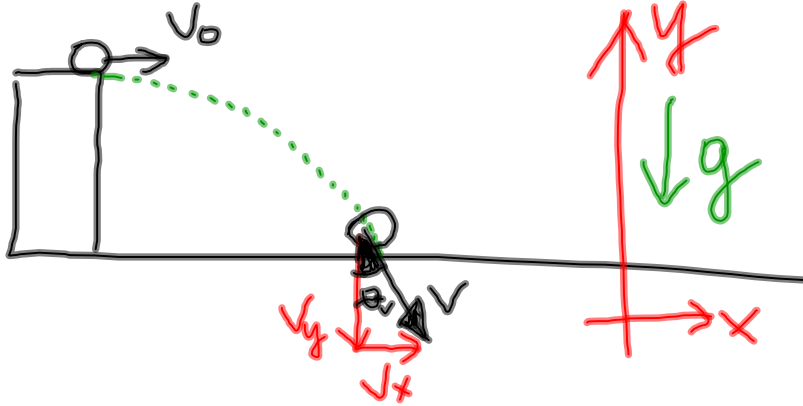
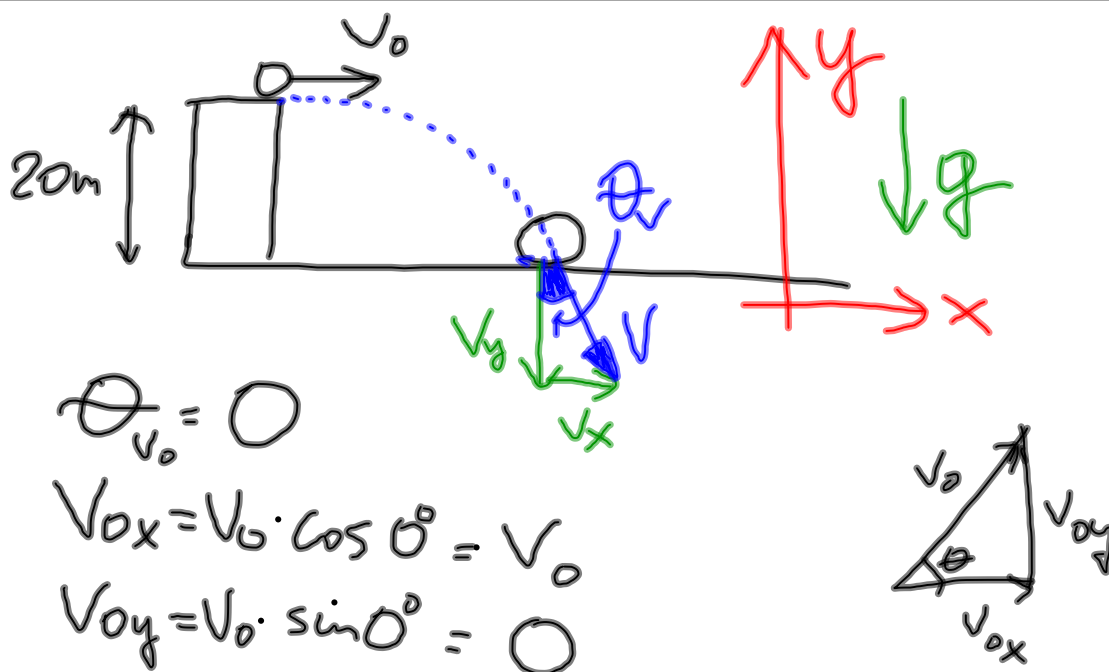


1. A ball is tossed horizontally at the initial velocity of 30 m/s from a height of 20 m.
- Total time in the air (hang time)?
 - Horizontal displacement (range)?
 - Final velocity just an instant before the ball hits the ground?



