3.1 ACCELERATION

STANDARDS

3.1 I can interpret and analyze the motion of an object moving with constant acceleration.

Chapter In Review

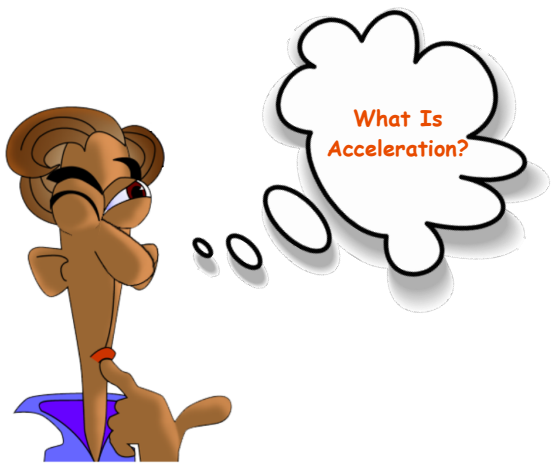
Distance = Total Length of Travel

Displacement = Change in position
= $\Delta x = x_f - x_o$

Chapter In Review

Average Speed = $\frac{\text{distance}}{\text{time}}$

Average Velocity = $\frac{\text{displacement}}{\text{time}}$



Acceleration?

Acceleration is the rate at which an object's velocity changes.

a

$$\text{Acceleration} = \frac{\Delta \vec{V}}{t} = \frac{\text{change in velocity}}{\text{time interval}}$$

Acceleration?

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UNITS M/S^2

$$\vec{a} = \frac{\Delta \vec{v}}{\Delta t} = \frac{\vec{v}_f - \vec{v}_o}{t} \quad \left(\frac{\frac{M}{S}}{S}\right)$$

Tesla Roadster

Tesla Roadster

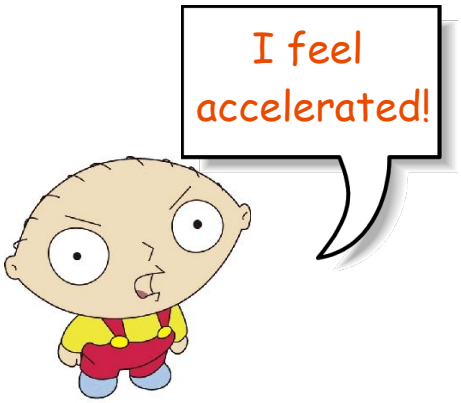
$V_0 = 0$
$V_f = 60\text{mph}$
$t = 1.9\text{s}$
$a = ?$

$\frac{60\text{ mi}}{1\text{ hr}} \times \frac{1600\text{ m}}{1\text{ mi}} \times \frac{1\text{ hr}}{3600\text{ s}} = 26.7\text{ m/s}$

$1\text{ m/s} = 2.24\text{ mph}$

$\vec{a} = \frac{\Delta \vec{v}}{t} = \frac{V_f - V_0}{t} = \frac{26.7\text{ m/s} - 0}{1.9\text{s}}$

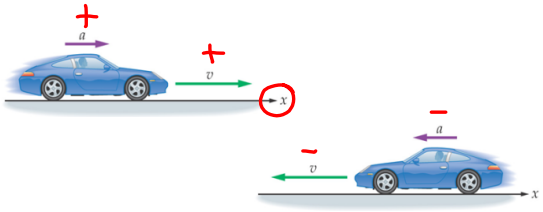
$\vec{a} = 14.1\text{ m/s}^2$



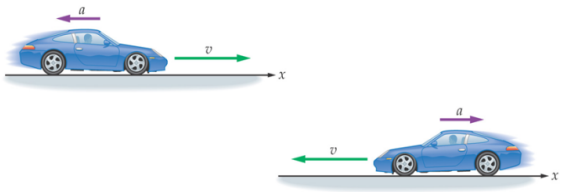
Deceleration?

Positive Acceleration vs. Negative Acceleration

When the velocity and acceleration of an object have the same sign, the speed of the object _increases_.



When the velocity and acceleration of an object have opposite signs, the speed of the object _decreases_.



Example

You are driving down Grand Ave. at 35.0 mph. Suddenly, an unsuspecting high school student begins to cross the street, and you have to slam on your brakes to avoid a collision. If it takes you 1.50 seconds to come to a complete stop, what is you acceleration in m/s²?

$V_0 = 35 \text{ mph} \times \frac{1 \text{ m/s}}{2.24 \text{ mph}} = 15.6 \text{ m/s}$

$V_f = 0$

$t = 1.50 \text{ s}$

$a = ?$

$\vec{a} = \frac{\vec{\Delta V}}{t} = \frac{V_f - V_i}{t} = \frac{0 - 15.6 \text{ m/s}}{1.5 \text{ s}}$

$\vec{a} = -10.4 \text{ m/s}^2$

PRACTICE

Unit 3 Practice Problems

(1-4)