Phys 2110 - 3 - 9/08/10

Note Title 9/8/2010

Const accel, 1-D

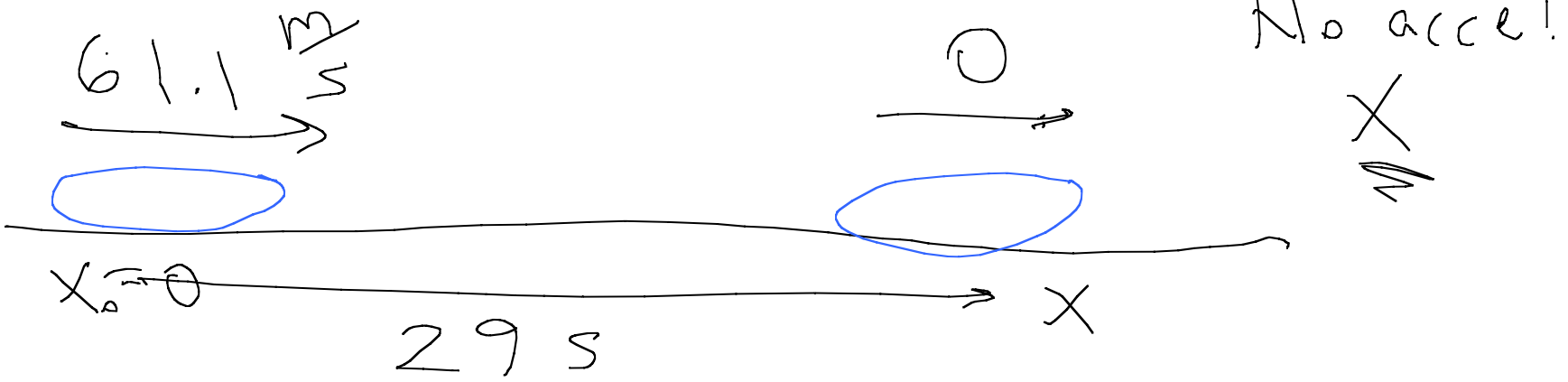
$$v = v_0 + at$$

$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

$$v^2 = v_0^2 + 2a(x - x_0)$$

$$x = x_0 + \frac{1}{2}(v_0 + v)t$$

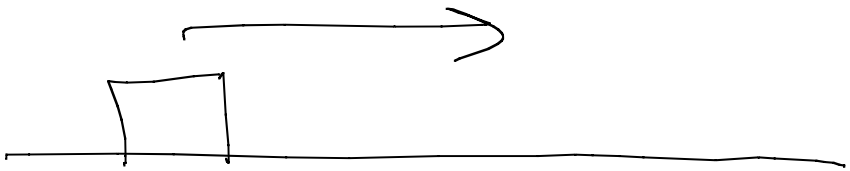
2.59 Jetliner touches down at 220 km/hr reverses engines... comes to a halt 29 s later. What is the shortest runway on which plane can land, assume constant accel

