TODAY'S LESSON:
Home Insurance
Y
(m) HEIGHT
V0=48 m/s
V0=44 m/s
V0=42 m/s
S=185 m
S=235 m
70°
S=85 m
X
(S) = DISTANCE
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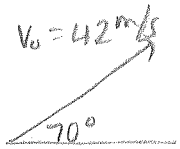
SPH 4U PROJECTILE MOTION

Cow on the Grass

x	y
$V_x = V\cos\theta$	$V_1 = V\sin\theta$
$= 14.4\ m/s$	$V_1 = 39.5\ m/s$
$a = 0\ m/s^2$	$a = -9.8\ m/s^2$
$d = 85m$	
$\leftarrow t \rightarrow$	



1. Find t, with x

$$v = \frac{d}{t} \rightarrow t = \frac{d}{v}$$

$$t = \frac{85m}{14.4\ m/s}$$

$$t = 5.9s$$

2. Find V_2, with y

$$a = \frac{V_2 - V_1}{t} \Rightarrow V_2 = V_1 + at$$

$$V_2 = 39.5\ m/s + (-9.8)(5.9s)$$

$$V_2 = -18\ m/s = 18\ m/s\ [down]$$

↑ pretty fast

3. Find d, with y

$$d = V_1 t + \frac{1}{2} a t^2$$

$$d = (39.5\ m/s)(5.9s) + \frac{1}{2}(-9.8\ m/s^2)(5.9s)^2$$

$$d = 62\ m$$

↑ the cow is not landing on a 62m hill, ∴ not realistic.

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

$$V = \sqrt{(14.4\ m/s)^2 + (18\ m/s)^2}$$

$$V = 23\ m/s$$

SPH 4U PROJECTILE MOTION

Cow on Tree

x	y
$v_x = v_0 \cos\theta$	$v_1 = v_0 \sin\theta$
$= 15.0\ m/s$	$v_1 = 41.3\ m/s$
$d = 185\ m$	$a = -9.8\ m/s^2$
$a = 0\ m/s^2$	

$\uparrow t \uparrow$

1. Find t, with x

$$v = \frac{d}{t} \Rightarrow t = \frac{d}{v}$$

$$t = \frac{185\ m}{15.0\ m/s} = 12.3\ s$$

2. Find d, with y

$$d = v_1 t + \frac{1}{2} a t^2$$

$$d = (41.3\ m/s)(12.3\ s) + \frac{1}{2}(-9.8\ m/s^2)(12.3\ s)^2$$

$$d = -233\ m = -2.3 \times 10^2\ m$$

↑

the tree is not 230 m below the horizontal, ∴ not realistic.

3. find v_2, with y

$$v_2 = v_1 + at$$

$$v_2 = 41.3\ m/s + (-9.8\ m/s^2)(12.3\ s)$$

$$v_2 = -79\ m/s = 79\ m/s\ [\text{down}]$$

↑

very fast!

$$\text{Total } v_{\text{final}} = \sqrt{v_x^2 + v_2^2}$$

$$v = \sqrt{(15.0\ m/s)^2 + (-79.0\ m/s)^2}$$

$$v = 80\ m/s$$

SPH 4U PROJECTILE MOTION

Cow on House

x	y
$v = v_0 \cos\theta$	$v_1 = v_0 \sin\theta$
$v = 16.4\ m/s$	$v_1 = 45.1\ m/s$
$a = 0\ m/s^2$	$a = -9.8\ m/s^2$
$d = 235m$	

1. Find t, with x

$$v = \frac{d}{t} \rightarrow t = \frac{d}{v}$$

$$t = \frac{235m}{16.4 m/s}$$

$$t = 14.3s$$

2. Find d, with y

$$d = v_1 t + \frac{1}{2} a t^2$$

$$d = (45.1 m/s)(14.3s) + \frac{1}{2}(-9.8 m/s^2)(14.3s)$$

$$d = -357m \rightarrow -3.6 \times 10^2 m$$

↑

the house is not 360m below the horizontal, unrealistic.

3. Find V_2, with y

$$V_2 = v_1 + at$$
$$V_2 = 45.1 m/s + (-9.8 m/s^2)(14.3s)$$
$$V_2 = -1958.9 m/s$$
$$V_2 = 2.0 \times 10^3\ m/s\ [down]$$

↑

super fast!

4. $v_{final} = \sqrt{v_x^2 + v_{2y}^2}$

$$v_{final} = \sqrt{(16.4 m/s)^2 + (1958.9 m/s)^2}$$

$$v_{final} = 2.0 \times 10^3 m/s$$