Homework 5.2 9, 10, 13, 14, 15, & 16

9. A stone is dropped from a height of 100 ft. For a free-falling object, acceleration is $a = -32 ft/s^2$ (the effect of gravity). Find the distance the stone has traveled after 2 sec. Note that the initial velocity is 0 because the stone was dropped, not thrown down. Find also the velocity of the stone when it hits the ground.

$a = -32 ft/s^2$

$a = -32 ft/s^2$

$v = \int a = \int -32 ft/s^2 \, dt$

$v = -32t + c$

$s = \int v = \int -32t \, dt$

$s = \frac{-32t^2}{2} + c$

$s = -16t^2 + c$

$\boxed{s = 64 \text{ feet}}$

$100 ft = -16t^2$

$t^2 = \frac{100}{16}$

$t^2 = 6.25$

$t = 2.5 sec$

$v = -32(2.5 sec)$

$\boxed{v = -80 ft/sec}$

10 An object is dropped from a stationary balloon at 500m. (a) Express the objects height above the ground as a function of time (b) How long does it take to hit the ground.?

$a = -9.8 m/s^2$

$v = \int a \, dt$

$v = -9.8t \, dt$

$s = \int v \, dt$

$s = \int -9.8t \, dt$

$s = \frac{-9.8t^2}{2} + c$

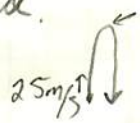
$\boxed{s = -4.9t^2 + 500}$

$t^2 = \frac{500}{4.9}$ $\quad 500 = +4.9t^2$

$t^2 = 102.0408$

$\boxed{t = 10.10153 \text{ sec}}$

13. a stone is hurled straight up from the ground at a velocity of 25m/s. (a) Find the maximum height that the stone reaches. (b) How long does it take for the stone to hit the ground? (c) Find the speed at which the stone hits the ground.



$a = -9.8 m/s^2$

$v = -9.8t \, dt$

$0 = -9.8t + 25$

$t = \frac{25}{9.8}$ $\quad s = 4.9t^2$ $\quad s = 4.9(2.551)^2$

a) $t = 2.551$ sec $\quad \boxed{s = 31.887 \text{ meters}}$

b) $\boxed{t = 5.102 \text{ sec}}$

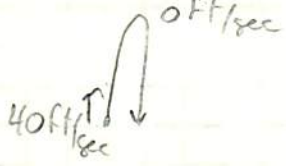
$v = -9.8(2.551)$

c) $\boxed{v = 25 m/s}$

Homework 5.2 9, 10, 13, 14, 15, & 16 continued

14. A ball is thrown vertically upward with an initial velocity of 40 ft/sec. (a). Find the maximum height of the ball. (b) How long does it take for the ball to hit the ground? (c). Find the speed at which the ball hits the ground.

$a = -32 ft/s^2$



$v = -32t + 40$

$0 = -32t + 40$

$t = \frac{40}{32}$

$t\uparrow = 1.25$ sec

$s = \int -32t$

$s = -16t^2$

$s = 16(1.25)^2$

a) $\boxed{s = 25 ft}$

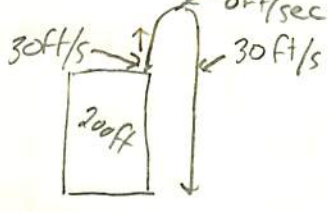
$t\uparrow\downarrow = 2(1.25)$

b) $\boxed{t\uparrow\downarrow = 2.5 sec}$

$v = -32(1.25)$

c) $\boxed{v = 40 ft/sec}$

15. A stone is thrown vertically upward from the roof of a 200 ft tall building with an initial velocity of 30 ft/s. (a) Find the equation describing the altitude of the stone from the ground. (b). How long does it take for the stone to hit the ground?



$a = -32 ft/s^2$

$v = \int a\, dt$

$v = -32t$

$0 = -32t + 30 ft$

$t\uparrow = \frac{30}{32}$ $t\uparrow = .9375$ sec

$s = \int -32t$

$s = -16(t^2) + C$

$\boxed{s = -16(.9375)^2 + 200}$

$s = 214.063 ft$

$214.063 = -16t^2$

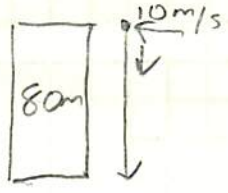
$t^2 = 13.379$ sec

$t\downarrow = 3.658$ sec

$t\uparrow\downarrow = 3.658 sec + .9375 sec$

$\boxed{t\uparrow\downarrow = 4.595 sec}$

16. A stone is thrown straight down from an 80m tall Building with an initial velocity of 10 m/s. (a) Find the equation describing the height of the stone from the ground. (b) How long does it take for the stone to hit the ground?



$a = +9.8 \text{ m/s}$

$v = 9.8t + C$

$v = 9.8t + 10$

$S = 4.9t^2 + 10t$

$80\text{m} = 4.9t^2 + 10t$

a). $0 = 4.9t^2 + 10t - 80$

b). $t = 3.147 \text{ sec}$