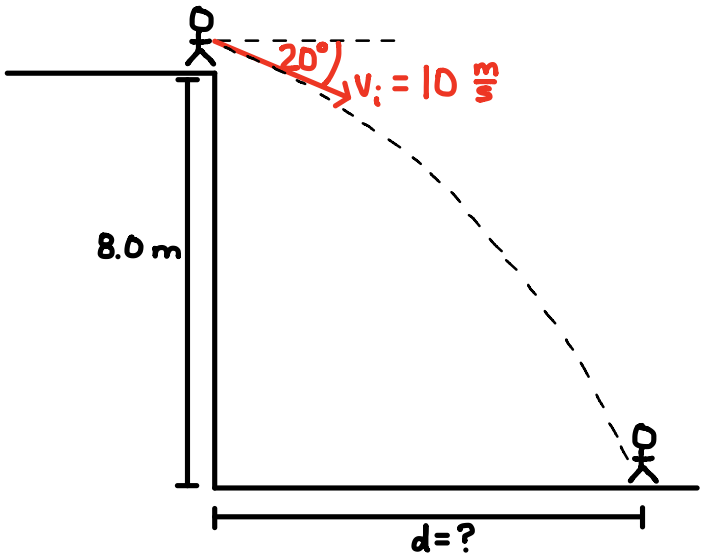
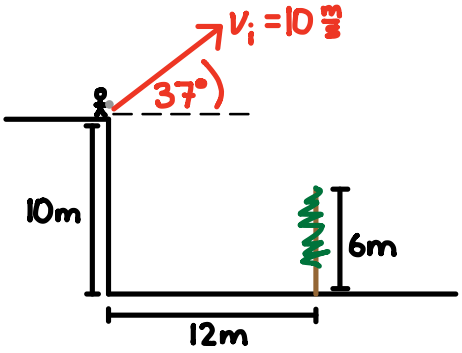
Anna throws a ball from a 8.0 m high tower towards Bobby at a velocity of 10 m/s 20° below the horizontal. How far from the tower should Bobby stand to catch the ball?



A rock is thrown from the top of a 10.0 m high building at a velocity of 10 m/s 37° above the horizontal. A 6.0 m tall tree is 12.0 m from the building. Will the rock make it over the tree? If it does, at what speed does it hit the ground? If it doesn't at what speed does it hit the tree?



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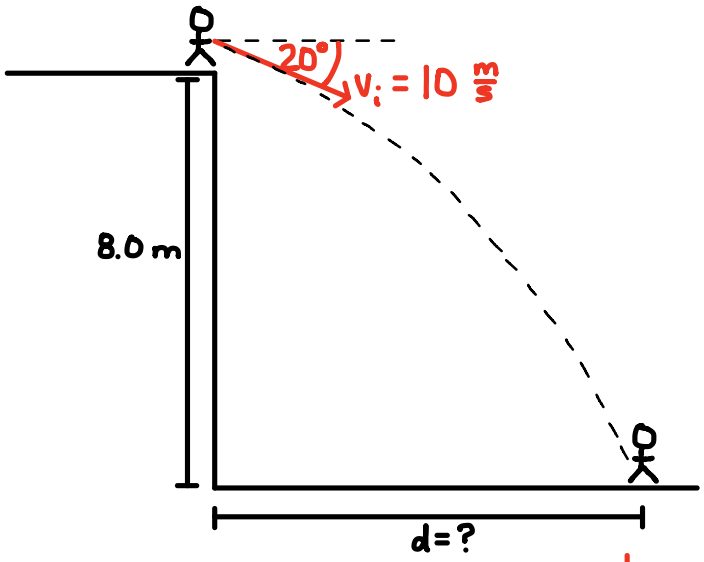