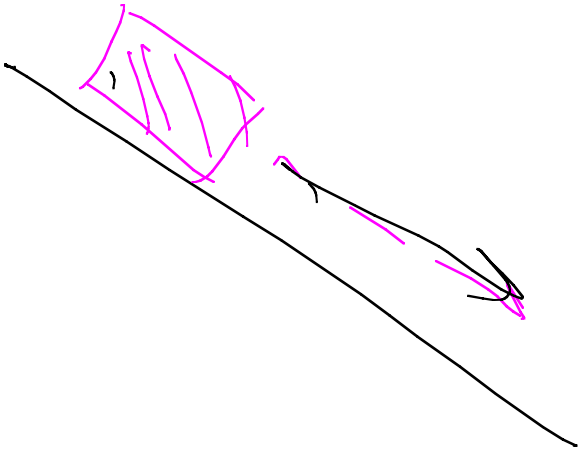


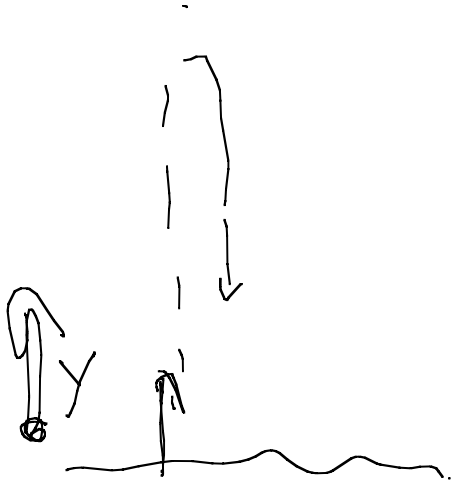
$$x = x_0 + \frac{1}{2}(v + v_0)t$$

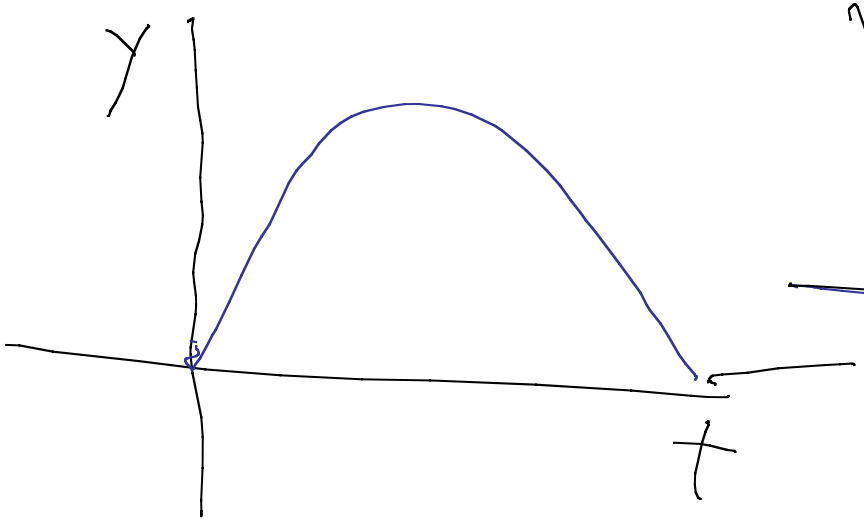
$$x = \frac{1}{2}\left(0 + 61.1\,\frac{m}{s}\right)29\,s$$

