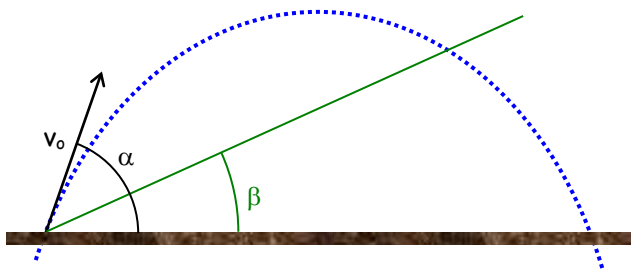
# Homework Set 2: Projectiles
Due Friday, September 6, 2024

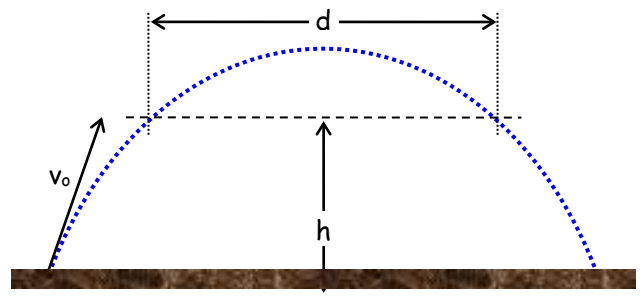



**1)** If a projectile is fired from the origin of the coordinate system with an initial velocity $v_o$ and in a direction making an angle $\alpha$ with the horizontal, show that the time required for the projectile to cross a line passing through the origin and making an angle $\beta < \alpha$ with the horizontal is

$$t_o = \frac{2v_o}{g}(\sin\alpha - \cos\alpha\tan\beta)$$

**2)** A projectile is fired with a velocity $v_o$ such that it passes through two points both a distance $h$ above the horizontal. Show that if the gun is adjusted for maximum range (derive what the angle is!), the separation of the points is

$$d = \frac{v_o}{g}\sqrt{v_o^2 - 4gh}$$




**3)** Two balls are thrown with equal speeds from the top of a cliff of height $h$. One is thrown at an angle $\alpha$ above the horizontal. The other is thrown at an angle $\beta$ below the horizontal. Show that each strikes the ground with the same speed and find the speed in terms of $h$ and the intial speed $v_0$.

Remember, final speed is total speed, $v = \sqrt{v_x^2 + v_y^2}$, not just $v_y$!