{m}{s}[E]}{5 \text{ s}}$$

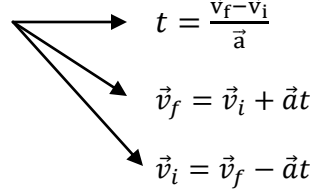
$$\vec{a} = \frac{10 \frac{m}{s}[W] - (-10 \frac{m}{s}[W])}{5 \text{ s}}$$

$$\vec{a} = \frac{20 \frac{m}{s}[W]}{5 \text{ s}}$$

$$\vec{a} = 4 \frac{m}{s^2} [W]$$

we can only continue to solve the problem if the directions are the same, these are not, so we must fix the directions to be the same.

We can rearrange our acceleration equation so that we can solve for the other variables if given the acceleration in the problem.

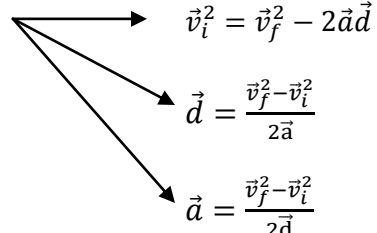
$$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{\Delta t}$$


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

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

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

Some other very useful equations

$$\vec{v}_f^2 = \vec{v}_i^2 + 2\vec{a}\vec{d}$$


$\vec{v}_i^2 = \vec{v}_f^2 - 2\vec{a}\vec{d}$

$\vec{d} = \frac{\vec{v}_f^2 - \vec{v}_i^2}{2\vec{a}}$

$\vec{a} = \frac{\vec{v}_f^2 - \vec{v}_i^2}{2\vec{d}}$

$$\vec{d} = \vec{v}_i t + \frac{1}{2}\vec{a}t^2$$

rearranging this one leads to solving the quadratic equation for time.

Assigned Problems - page 36 - 3 to 6

- page 46 - 1 to 5, 7

Review for Chapter 1 Test - page 49 - 1 to 3, 4bc, 5ab, 7 to 9, 12, 14 to 16, 20