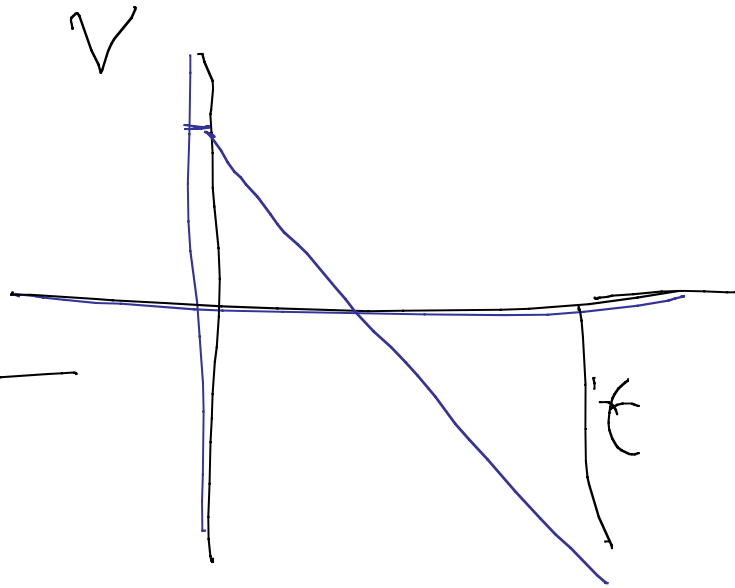
$$\approx 886\,m$$







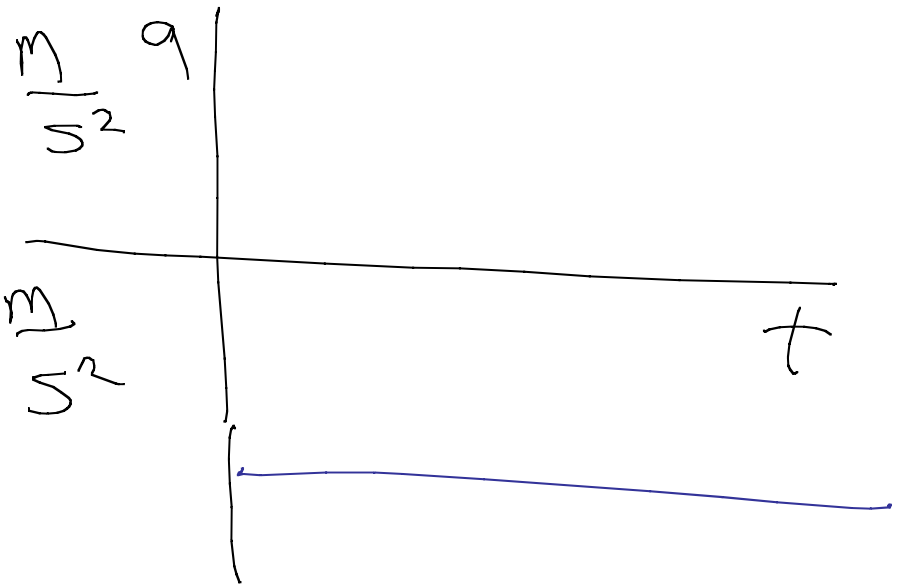


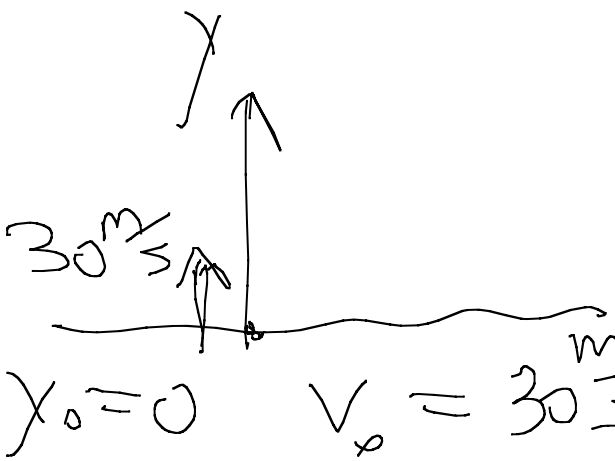


$$a = -9.80 \frac{m}{s^2}$$

$$g = 9.80 \frac{m}{s^2}$$

$$a = -g$$





Toss rock up w/ initial speed $v_0 = 30 m/s$

what are y, v, a at $t = 1s, 2s, 3s$

$$v = v_0 + at = (30 \tfrac{m}{s}) - (9.8 \tfrac{m}{s^2})t$$

$$x = x_0 + v_0 t + \tfrac{1}{2} a t^2$$

$$= 0 + (30 \tfrac{m}{s})t - \tfrac{1}{2}(9.8 \tfrac{m}{s^2}) t^2$$

$$a = -9.8 \tfrac{m}{s^2}$$

	y	v
0 s	0 m	30 $\frac{m}{s}$
1 s	25.1 m	20.2 $\frac{m}{s}$
2 s	40.4 m	10.4 $\frac{m}{s}$
3 s	45.9 m	0.600 $\frac{m}{s}$
4 s	41.6 m	-9.20 $\frac{m}{s}$

a) when does it get to max ht?

b) what is max ht?

c) when it hit ground

d) How long it take to hit ground

a) when does $v = 0$?

$t = 3.06\,s$ $\quad 0 = 30\frac{m}{s} - (9.8\frac{m}{s})t$

what is max ht?

$$y = \left(30\frac{m}{s}\right)(3.06s) - \frac{1}{2}\left(9.8\frac{m}{s^2}\right)(3.06s)^2$$

$$= 45.9\ m.$$

$$v^2 = v_0^2 + 2a(y - y_0)$$

$$0 = \left(30\frac{m}{s}\right)^2 + 2\left(-9.8\frac{m}{s^2}\right)(y - y_0)$$

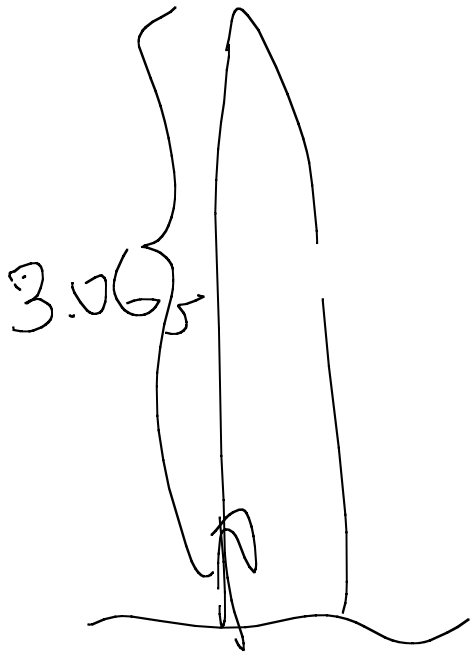
$$(y - y_0) = 45.9$$

How long to hit ground?

