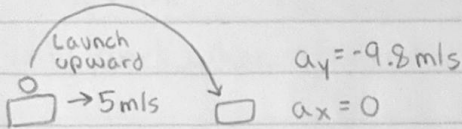


## 2-Dimensional Motion

PH III

1. Projectile motion

2. Motion in a circle



A punter kicks a football at an angle of  $30^\circ$  with the horizontal and at an initial velocity of 20 m/s. Where should a punt returner position himself to catch the football just before it strikes the ground?

Diagram: A vector  $\vec{v}_0$  is shown at an angle of  $30^\circ$  to the horizontal.

$$\vec{v}_{0x} = 20 \cos 30 = 17.3 \text{ m/s} \quad \text{Assume launch and receiving levels are the same}$$
$$\vec{v}_{0y} = 20 \sin 30 = 10 \text{ m/s}$$
$$0 = 10 - 9.8t \quad t = 2.04 \text{ s} \quad 29 = 17.3t \quad t = 1.676 \text{ s}$$
$$\vec{x} = 17.3(2.04) = 35.3 \text{ m} \quad \vec{y} = 10(1.676) - \frac{1}{2}(9.8)(1.676)^2 = 3 \text{ m}$$

Diagram: A vector  $\vec{v}_0$  is shown at an angle of  $24^\circ$  to the horizontal. The horizontal component is 50 m and the vertical component is -36 m.

$$\vec{a} = 4 \text{ m/s}^2 \quad \vec{v}_{0y} = \vec{v}_f \cos 24$$
$$\vec{v}_{0x} = -\vec{v}_f \sin 24$$

Diagram: A vector  $\vec{v}_0$  is shown at an angle of  $24^\circ$  to the horizontal.