§11-1 Projectile Motion

horizontally → velocity is constant

$$V = \frac{\Delta d}{\Delta t}$$

vertically → constant acceleration of $-9.81 m/s^2$

$$a = \frac{\Delta V}{\Delta t} \quad \text{and} \quad V_{ave} = \frac{\Delta d}{\Delta t}$$

maybe useful:

$$\Delta d = V_1 \Delta t + \frac{1}{2} a (\Delta t)^2$$

$$\Delta d = V_2 \Delta t - \frac{1}{2} a (\Delta t)^2$$

$$V_2^2 = V_1^2 + 2a\Delta d$$

* neglect air resistance
* the link between the horizontal and vertical motion is the TIME!

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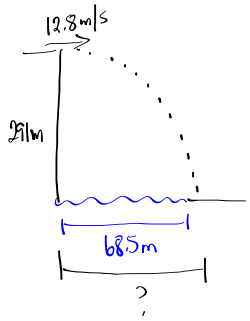


Use the vertical motion to find time:

$V_1 = 0$

$\Delta d = -291\,m$

$a = -9.81\,m/s^2$

$\Delta t = ?$

$\Delta d = \cancel{V_1 \Delta t}^{0} + \frac{1}{2}a(\Delta t)^2$

$\Delta d = \frac{1}{2}a(\Delta t)^2$

$(\Delta t)^2 = \frac{2\Delta d}{a}$

$(\Delta t)^2 = \frac{2(-291\,m)}{-9.81\,m/s^2}$

$\Delta t = 7.70\,s$

Horizontally (velocity is constant)

$V = \frac{\Delta d}{\Delta t}$

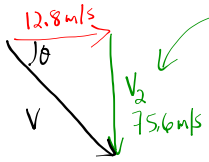
$\Delta d = V\Delta t$

$\Delta d = (12.8\,m/s)(7.70\,s)$

$\Delta d = 98.6\,m$

a) Since $98.6\,m > 68.5\,m$, the rock lands on the other side of the river.

b) velocity at impact:



$V_1 = 0$

$a = -9.81\,m/s^2$

$\Delta d = -291\,m$

$\Delta t = 7.70\,s$

$V_2 = ?$

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

$a = \frac{V_2 - V_1}{\Delta t}$

$V_2 = \cancel{V_1}^{0} + a\Delta t$

$V_2 = (-9.81\,m/s^2)(7.70\,s)$

$V_2 = -75.6\,m/s$

$V^2 = 12.8^2 + 75.6^2$

$V = 76.6\,m/s$

$\tan\theta = \frac{75.6}{12.8}$

$\theta = 80.4°$

The velocity at impact will be 76.6 m/s [80.4° below the horizontal]

TO DO

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