

# Math 233 - Quiz 6

October 5, 2023

Name key

Score \_\_\_\_\_

Show all work to receive full credit. Supply explanations when necessary.

1. (10 points) A projectile is fired from ground level at an angle of  $8^\circ$  with the horizontal. The projectile is to have a range of 50 meters. Find the required initial velocity and the maximum height of the projectile. (Use  $g = 9.8 \text{ m/s}^2$ .)

$$\vec{r}(t) = v_0 \cos 8^\circ t \hat{i} + (-4.9t^2 + v_0 \sin 8^\circ t) \hat{j}$$

$$v_0 \cos 8^\circ t = 50$$

$$-4.9t^2 + v_0 \sin 8^\circ t = 0$$

$$t(-4.9t + v_0 \sin 8^\circ) = 0$$

$$t=0 \quad \text{or} \quad t = \frac{v_0 \sin 8^\circ}{4.9}$$

$$(v_0 \cos 8^\circ) \left( \frac{v_0 \sin 8^\circ}{4.9} \right) = 50 \Rightarrow v_0^2 \approx 1777.698$$

$$v_0 \approx 42.163 \text{ m/s}$$

MAX HEIGHT...

$$-9.8t + v_0 \sin 8^\circ = 0$$

$$t = \frac{v_0 \sin 8^\circ}{9.8} \approx 0.6 \text{ sec}$$

$$-4.9(0.6)^2 + (v_0 \sin 8^\circ)(0.6) \approx 1.76 \text{ m}$$