X	Y
$v_x = 10 \cos 20° \frac{m}{s}$	$v_{iy} = +10 \sin 20° \frac{m}{s}$
$t = ?$	$a_y = +9.8 \frac{m}{s^2}$
$d_x = ?$	$d_y = +8.0\ m$ (↓ +)
	$t = ?$

$$d_y = v_{iy}t + \frac{1}{2}a_y t^2$$

$$0 = \frac{1}{2}a_y t^2 + v_{iy}t - d_y$$

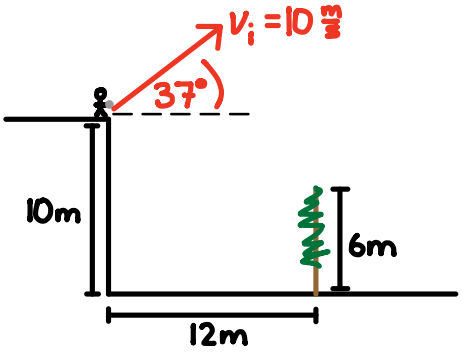
$$t = \frac{-v_{iy} \pm \sqrt{v_{iy}^2 - 4(\frac{1}{2}a_y)(-d_y)}}{2(\frac{1}{2}a_y)}$$

$t = -1.6736\ s$, $0.9756\ s$

$d_x = v_x t$

$= 9.17\ m$

A rock is thrown from the top of a 10.0 m high building at a velocity of 10 m/s 37° above the horizontal. A 6.0 m tall tree is 12.0 m from the building. Will the rock make it over the tree? If it does, at what speed does it hit the ground? If it doesn't at what speed does it hit the tree?



X	Y
$V_x = 10 \cos 37° \frac{m}{s}$	$V_{iy} = 10 \sin 37° \frac{m}{s}$
$d_x = 12$ m	$a_y = -9.8 \frac{m}{s^2}$
$t = ?$	$t = ?$
	$d_y = ?$
$t = \frac{d_x}{V_x} = \frac{12}{10 \cos 37°} = 1.503 s$	$d_y = v_{iy} t + \frac{1}{2} a_y t^2$
	$= (10 \sin 37°)(1.503) + \frac{1}{2}(-9.8)(1.503)^2$
	$= -2.02$ m

THE ROCK MAKES IT OVER THE TREE. (IT CLEARS IT BY ~2 m.)

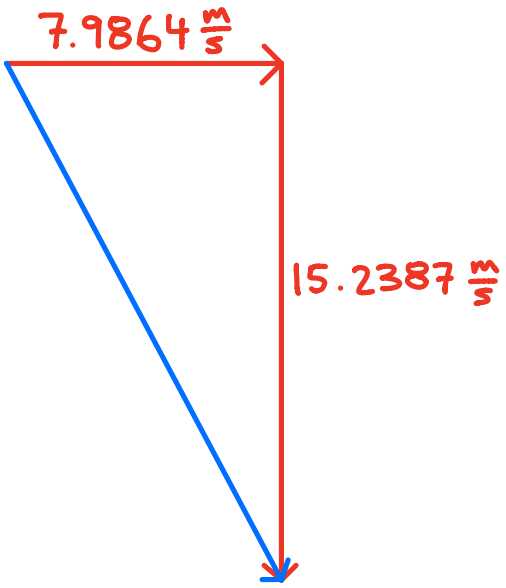
X	Y
$V_x = 10 \cos 37^\circ \frac{m}{s}$	$V_{iy} = 10 \sin 37^\circ \frac{m}{s}$
	$a_y = -9.8 \frac{m}{s^2}$
	$d_y = -10\ m$
	$V_{fy} = ?$

$$V_{fy}^2 = V_{iy}^2 + 2a_y d_y$$

$$V_{fy} = \pm\sqrt{V_{iy}^2 + 2a_y d_y}$$

$$= \pm\sqrt{(10 \sin 37^\circ)^2 + 2(-9.8)(-10)}$$

$$= \cancel{-}\ 15.2387 \frac{m}{s}$$



$$V_f = \sqrt{V_x^2 + V_{fy}^2}$$

$$= 17.2 \frac{m}{s}$$