

# FRC 2012: Rebound Rumble Shooter Projectile Calculation

$$d = V \cdot \cos(\beta) \cdot t$$
$$\Rightarrow V = d / (\cos(\beta) \cdot t)$$

$$h = V \cdot \sin(\beta) \cdot t - 0.5 \cdot g \cdot t^2$$
$$\Rightarrow h = (d / (\cos(\beta) \cdot t)) \cdot \sin(\beta) \cdot t - 0.5 \cdot g \cdot t^2$$
$$\Rightarrow h = d \cdot \tan(\beta) - 0.5 \cdot g \cdot t^2$$
$$\Rightarrow 0.5 \cdot g \cdot t^2 = d \cdot \tan(\beta) - h$$
$$\Rightarrow t^2 = (d \cdot \tan(\beta) - h) \cdot 2 / g$$
$$\Rightarrow t = \sqrt{(d \cdot \tan(\beta) - h) \cdot 2 / g}$$

$$d = V \cdot \cos(\beta) \cdot t$$
$$\Rightarrow d = V \cdot \cos(\beta) \cdot \sqrt{(d \cdot \tan(\beta) - h) \cdot 2 / g}$$
$$\Rightarrow V = d / (\cos(\beta) \cdot \sqrt{(d \cdot \tan(\beta) - h) \cdot 2 / g})$$

V: Shooter wheel velocity  
 $\beta$ : Shooter wheel angle  
d: Target distance  
h: Target height  
t: Time to reach target  
g: Gravitational acceleration

