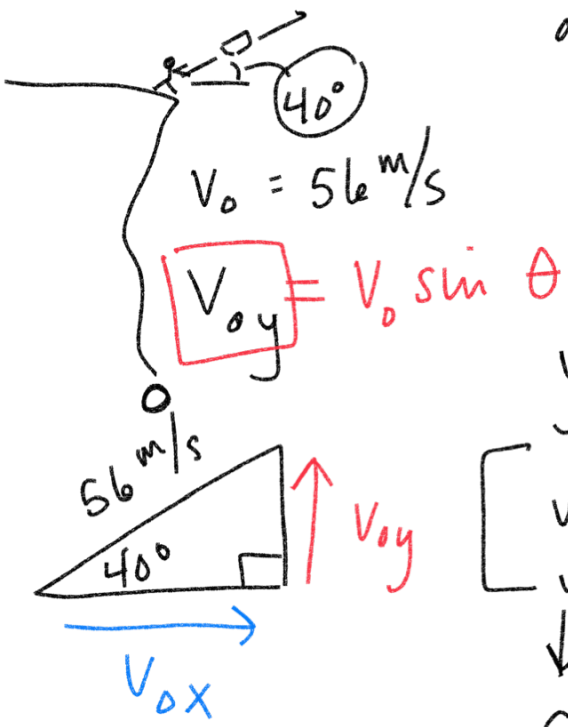
TH-GP General Physics Week 18 2/1

Alec threw Nate's hopes and dreams 56 m/s at an angle 40° above the horizontal from a 1500 m cliff.



a) How long until Nate's hopes and dreams are unfilled and destroyed upon impacting the cold, cruel ground?

$$y = y_0 + V_{0y}t + \frac{1}{2}a_y t^2$$

$$\left[y = y_0 + (V_0 \sin\theta)t - 4.9t^2\right]$$

$$0 = 1500 + (56 \sin 40^\circ)t - 4.9t^2$$

Desmos $\boxed{t = 21.55\ s}$

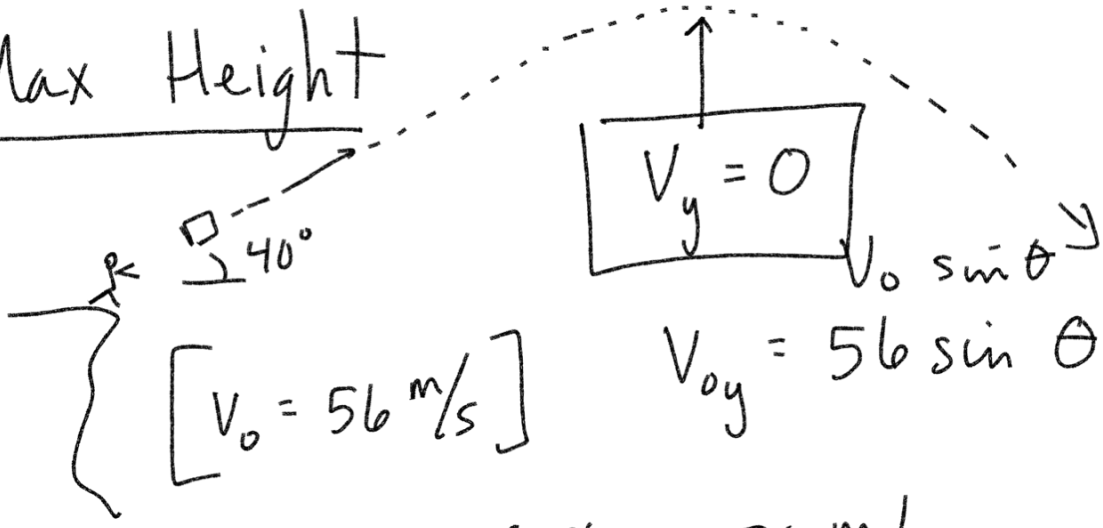
b) How far from the base of the cliff will Nate's life shatter into a confetti of disappointment and gross-but completely earned-reality?

$$x_f = x_0 + V_{0x}t \qquad x_f = \cancel{x_0}^{\,0} + (V_0 \cos\theta)t$$

$$(56 \cos 40)(21.55\ s)$$

$$\boxed{924.5\ m}$$

Max Height



36↑ 0s

26↑ 1s

16↑ 2s

6↑ 3s

−4↓ 4s

$[V_0 = 56\ m/s]$

$V_{0y} = 56 \sin\theta$

$V_{0y} = 56 \sin 40 = 36\ m/s$

$V_f = V_{0y} + at$

$0 = 56 \sin 40 - 9.8t$

$-56 \sin 40 \quad -56 \sin 40$

$\frac{+56 \sin 40}{+9.8} = \frac{-9.8t}{-9.8}$

$t = \frac{56 \sin 40}{9.8}$

$\boxed{t = 3.67s}$

Summary: To find time to max height: $\frac{-V_{0y}}{a}$

To find max height

$y = y_0 + V_{0y}t - 4.9t^2$

$= 1500 + (56 \sin 40)(3.67) - 4.9(3.67)^2$

$= \boxed{1566\ m}$

What is the impact <u>velocity</u>?

$$V_f = V_{oy} + at$$

$$\downarrow$$

$$V_o \sin\theta + at$$

$$\downarrow$$

$$\underbrace{56 \sin 40}_{} - 9.8(21.55)$$

$$36 - 9.8(21.55)$$

$$\boxed{-175.2 \text{ m/s}}$$

Nate threw a dozen newly made helpops at 95 m/s at an angle of 60 above horizontal from a 500 m tall cliff.

1.) Find time to impact.
2.) Find distance traveled from base
3.) Find time/distance of max height
4.) Find velocity upon impact.

1.) Time to impact

$$y = y_0 + (v_{0y} \sin\theta)t - 4.9t^2$$

$$0 = 500 + (95 \sin 60)t - 4.9t^2$$

$$\boxed{t = 21.53\,s}$$

2.) Find distance.

$$x_f = \cancel{x_0}^{\,0} + (v_{0x} \cos\theta)t$$

$$(95 \cos 60)(21.53\,s)$$

$$= \boxed{1022.7\,m}$$

3.) Find max height/distance

$$V_f = V_{oy} + at$$

$$0 = 95\sin 60 - 9.8t$$

$$+9.8t \qquad\qquad +9.8t$$

$$\frac{9.8t}{9.8} = \frac{95\sin 60}{9.8}$$

$$\boxed{t = 8.4\,s}$$

Max Height $\quad y = y_0 + V_{oy}t - 4.9t^2$

$$500 + (95\sin 60)t - 4.9t^2$$

$$500 + (95\sin 60)(8.4) - 4.9(8.4)^2$$

$$= \boxed{845.3\,m}$$

4.) Velocity impact

$$V_f = V_{oy} - at$$

$$95\sin 60 - 9.8(21.53\,s)$$

$$\boxed{= -128.6\ m/s}$$