$-9.8 m/s^2$

Example 2. A nut is falling at a rate of -5m/s. If gravity accelerates the nut at a rate of ~~9.8m/s²~~, what will be the velocity of the nut after 6 more seconds?

$V_{x0} = -5 m/s$

$a = -9.8 m/s^2$

$t = 6s$

$V_x = ?$

$V_x = V_{x0} + at$

$V_x = -5 m/s + (-9.8 m/s^2)(6s)$

$V_x = -5 m/s - 58.8 m/s = -63.8 m/s$

1. A grouse takes off from the 8 yard line of a football field and travels to the 40 yard line over a time of 8 seconds. What is its average velocity?

$\Delta x = 32 yards$

$\Delta t = 8s$

$\bar{V} = \frac{\Delta x}{\Delta t} = \frac{32 yards}{8 sec} = 4 yards/sec$

2. How long will it take you to drive 200 miles if you have a velocity of 60mph?

$\Delta x = 200 miles$

$\bar{V} = 60 mph = \frac{60 miles}{hour}$

$\bar{V} = \frac{\Delta x}{\Delta t}$

$\frac{60 miles}{hour} = \frac{200 miles}{\Delta t}$

$60 miles (\Delta t) = 200 miles \cdot hour$

$\Delta t = \frac{200 miles \cdot hour}{60 miles} = 3.33 hours$

3. You drop a rock off of a very high bridge. The rock accelerates at a rate of -9.8m/s². You see a splash 8 seconds after you release the rock. What is the rock's velocity when it hits the water?

$a = -9.8 m/s^2$

$\Delta t = 8s$

$\bar{a} = \frac{\Delta V}{\Delta t} =$

$\Delta V = ?$

$-9.8 m/s^2 = \frac{\Delta V}{8s}$

$\Delta V = (-9.8 m/s^2)(8s) = -78.4 m/s$

4. A ball falls for 10 seconds with an acceleration of -9.8m/s². What is the ball's displacement during this time?

$\Delta t = 10s$

$a = -9.8 m/s^2$

$V_{x0} = 0 m/s$

$\Delta x = ?$

$\Delta x = V_{x0} t + \frac{1}{2} a t^2$

$\Delta x = (0 m/s)(t) + \frac{1}{2}(-9.8 m/s^2)(10s)^2$

$\Delta x = -490 m$

5. A runner's velocity at 12:34:33 PM is 4m/s. At time 12:34:38 PM, the runner's velocity is 2m/s. What is the runner's average acceleration over this time period?

$\Delta t = 5s$

$\Delta v = -2 m/s$

$\bar{a} = \frac{\Delta v}{\Delta t} = \frac{-2 m/s}{5s} = -0.4 m/s^2$

8. A child traveling at a rate of -15m/s along a zip line. After decelerating at a constant rate for 5 seconds, the child comes to a stop.

a. What is the child's average acceleration?

$v_{x0} = -15 m/s$ $\quad v_x = v_{x0} + at$

$\Delta t = 5s$

$a = ?$ $\quad v_x = 0 m/s$

$0 m/s = -15 m/s + a(5s)$

$15 m/s = a(5s)$

$\frac{15 m/s}{5s} = a$

$3 m/s^2 = a$

b. What distance does the child travel during this deceleration period?

$a = 3 m/s^2$ $\quad \Delta x = v_{x0} t + \frac{1}{2} a t^2$

$\Delta t = 5s$ $\quad \Delta x = (-15 m/s)(5s) + \frac{1}{2}(3 m/s^2)(5s)^2$

$v_{x0} = -15 m/s$ $\quad \Delta x = -75m + (\frac{3}{2} m/s^2)(25 s^2)$

$v_x = 0 m/s$ $\quad \Delta x = -75m + 37.5m = -37.5m$

Do #10 first

9. A driver sees a turtle in the road and hits the brakes. It takes him 3 seconds to stop, and the car slides a distance of 20 meters. What was his car's rate of deceleration?

$\Delta x = 20m$

$\Delta t = 3s$

$v_x = 0 m/s$

$\Delta a = ?$

$v_{x0} = 13.3 m/s$

$a = \frac{\Delta v}{\Delta t} = \frac{v_x - v_{x0}}{\Delta t} = \frac{0 m/s - 13.3 m/s}{3s} = \frac{-13.3 m/s}{3s} = -4.4 m/s^2$

10. How fast was the driver (from the previous question) going before he hit the brakes?

$\Delta x = 20m$

$\Delta t = 3s$

$v_x = 0 m/s$

$v_{x0} = ?$

$\bar{v} = \frac{v_{x0} + v_x}{2} = \frac{\Delta x}{\Delta t}$

$\frac{v_{x0} + 0 m/s}{2} = \frac{20m}{3s}$

$v_{x0} = \frac{40m}{3s} = 13.3 m/s$