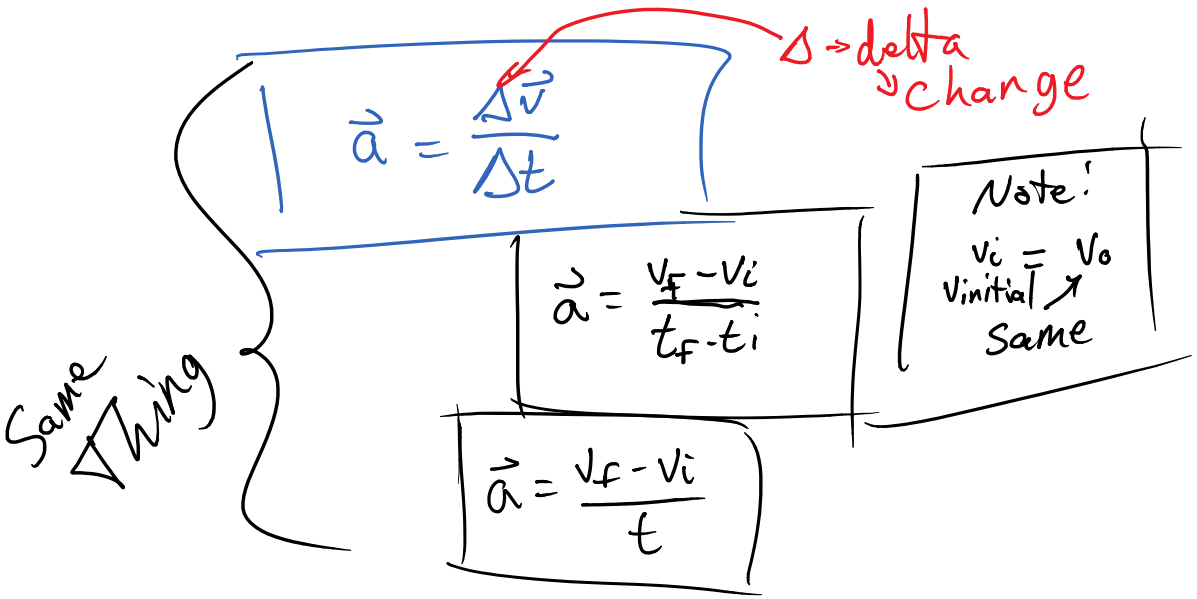
2.2 Acceleration

October-01-15 8:21 AM

Whenever a body experiences a change in velocity, that experience is called an acceleration.

So the Formula Follows:



Ex. Jeff is going for a jog and is jogging west at a speed of 1m/s. A velociraptor jumps out in front of him, so Jeff bolts in the opposite direction at a speed of 7m/s. It takes him a precious 1.3s to turn around and get to speed. What was Jeff's acceleration?

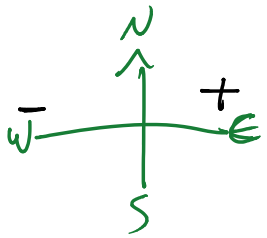
$v_i = 1\,m/s$ west $= -1\,m/s$

$v_f = 7\,m/s$ east $= 7\,m/s$

$t = 1.3s$

exact values

$\vec{a} = \frac{v_f - v_i}{t}$



$\vec{a} = \frac{7\,m/s - (-1\,m/s)}{} = \frac{8\,m/s}{}$

$t = 1.3\,s$ $\Rightarrow$ 2 sig figs

$\vec{a} = \frac{7\,m/s - (-1\,m/s)}{1.3\,s} = \frac{8\,m/s}{1.3\,s}$

$\vec{a} = 6.1538\ m/s^2$

Jeff's acceleration was $6.2\ m/s^2$ east.

Rearranging

Ex 2. The velociraptor chases Jeff to feast on delicious neck-meats. A raptor can accelerate at $3.0\ m/s^2$. How long does it take the raptor to begin catching up to Jeff?

Bigger than Jeff's $\vec{v}$

① $\vec{a} = 3.0\ m/s^2$
$v_i = 0\ m/s$
$v_f = 7.\ m/s$
$t = ?$ ← Looking for this

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

③ Solve generally for t.

$t \cdot \vec{a} = \left(\frac{\vec{v}_f - \vec{v}_i}{t}\right) t$

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

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

$t = \frac{7 - 0}{3.0} = 2.\overline{3}$ $\quad t = 2.3\,s$

The raptor is catching up after 2.3s.

Ex. After 2.3s the velociraptor takes 1.3s longer to catch Jeff. What was its final velocity when it sunk its teeth into Jeff's neck?

catch Jeff. What was its [illegible]
sunk its teeth into Jeff's neck?

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

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

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

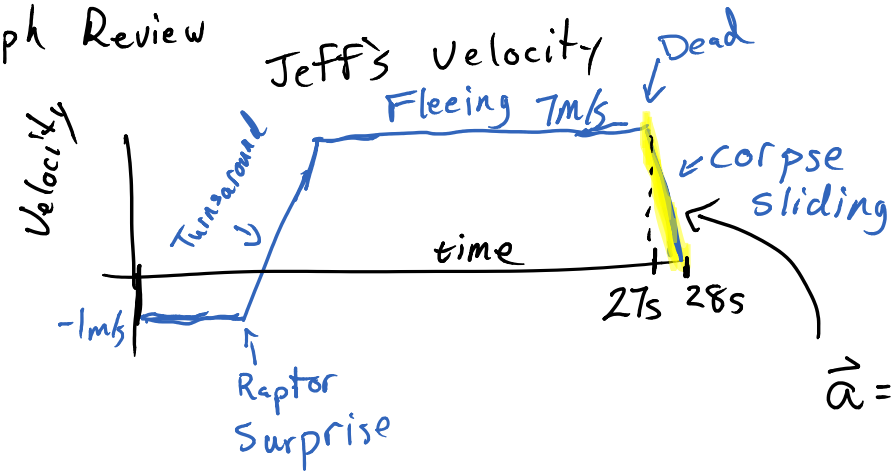
① $\vec{a} = 3 m/s^2$
$\vec{v}_f = ?$
$\vec{v}_i = 7 m/s$
$t = 13 s$

$v_f = 7 m/s + 3 m/s^2 \cdot 13 s$

$v_f = 7 m/s + 39 m/s$

$v_f = 46 m/s \leftarrow$

Graph Review



What was the acceleration of Dead Jeff?

$\vec{a} = -7 m/s^2$

When you have a uniform acceleration the average velocity can be used to find displacements.

No acceleration → $\vec{d} = \vec{v} \cdot t$

Have acceleration

$\vec{d} = \vec{v}_{avg} \cdot t$

$\vec{d} = \left(\frac{\vec{v}_i + \vec{v}_f}{2}\right) \cdot t$

Ex. How far, from start to finish did the velociraptor have to run to catch Jeff?

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

$\vec{d} = \left(\frac{\vec{v}_i + \vec{v}_f}{\quad}\right) \cdot t$

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

$\vec{v}_f = 46 m/s$ ← 2 sig figs

$t = 15.3 s$

$$\vec{d} = \left(\frac{\vec{v}_i + \vec{v}_f}{2}\right) \cdot t$$

$$\vec{d} = \left(\frac{0 + 46}{2}\right) \cdot 15.3$$

$$\vec{d} = 23 \times 15.3$$

$$\vec{d} = 351.9$$

The raptor ran 350m for its meal.

clever girl!

Practice p. 49

HWp. 52

Note! All classes

Quiz → 1 question rearranging

→ 1-3 questions calculations