

Equations:

$$d_y = V_{0y}t + \frac{1}{2}at^2 \quad V - V_0 = at \quad d_x = Vt \quad g = -9.8 \text{ m/s}^2$$

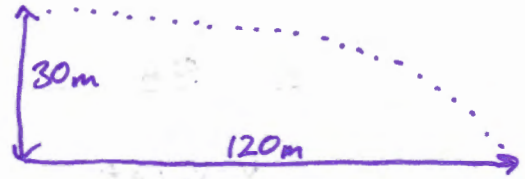
23. A steel ball is shot from a slingshot from a cliff that is 30 m high. It lands 120 m from the base of the cliff.

a. How long does it take to hit the ground?

$$d_y = V_{0y}t + \frac{1}{2}at^2$$

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

$$t^2 = 6.12 \quad t = 2.47 \text{ s}$$



b. What is the horizontal velocity right before hitting the ground?

$$d_x = Vt \quad \text{or} \quad V = \frac{d_x}{t}$$

$$V = \frac{120}{2.47} \quad V = 48.6 \text{ m/s}$$

c. What is the vertical velocity right before hitting the ground?

$$a = \frac{V - V_0}{t} \quad \text{or} \quad V - V_0 = at$$

$$V - 0 = (-9.8)(2.47)$$

$$V = -24.2 \text{ m/s}$$

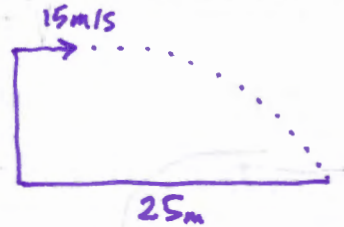
24. A projectile is shot horizontally from a cliff at 15 m/s and it lands 25m from the base of the cliff.

a. How long does it take to hit the ground

$$d_x = Vt$$

$$25 = 15t$$

$$t = 1.67 \text{ s}$$



b. How tall is the cliff?

$$d_y = V_{0y}t + \frac{1}{2}at^2$$

$$d_y = (0)(1.67) + \frac{1}{2}(-9.8)(1.67^2)$$

$$d_y = 0 + 13.6$$

$$d_y = 13.6 \text{ m}$$

c. What is the vertical velocity right before hitting the ground?

$$V - V_0 = at$$

$$V - 0 = (-9.8)(1.67)$$

$$V = -16.37 \text{ m/s}$$

25. A projectile is shot horizontally from a cliff at 15 m/s and it takes 1.93 s to hit the ground.

a. How tall is the cliff?

$$d_y = V_{0y}t + \frac{1}{2}at^2$$

$$d_y = (0)(1.93) + \frac{1}{2}(-9.8)(1.93^2)$$

$$d_y = 0 + 18.25$$

$$d_y = 18.25 \text{ m}$$



b. What is the range the ball lands?

$$d_x = Vt$$

$$d_x = (15)(1.93)$$

$$d_x = 28.95 \text{ m}$$

c. What is the vertical velocity right before hitting the ground?

$$V - V_0 = at$$

$$V - 0 = (-9.8)(1.93)$$

$$V = -18.91 \text{ m/s}$$