When is $y = 0$?

$$y = v_0 t - \frac{1}{2} g t^2$$

$$= 0$$



$$t\left(v_0 - \frac{1}{2} g t\right) = 0$$

$$= 6.12\ s$$

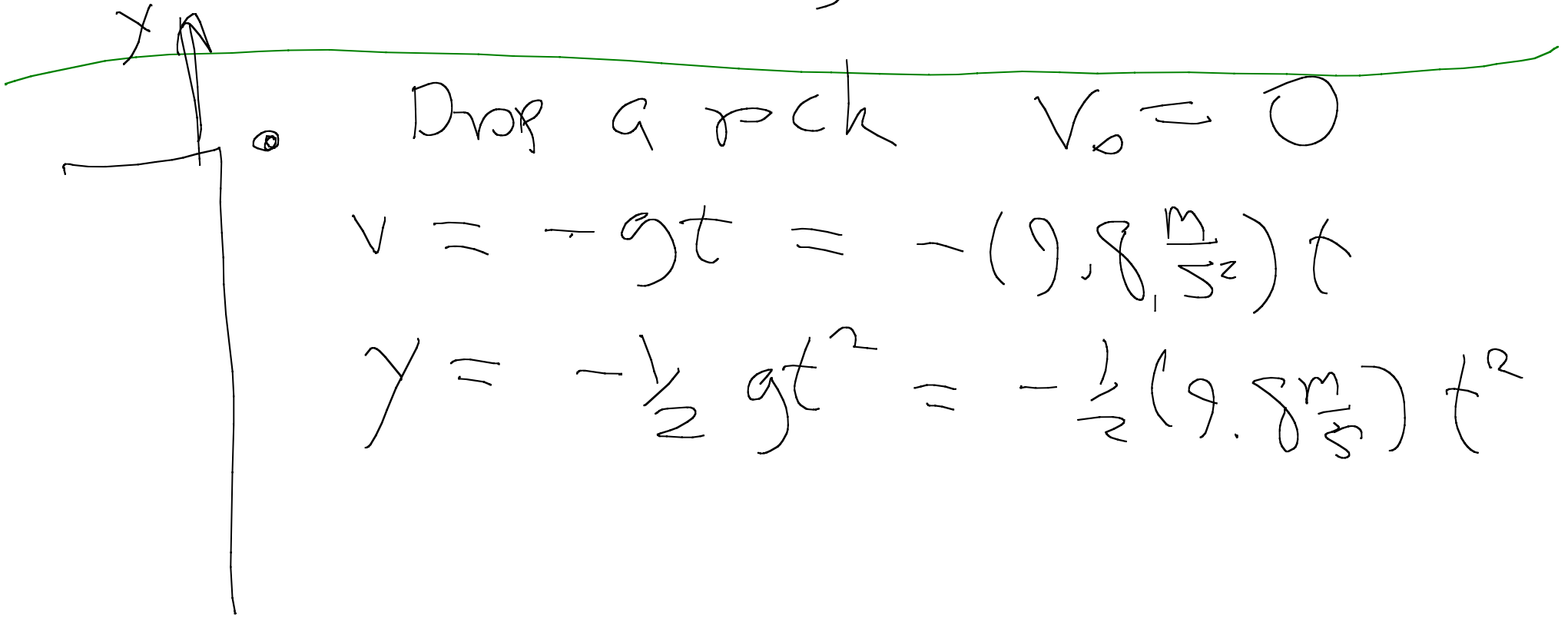
$$t = 0$$

$$v_0 = \frac{1}{2} g t \qquad t = \frac{2 v_0}{g} = \frac{2(30\ m)}{9.8\ m/s^2}$$

