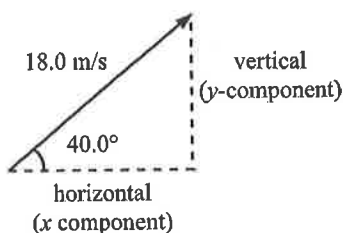


Lesson 5—Projectiles—Thrown at an Angle

PRACTICE EXERCISES ANSWERS AND SOLUTIONS

1. We are asked to find the horizontal component. First, find the vertical and horizontal components of the velocity



$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\sin 40.0^\circ = \frac{\text{vertical}}{18.0 \text{ m/s}}$$

vertical component of velocity

$$= (18.0 \text{ m/s})(\sin 40.0^\circ)$$

$$= 11.6 \text{ m/s}$$

$$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\cos 40.0^\circ = \frac{\text{horizontal}}{18.0 \text{ m/s}}$$

horizontal component of velocity

$$= (18.0 \text{ m/s})(\cos 40.0^\circ)$$

$$= 13.8 \text{ m/s}$$

Find t from vertical component

$\vec{v}_{y(i)}$	$\vec{v}_{y(t)}$	\vec{a}	d	t
11.6 m/s	-11.6 m/s	-9.81 m/s ²	×	?

$$\vec{a} = \frac{\vec{v}_{y(t)} - \vec{v}_{y(i)}}{t}$$

$$-9.81 \text{ m/s}^2 = \frac{-11.6 \text{ m/s} - 11.6 \text{ m/s}}{t}$$

$$t = \frac{-11.6 \text{ m/s} - 11.6 \text{ m/s}}{-9.81 \text{ m/s}^2}$$

$$= 2.36 \text{ s}$$

Horizontal speed

$$v_x = \frac{d}{t}$$

Range

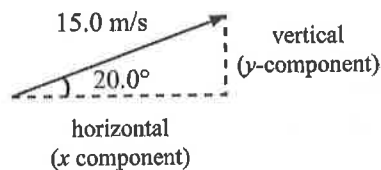
$$d = v_x t$$

$$= (13.8 \text{ m/s})(2.36 \text{ s})$$

$$= 32.6 \text{ m}$$

2. We are asked to find the horizontal component.

First find the vertical and horizontal components of the velocity



$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\sin 20.0^\circ = \frac{\text{vertical}}{15.0 \text{ m/s}}$$

vertical component of velocity

$$= (15.0 \text{ m/s})(\sin 20.0^\circ)$$

$$= 5.13 \text{ m/s}$$

$$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\cos 20.0^\circ = \frac{\text{horizontal}}{15.0 \text{ m/s}}$$

horizontal component of velocity

$$= (15.0 \text{ m/s})(\cos 20.0^\circ)$$

$$= 14.1 \text{ m/s}$$

Find t from the vertical component

$\vec{v}_{y(i)}$	$\vec{v}_{y(t)}$	\vec{a}	d	t
5.13 m/s	-5.13 m/s	-9.81 m/s ²	×	?

$$\vec{a} = \frac{\vec{v}_{y(t)} - \vec{v}_{y(i)}}{t}$$

$$-9.81 \text{ m/s}^2 = \frac{-5.13 \text{ m/s} - 5.13 \text{ m/s}}{t}$$

$$t = 1.05 \text{ s}$$

Horizontal speed

$$v_x = \frac{d}{t}$$

Range

$$d = v_x t$$

$$= (14.1 \text{ m/s})(1.05 \text{ s})$$

$$= 14.8 \text{ m}$$