Oct 27-9:51 AM



Oct 27-12:59 PM

(x)	(y)
$a_x = 0$	$a_y = -9.8 \frac{m}{s^2}$
$v_{0x} = 30 \frac{m}{s}$	$v_{0y} = 0$
$v_x = v_{0x} = 30 \frac{m}{s}$	$v_y = ?$
$\Delta x = ?$	$\Delta y = -20 m$
$t = ?$	$t = ?$

Oct 27-1:01 PM

(x)	(y)
$v_{0x} = 30 \frac{m}{s}$	$v_{0y} = 0$
$v_x = v_{0x} = 30 \frac{m}{s}$	$v_y = ?$
$a_x = 0$ ALWAYS!	$a_y = -9.8 \frac{m}{s^2}$
$\Delta x = ?$	$\Delta y = -20 m$
$t = ?$	$t = ?$

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$$\textcircled{y} \quad \Delta y = \cancel{V_{0y}} t + \frac{1}{2} g t^2$$
$$a) \quad -20 = \frac{1}{2} (-9.8) t^2$$
$$-20 = -4.9 t^2$$
$$\boxed{t = 2.02 \text{ s}}$$

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$$b) \quad \textcircled{x} \quad \Delta x = \frac{1}{2} (V_{0x} + V_x) t$$
$$\Delta x = \frac{1}{2} (30 + 30) (2.02)$$
$$\boxed{\Delta x = 60.6 \text{ m}}$$

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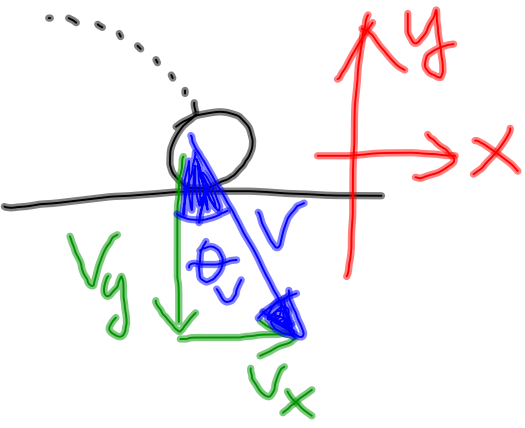
$$c) V = \sqrt{V_x^2 + V_y^2}$$

$$x) V_x = V_{0x} = 30 \frac{m}{s}$$

$$y) V_y = V_{0y} + gt$$

$$V_y = 0 - 9.8(2.02)$$

$$V_y = -19.8 \frac{m}{s}$$



The diagram shows a coordinate system with a red x-axis pointing right and a red y-axis pointing up. A dashed line represents the parabolic path of a projectile. At a point on the path, a blue vector labeled 'V' represents the total velocity. This vector is decomposed into a horizontal blue component labeled 'V_x' and a vertical green component labeled 'V_y'. The angle between the total velocity vector 'V' and the horizontal component 'V_x' is labeled with the Greek letter theta (θ). A small circle is drawn at the tip of the velocity vector 'V'.

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$$V = \sqrt{V_x^2 + V_y^2}$$

$$V = \sqrt{(30)^2 + (-19.8)^2}$$

$$V = 36.0 \frac{m}{s}$$

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$$\theta = \tan^{-1} \left| \frac{v_y}{v_x} \right|$$