$$v = v_0 - gt$$

$$= \left(30 \tfrac{m}{s}\right) - \left(9.8 \tfrac{m}{s}\right)(6.12\,s)$$

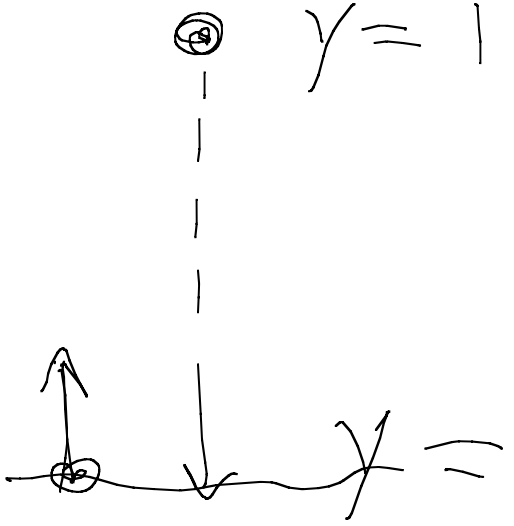
$$= -30.0 \tfrac{m}{s}$$



$$v = -gt = -\left(9.8 \tfrac{m}{s^2}\right) t$$

$$y = -\tfrac{1}{2} g t^2 = -\tfrac{1}{2}\left(9.8 \tfrac{m}{s}\right) t^2$$

3.44 Drops watch from eye level (170 cm) to floor. Watch takes 0.95 s to fall. On what planet is he?

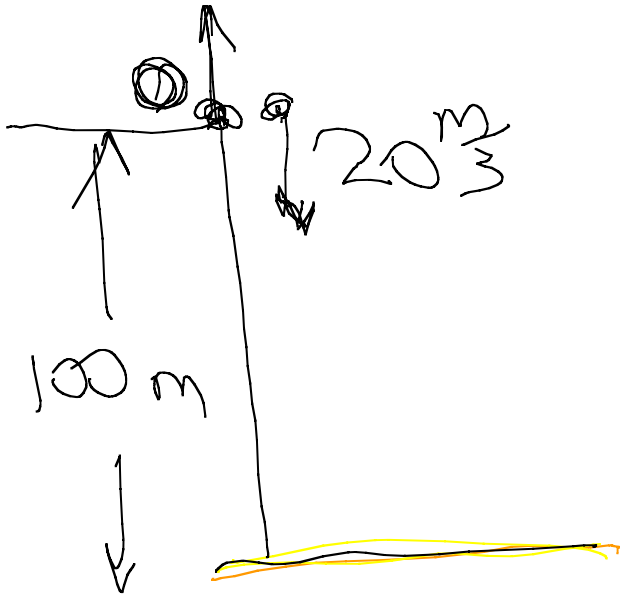


$$y = y_0 + v_0 t + \frac{1}{2} a t^2$$

$$0 = 1.70\,m + \frac{1}{2}(-g)(0.95\,s)^2$$

$$g = 3.77\ \frac{m}{s^2}$$

Mars



From top of cliff, throw rock down at $20\ \frac{m}{s}$. When it hit ground?

$$y = x_0 + v_0 t + \frac{1}{2} a t^2$$

When is $y = -100\ m$?

$$-100\ m = 0 + \left(-20\ \frac{m}{s}\right) t - \frac{1}{2}\left(9.8\ \frac{m}{s}\right) t^2$$

Solve for t !!!

$$-100 = (-20)t - 4.9t^2$$

$$4.9t^2 + 20t - 100 = 0$$

$$t = \frac{-20 \pm \sqrt{(20)^2 + 4(100)(4.9)}}{9.8}$$

$$= \begin{cases} 2.92\ s & \longleftarrow \quad t > 0 \\ -6.998\ s \end{cases}$$

What is velocity when it hit ground?

$$v = \left(-20\tfrac{m}{s}\right) - \left(9.8\tfrac{m}{s^2}\right)(2.92s)$$

$$= -48.6\tfrac{m}{s}$$

$$v^2 = v_0^2 + 2a(y - y_0)$$

$$v^2 = \left(-20\tfrac{m}{s}\right)^2 + 2\left(-9.8\tfrac{m}{s^2}\right)(-100m)$$

$$v = -48.6\tfrac{m}{s}$$

$$a = g \sin\theta$$