

Free Fall & Accel of Gravity

1.
 $v_i = 0 \text{ m/s}$
 $v_f = -73.5 \text{ m/s}$
 $g = -9.80 \text{ m/s}^2$

a) $\Delta d = \frac{v_f^2 - v_i^2}{2g}$
 $= \frac{(-73.5)^2 - 0}{2(-9.80)}$
 $= -276 \text{ m}$

b) $\Delta t = \frac{v_f - v_i}{g}$
 $= \frac{-73.5 - 0}{-9.80}$
 $= 7.50 \text{ s}$

2.
 $\Delta d = 52.3 \text{ m}$
 $v_f = 0 \text{ m/s}$
 $g = -9.80 \text{ m/s}^2$

$v_i^2 = v_f^2 - 2g\Delta d$
 $v_i = \sqrt{0^2 - 2(-9.80)(52.3)}$
 $= 32.1 \text{ m/s}$

$v_f = v_i + g\Delta t$
 $\Delta t = \frac{v_f - v_i}{g} = \frac{0 - 32.1}{-9.80} = 3.28 \text{ s} \times 2$
 $= 6.56 \text{ s}$

3.
 $v_i = 15.0 \text{ m/s}$
 $\Delta t = 1.20 \text{ s}$
 $g = -9.80 \text{ m/s}^2$

a) $v_f = v_i + g\Delta t$
 $= 15.0 + (-9.80)(1.20)$
 $= 15.0 - 11.8$
 $= 3.2 \text{ m/s}$

b) $\Delta d = v_i\Delta t + \frac{1}{2}g\Delta t^2$
 $= (15.0)(1.20) + \frac{1}{2}(-9.80)(1.20)^2$
 $= 18.0 \text{ m} - 7.06$
 $= 10.9 \text{ m}$

c) $v_f = 0$

$\Delta d = \frac{v_f^2 - v_i^2}{2g}$
 $= \frac{0 - (15.0)^2}{2(-9.80)}$
 $= 11.5 \text{ m}$

d) -9.80 m/s^2

5. When cord begins to stretch

$\Delta d = -75.0 \text{ m}$
 $v_i = 0 \text{ m/s}$
 $g = -9.80 \text{ m/s}^2$
 $v_f^2 = \frac{v_i^2 - 2g\Delta d}{1}$
 $= \sqrt{0 + 2(-9.80)(-75.0)}$
 $= -38.3 \text{ m/s}$

4.
 $v_i = 6.55 \text{ m/s}$
 $\Delta d = -400.0 \text{ m}$
 $g = -9.80 \text{ m/s}^2$

$v_f^2 = v_i^2 + 2g\Delta d$
 $= (6.55)^2 + 2(-9.80)(-400.0)$
 $= \sqrt{42.9 + 7840}$
 $= 89 \text{ m/s}$

$\Delta t = \frac{v_f - v_i}{g} = \frac{-89 - 6.55}{-9.80}$
 $= 9.8 \text{ s}$

Alternately, use quadratic formula

$\Delta d = v_i\Delta t + \frac{1}{2}g\Delta t^2$
 $\frac{1}{2}g\Delta t^2 + v_i\Delta t - \Delta d = 0$
 $-4.90\Delta t^2 + 6.55\Delta t + 400.0 = 0$
 $\Delta t = \frac{-6.55 \pm \sqrt{6.55^2 - 4(-4.90)(400.0)}}{2(-4.90)}$

$\Delta t = \frac{-6.55 \pm 89}{-9.80} = 9.8 \text{ s}$
 cannot have negative time!

$\bar{a} = 8.50 \text{ m/s}^2$

$v_i = -38.3 \text{ m/s}$

$v_f = 0$

$\Delta d = \frac{v_f^2 - v_i^2}{2g}$
 $= \frac{0 - (-38.3)^2}{2(8.50)}$
 $= -86.5 \text{ m}$

$-75.0 + (-86.5) = -161.5 \text{ m}$
 $= 161.5 \text{ m}$