

Circle your recitation section:

5. 8:00 Hoch 6. 9:05 Hoch

7. 10:10 Balicas 8. 11:15 Jain

9. 12:20 Jain

Other (write in):

SHOW ALL WORK TO GET FULL CREDIT! – ALL ANSWERS MUST SHOW UNITS

In the following air resistance is neglected and gravity ($g = 9.81 \text{ m/s}^2$) acts in the negative y -direction. At time $t = 0$ a ball is kicked to have an initial speed of $v_0 = 22 \text{ m/s}$ at an angle of 25° with respect to the ground. Choose your coordinate system, so that the initial position of the ball is at $x_0 = y_0 = 0$, the y axis is up and the x axis is on the ground, in the direction of the motion of the ball.

1. [3 Pts] Find the initial velocities
- $v_{x,0}$
- and
- $v_{y,0}$
- .

$$v_{x,0} = v_0 \cos(\theta) = 19.9 \text{ m/s}$$

$$v_{y,0} = v_0 \sin(\theta) = 9.30 \text{ m/s}$$

2. [5 Pts] Write down the solutions for
- $x(t)$
- and
- $y(t)$
- .

$$x(t) = v_{x,0} t$$

$$y(t) = v_{y,0} t - \frac{1}{2} g t^2$$

3. [4Pts] Find the time
- t_{max}
- at which the ball reaches its maximum height.

$$t_{\text{max}} = \frac{v_{y,0}}{g} = 0.948 \text{ s}$$

4. [2 Pts] Find the maximum height.

$$y_{\text{max}} = y(t_{\text{max}}) = v_{y,0} t_{\text{max}} - \frac{1}{2} g t_{\text{max}}^2 = 4.41 \text{ m}$$

5. [4Pts] How long is the ball in the air, before it returns to hit the ground?

$$t_1 = 2 t_{\text{max}} = 1.90 \text{ s}$$

6. [2 Pts] At what distance from its original position does the ball hit the ground.

$$x_1 = v_{x,0} t_1 = 37.8 \text{ m}$$