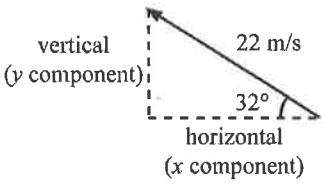
10. First we find the vertical and horizontal components of the velocity.



$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$$
$$\sin 32° = \frac{\text{vertical}}{22 \text{ m/s}}$$
vertical component of the velocity
$$= (22 \text{ m/s})(\sin 32°)$$
$$= 18.7 \text{ m/s}$$

$$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$
$$\cos 32° = \frac{\text{horizontal}}{22 \text{ m/s}}$$
horizontal component of the velocity
$$= (22 \text{ m/s})(\cos 32°)$$
$$= 18.7 \text{ m/s}$$

Find t from the vertical component

$\vec{v}_{y(i)}$	$\vec{v}_{y(f)}$	$\vec{a}$	$\vec{d}$	t
–11.7 m/s	×	–9.81 m/s^2	–9.0 m	?

Let's find $v_{y(f)}$ so that we do not have a quadratic equation. Use the following equation of motion.

$$v^2 = v_0^2 + 2ad$$
so $$v_{y(f)}^2 = v_{y(i)}^2 + 2ad$$
$$= (11.7 \text{ m/s})^2 + 2(9.81 \text{ m/s}^2)(9.0 \text{ m})$$
$$= 17.7 \text{ m/s}$$

The ball touches the ground with this velocity so $\vec{v}_{y(f)} = -17.7$ m/s

Now find t

$$\vec{a} = \frac{\vec{v}_{y(f)} - \vec{v}_{y(i)}}{t}$$
$$-9.81 \text{ m/s}^2 = \frac{-17.7 \text{ m/s} + 11.7 \text{ m/s}}{t}$$
$$t = 0.61 \text{ s}$$

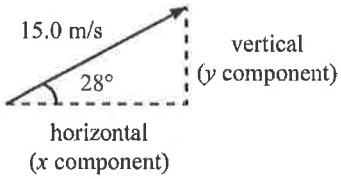
Horizontal speed

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

The distance
$$d = vt$$
$$= (18.7 \text{ m/s})(0.61 \text{ s})$$
$$= 11 \text{ m}$$

11. We are asked to find the vertical component.

First, we will find the vertical and horizontal components of the velocity.



$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$$
$$\sin 28° = \frac{\text{vertical}}{15 \text{ m/s}}$$
vertical component of the velocity
$$= (15 \text{ m/s})(\sin 28°)$$
$$= 7.04 \text{ m/s}$$

$$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$
$$\cos 28° = \frac{\text{horizontal}}{15 \text{ m/s}}$$
horizontal component of the velocity
$$= (15 \text{ m/s})(\cos 28°)$$
$$= 13.2 \text{ m/s}$$

Find t from the horizontal component.

$$\text{speed } v = \frac{d}{t}$$
$$t = \frac{d}{v}$$
$$= \frac{32 \text{ m}}{13.2 \text{ m/s}}$$
$$= 2.42 \text{ s}$$

Consider Vertical motion

$\vec{v}_0$	$\vec{v}$	$\vec{a}$	$\vec{d}$	t
7.04 m/s	×	–9.81 m/s^2	?	2.42 s

$$\vec{d} = \vec{v}_0 t + \frac{1}{2}\vec{a}t^2$$
$$= (7.04 \text{ m/s})(2.42 \text{ s}) + \frac{1}{2}(-9.81 \text{ m/s}^2)(2.42 \text{ s})^2$$
$$= 12 \text{ m high}$$

