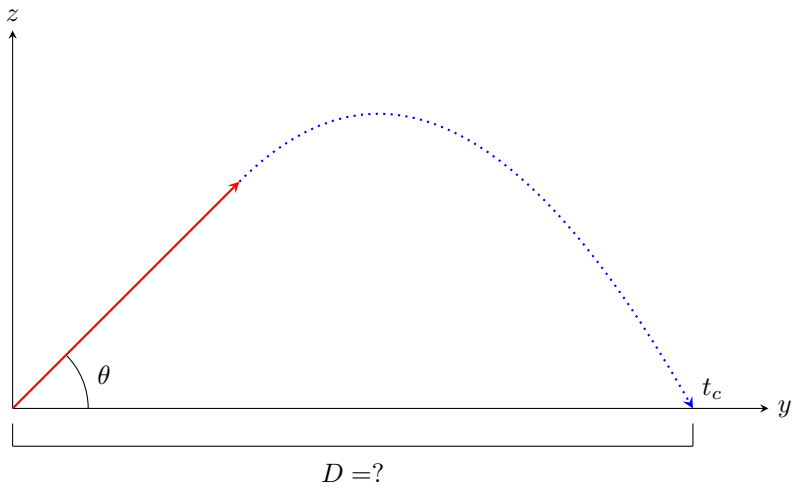
Vectors

Laith

2/6/2023

1 Example Problem

A ball is thrown at time $t = 0$. Determine the time it hits the ground.



$$\mathrm{y}(t) = v_0 \cos(\theta) t \qquad \mathrm{z}(t) = v_0 \sin(\theta) t - \frac{1}{2} g t^2 \tag{1.1}$$

When the ball hits the ground at time t_c , $\mathrm{z}(t_c) = 0$ (1.2)

$$\mathrm{z}(t_c) = v_0 \sin(\theta)(t_c) - \frac{1}{2} g (t_c)^2 = 0 \tag{1.3}$$

$$t_c (v_0 \sin(\theta) - \frac{1}{2} g \cdot t_c) = 0 \tag{1.4}$$

$$\Rightarrow t_c = 0 \;\Big|\; v_0 \sin(\theta) - \frac{1}{2} g \cdot t_c = 0 \tag{1.5}$$

$$\cancel{t_c = 0} \;\Big|\; v_0 \sin(\theta) - \frac{1}{2} g \cdot t_c = 0 \tag{1.6}$$

$$v_0 \sin(\theta) - \frac{1}{2} g \cdot t_c = 0 \tag{1.7}$$

$$\Rightarrow v_0 \sin(\theta) = \frac{1}{2} g \cdot t_c \Rightarrow \boxed{t_c = \frac{2(v_0 \sin(\theta))}{g}} \tag{1.8}$$