$$\theta = \tan^{-1} \left| \frac{-19.8}{30} \right|$$

$$\theta = 33.4^\circ \text{ S of E}$$

E 33.4° S

$\theta_v = 33.4^\circ$ BELOW THE HORIZONTAL

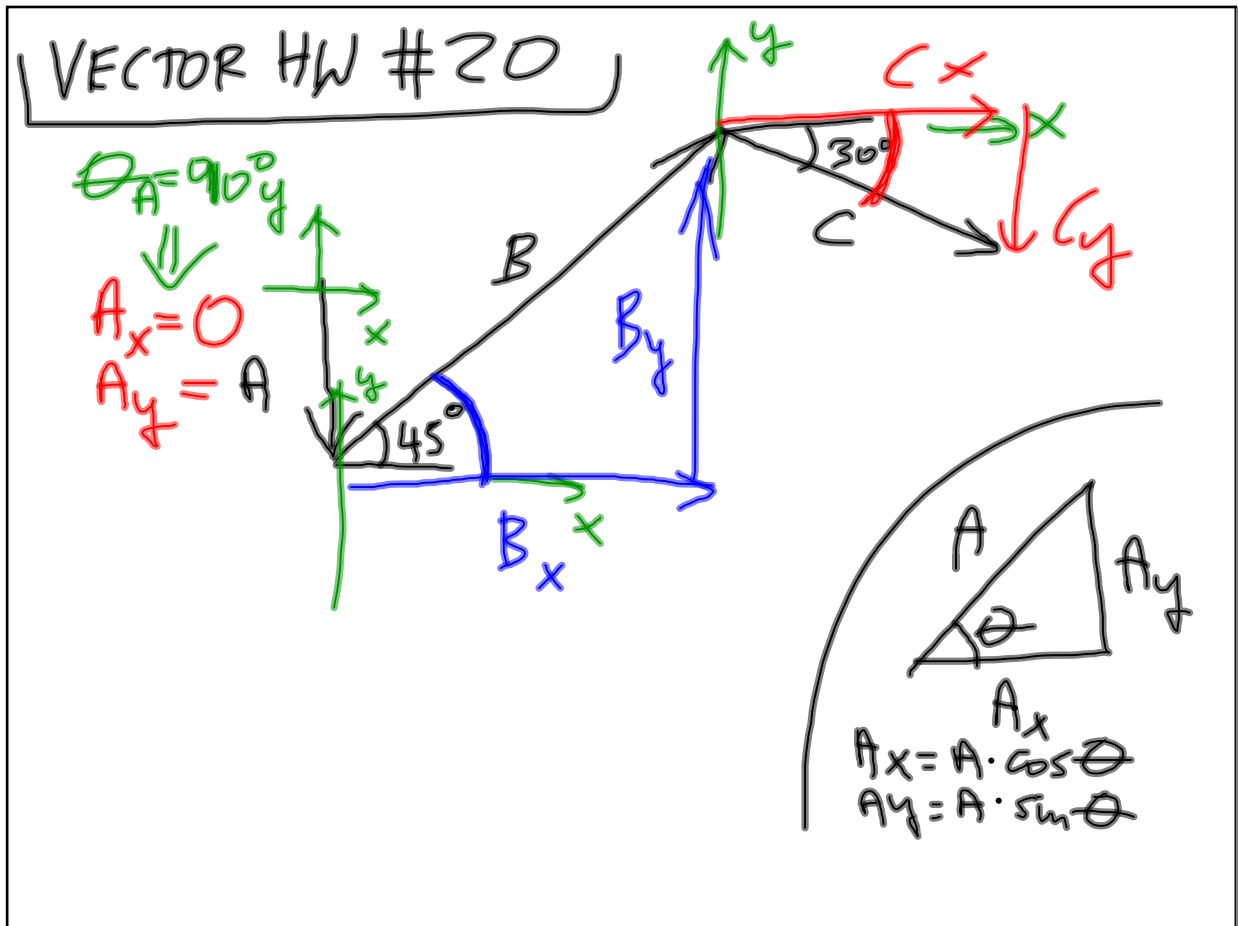
Oct 28-9:45 AM

Practice problem.

A rocket is fired with the initial horizontal velocity of 60 m/s from a rooftop of a building which is 80 m high.

- Total time in the air?
- Range of the rocket?
- Final velocity an instant before the impact with the ground?

Oct 28-9:49 AM



Oct 28-8:35 AM

$$R = A + B + C$$

$$R_x = A_x + B_x + C_x$$

$$R_x = 0 + 14.14 + 6.06$$

$$R_x = 20.2 \text{ m}$$

$$R_y = A_y + B_y + C_y$$

$$R_y = -10 + 14.14 - 3.5$$

$$R_y = 0.64 \text{ m}$$

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$$R = \sqrt{R_x^2 + R_y^2}$$

