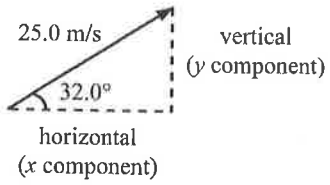
3. We are asked to find the horizontal component.



$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$$
$$\sin 32.0° = \frac{\text{vertical}}{25.0 \text{ m/s}}$$
vertical component of velocity
$$= (25.0 \text{ m/s})(\sin 32.0°)$$
$$= 13.2 \text{ m/s}$$

$$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$
$$\cos 32.0° = \frac{\text{horizontal}}{25.0 \text{ m/s}}$$
horizontal component of velocity
$$= (25.0 \text{ m/s})(\cos 32.0°)$$
$$= 21.2 \text{ m/s}$$

Find t from the vertical component

$\vec{v}_{y(i)}$	$\vec{v}_{y(f)}$	$\vec{a}$	d	t
13.2 m/s	–13.2 m/s	–9.81 m/s^2	×	?

$$\vec{a} = \frac{\vec{v}_{y(f)} - \vec{v}_{y(i)}}{t}$$
$$-9.81 \text{ m/s}^2 = \frac{-13.2 \text{ m/s} - 13.2 \text{ m/s}}{t}$$
$$t = 2.70 \text{ s}$$

Horizontal speed
$$v = \frac{d}{t}$$

Range
$$d = v_x t$$
$$= (21.2 \text{ m/s})(2.70 \text{ s})$$
$$= 57.3 \text{ m}$$

4. Find the vertical component of the velocity
$$v_y = v \sin q$$
$$= (20.0 \text{ m/s})(\sin 27.0°)$$
$$= 9.08 \text{ m/s}$$

v_0	v	a	d	t
9.08 m/s	0	–9.81 m/s^2	?	×

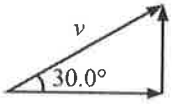
$$v^2 = v_0^2 + 2ad$$
$$0 = (9.08 \text{ m/s})^2 + 2(-9.81 \text{ m/s}^2)d$$
$$0 = 82.4 \text{ m}^2/\text{s}^2 - (19.60 \text{ m/s}^2)d$$
$$d = \frac{82.4 \text{ m}^2/\text{s}^2}{19.60 \text{ m/s}^2}$$
$$= 4.21 \text{ m}$$

5.

v_0	v	$\vec{a}$	$\vec{d}$	t
?	0	–9.81 m/s^2	5.75 m	×

$$v^2 = v_0^2 + 2ad$$
$$0 = v_0^2 + 2(-9.81 \text{m/s}^2)(5.75 \text{ m})$$
$$0 = v_0^2 - 113 \text{ m}^2/\text{s}^2$$
$$v_0^2 = 113 \text{ m}^2/\text{s}^2$$
$$v_0 = 10.6 \text{ m/s}$$

NOTE: this is the initial vertical velocity



$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$$
$$\sin 30.0° = \frac{10.6 \text{ m/s}}{v}$$
$$v = 21.1 \text{ m/s}$$

∴ the object was thrown at a velocity of 10.6 m/s at an angle of 30.0° to the horizontal.

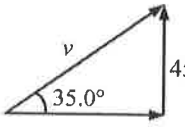
6.

$\vec{v}_0$	$\vec{v}$	$\vec{a}$	$\vec{d}$	t
?	0	–9.81 m/s^2	×	4.63 s

NOTE: We divide the time by 2 because time to go up equals time to come down. The velocity at the top of the arc and the final velocity will both be zero. It will take 4.63 s to come down.

$$\vec{a} = \frac{\vec{v} - \vec{v}_0}{t}$$
$$-9.81 \text{ m/s}^2 = \frac{0 - \vec{v}_o}{4.63 \text{ s}}$$
$$\vec{v}_0 = (9.81 \text{ m/s}^2)(4.63 \text{ s})$$
$$= 45.4 \text{ m/s up}$$

NOTE: this is the initial vertical velocity



$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$$
$$\sin 35.0° = \frac{45.4 \text{ m/s}}{v}$$
$$v = 79.1 \text{ m/s}$$

∴ the object was projected into the air at a velocity of 79.1 m/s at an angle of 35.0° to the horizontal

