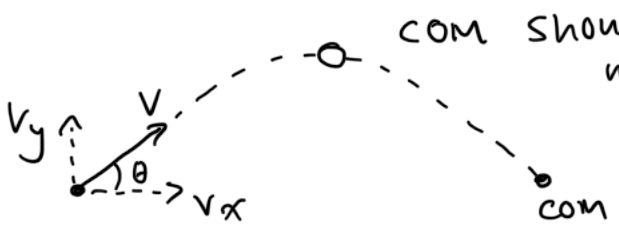
- A ball is initially thrown at a speed v at an angle of θ to the horizontal. At the top of its motion (when the ball is moving horizontally), it suddenly explodes into two pieces of equal mass. One piece lands back at the starting point, and the other piece lands on the ground at the same time. How far from the starting point did the other piece land?



$$2gh = v^2\sin^2\theta \qquad \frac{v^2\sin^2\theta}{2g} = \frac{1}{2}gt^2$$

$$h = \frac{v^2\sin^2\theta}{2g}$$

$$\frac{v\sin\theta}{g} = t \rightarrow 2t = \frac{2v\sin\theta}{g}$$

$$\Delta x = \frac{2v^2\sin\theta\cos\theta}{g} = \frac{v^2\sin 2\theta}{g}$$

$$\frac{v^2\sin 2\theta}{g} = \frac{\frac{m}{2}(0) + \frac{m}{2}(x')}{m}$$

$$\frac{v^2\sin 2\theta}{g} = \frac{1}{2}(x')$$

$$x' = 2\frac{v^2\sin 2\theta}{g} \quad \text{(or 2x range)}$$