

Projectile Review - Short

1.) How many parts are in a projectile problem, and what are they?

2 PARTS. HORIZONTAL (x)
VERTICAL (y)

2.) A rock is thrown horizontally from a cliff at 15 m/s, if the cliff is 20.0 m high:

a.) how long will it take to reach the ground?

$$d = v_0 t + \frac{1}{2} a t^2 \quad -20 = 0 + (-4.905)(t^2)$$

$$\frac{-20}{-4.905} = \frac{(-4.905)t^2}{-4.905} \quad / \quad t^2 = \pm \sqrt{4.07747} \quad / \quad t = 2.0195$$

$$t = 2.02$$

b.) how far from the base of the cliff will it land? RANGE

$$\vec{v}_x = \frac{\vec{d}_x}{t} \quad / \quad 15 = \frac{\vec{d}_x}{2.02} \quad / \quad \vec{d}_x = 30.289 \text{ m}$$

$$\vec{d}_x = + 30.3 \text{ m}$$

c.) what are its final vertical and horizontal velocities?

$$\vec{v}_x = +15 \text{ m/s}$$

$$\vec{v}_y \Rightarrow \vec{v}_{Fy} = \vec{v}_{0y} + \vec{a}_y t \quad / \quad \vec{v}_{Fy} = 0 + (-9.81)(2.02) \quad / \quad \vec{v}_y = -19.8 \text{ m/s}$$

3.) A cliff diver wishes to clear 3.0 m of rock from the base of a 20.0 m high cliff. With what initial velocity must the diver jump (horizontally) to land safely in the water?

$$\vec{d}_y = \vec{v}_{0y} t + \frac{1}{2} \vec{a}_y t^2 \quad / \quad -20 = (-4.905)(t^2) \quad / \quad t = 2.019275 \text{ s}$$

$$\vec{d}_x = \vec{v}_x t + \frac{1}{2} \vec{a}_x t^2 \quad / \quad 3.0 = (v_x)(2.02) + 0 \quad / \quad t = 1.485 \text{ s} \quad / \quad t = 1.49 \text{ s}$$

4.) A cat is thrown at 3.0 m/s off a 75 m high building, will it strike a physics student who is standing 12 m from the building's base? Prove your answer.

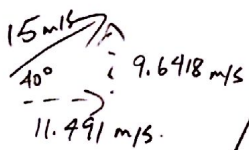
$$\vec{d}_y = \vec{v}_{oy}t + \frac{1}{2}\vec{a}t^2 \quad / \quad -75 = 0(t) + (-4.905)(t^2) \quad / \quad t = 3.9103s$$

$$\vec{d}_x = \vec{v}_{ox}t + \frac{1}{2}\vec{a}t^2 \quad / \quad \vec{d}_x = (3.0)(3.91) + \cancel{(0)(3.91^2)} \quad \vec{d}_x = 11.731m$$

IT DOES NOT HIT THE STUDENT.

$$\boxed{\vec{d}_x = 11.7m}$$

5.) A football is kicked at 40° with a velocity of 15 m/s, find its total air time, range, and max height.



$$\textcircled{1} \quad \vec{d}_y = \vec{v}_{oy}t + \frac{1}{2}\vec{a}_yt^2 \quad / \quad 0 = (9.6418)(t) + (-4.905)(t^2)$$

$$t = 1.9657s \quad / \quad \boxed{t = 1.97s}$$

$$\textcircled{2} \quad \vec{d}_x = \vec{v}_{ox}t + \frac{1}{2}\vec{a}_xt^2 \quad / \quad \vec{d}_x = (11.491)(1.97) + \cancel{\frac{1}{2}(0)(1.97)^2}$$

$$\vec{d}_x = 22.587m \quad / \quad \boxed{\vec{d}_x = 22.6m}$$

$$\textcircled{3} \quad \vec{d}_y = \vec{v}_{oy}t + \frac{1}{2}\vec{a}_yt^2 \quad / \quad \vec{d}_y = (9.64)(0.983) + (-4.905)(0.983)^2$$

$$\vec{d}_y = 4.7382m \quad / \quad \boxed{\vec{d}_y = 4.74m}$$

Answers - 1.) 2, vertical and horizontal

2.) 2.02 s, 30m, 20 m/s down, 15m/s

3.) 1.5 m/s

4.) Misses by
30.0m

5.) 1.97 s, 23m,
4.7m

4.74 m