

Acceleration

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

Kinematics
Formula
#1

delta
↓
means change

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

Note:
 $\vec{v}_0 = \vec{v}_i$
↑ same
initial

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

Ex.

Chloe is going on a jog. She is jogging north at a pace of 3m/s. A velociraptor jumps out in front of her, so she spin around and sprints in the opposite direction taking a mere 0.7s to reach top speed of 10m/s. What is Chloe's acceleration?

① List your variables
 $v_i, v_f, a, \Delta t$

① $\vec{v}_i = 3\text{m/s}$
 $\vec{v}_f = -10\text{m/s}$
 $t = 0.7\text{s}$
 $\vec{a} = ?$

N+
↑
S-

② Choose the correct formula.

② $\vec{a} = \frac{v_f - v_i}{t}$

③ Done

③ Solve for the unknown generally.

↖ No numbers.

④ $\vec{a} = \frac{-10 - 3}{0.7} = \frac{-13}{0.7}$
 $= -18.57$
 $= -19\text{m/s}^2$

④ Plug in values, get the answer.

⑤ ...

plug in values, get answer.

$$-17 \text{ m/s}^2$$

⑤ Full sentence questions get a full sentence answer.

⑤ Chloe's acceleration was -19 m/s^2 , or $19 \text{ m/s}^2 \text{ S}$.

Ex. The velociraptor is groggy from cryosleep. It accelerates at a slow 3.0 m/s^2 towards Chloe. How long does it take to match Chloe's velocity?

① $v_i = 0 \text{ m/s}$

$v_f = 10 \text{ m/s}$

$a = -3.0 \text{ m/s}^2$

~~$t = ?$~~

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

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

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

$$t = \frac{-10 - 0}{-3} = \frac{-10}{-3} = +3.\bar{3}$$

$$t = 3.3 \text{ s}$$

The velociraptor takes 3.3s to match velocity with Chloe.

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

No acceleration

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

Uniform acceleration

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



$$\vec{d} = \frac{\vec{v}_i + \vec{v}_f}{2} \cdot t$$

Kinematics Formula

#2

Ex. Tim bravely sacrifices himself to tackle

the velociraptor. They tumble on the ground and slide to a stop after 2.4s. How far did they slide on the ground?

$$v_i = -10 \text{ m/s}$$

$$v_f = 0 \text{ m/s}$$

~~$v_i = ?$~~

$$d = ?$$

$$t = 2.4 \text{ s}$$

$$\vec{d} = \frac{\vec{v}_i + \vec{v}_f}{2} \cdot t$$

$$\vec{d} = \frac{-10 \text{ m/s} + 0 \text{ m/s}}{2} \cdot 2.4 \text{ s}$$

$$\vec{d} = -12 \text{ m}$$

Tim and the raptor
slid 12m S.