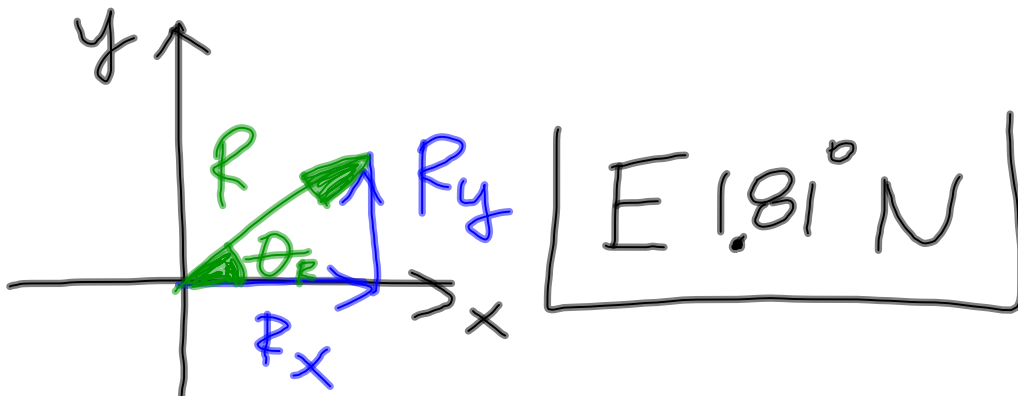
$$R = \sqrt{(20.2)^2 + (0.64)^2}$$

$$R = 20.2 \text{ m}$$

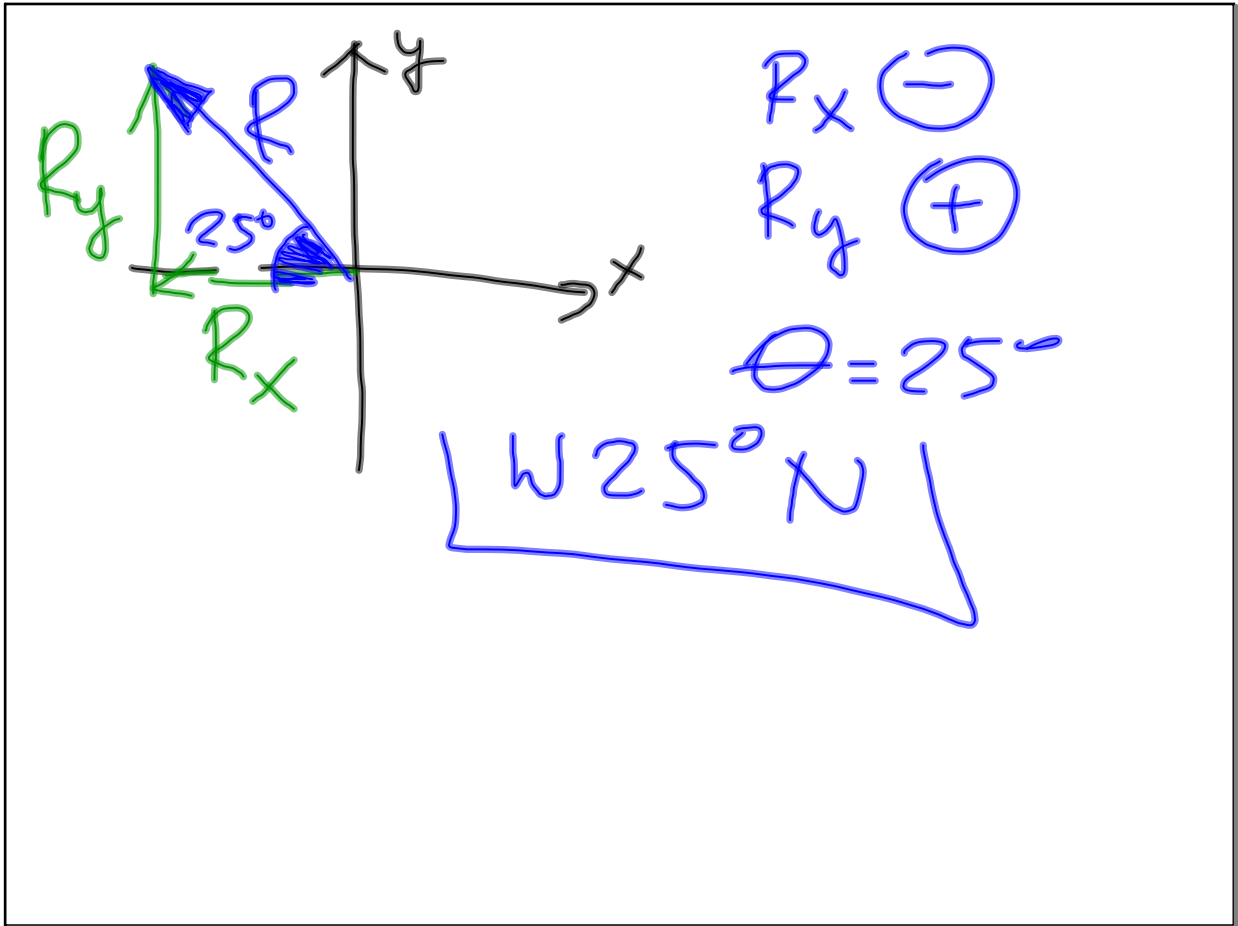
$$\theta = \tan^{-1} \left| \frac{R_y}{R_x} \right| \quad \theta = 1.81^\circ$$

$$\theta = \tan^{-1} \left| \frac{0.64}{20.2} \right|$$

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Oct 28-8:45 AM



Oct 28-8:50 AM