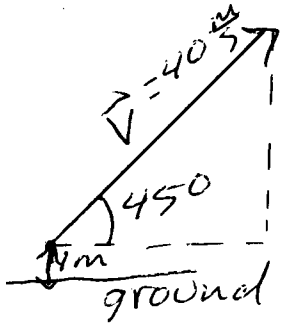
Physics 1P

Traiger

Projectile From Ground Problems

(1)



a)

$\vec{V}_y = 40 \frac{m}{s} \sin 45° = 28.3 \frac{m}{s}$

b) $\vec{V}_x = 40 \frac{m}{s} \cos 45° = 28.3 \frac{m}{s}$

c) How long to reach top of flight?

Use $V_{fy} = V_{oy} + gt$

Set $V_{fy} = 0$, so $0 = V_{oy} + gt$

$$t = \frac{-V_{oy}}{g} = \frac{-28.3 \frac{m}{s}}{-9.8 \frac{m}{s^2}} = 2.9s$$

d) How high?

Use $y_f = y_o + V_{oy} t + \frac{1}{2} g t^2$

$$y_f = 1m + \left(28.3 \frac{m}{s} \cdot 2.9s\right) + \frac{1}{2} \cdot \left(-9.8 \frac{m}{s^2}\right) \cdot (2.9s)^2$$

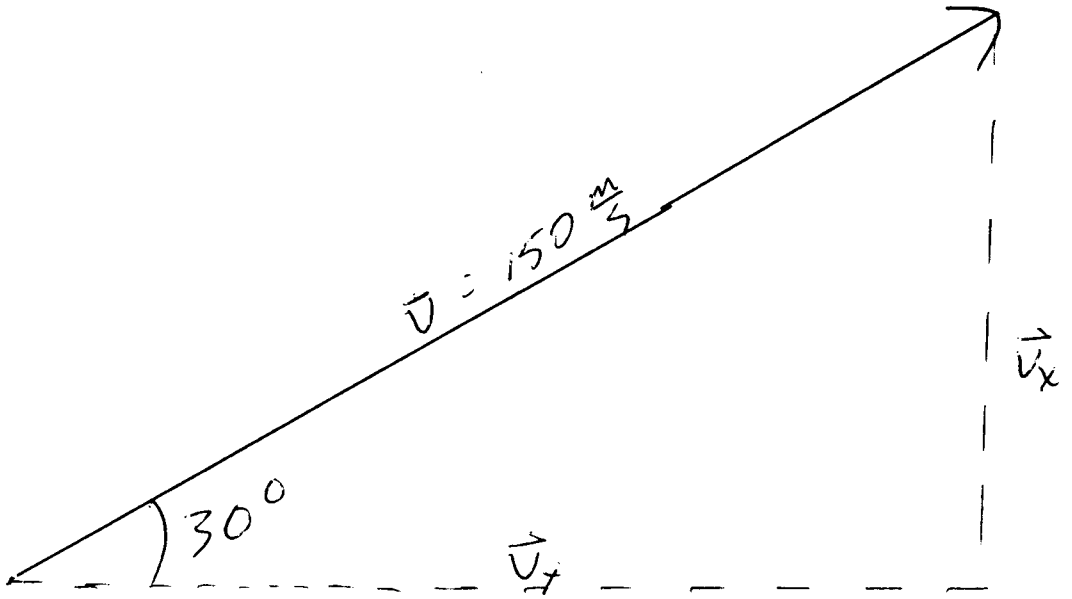
$y_f = 1m + 82m + (-41m) = 42m$

e) Time to hit ground?

Multiply Time up $\times 2 = 2.9s \cdot 2 = 5.8s$

f) Total Distance = $x = \vec{V}_x \cdot t = 28.3 \frac{m}{s} \cdot 5.8s = 164m$

(2)



a) $\vec{v}_y = 150 \frac{m}{s} \sin 30^\circ = 75 \frac{m}{s}$

b) $\vec{v}_x = 150 \frac{m}{s} \cos 30^\circ = 130 \frac{m}{s}$

c) Time: Use $v_{fy} = v_{oy} + at$ and set $v_{fy} = 0$ at the top

$0 = v_{oy} + at$, so $t = \frac{-v_{oy}}{a} = \frac{-75 \frac{m}{s}}{-9.8 \frac{m}{s^2}} = 7.7\,s$

d) How high?

$y_f = y_0 + v_{oy} t + \frac{1}{2} a t^2 = 0 + 75 \frac{m}{s} \cdot 7.7\,s + \frac{1}{2} 9.8 \frac{m}{s^2} (7.7\,s)^2$

$= 578\,m + (-291\,m) = 287\,m$

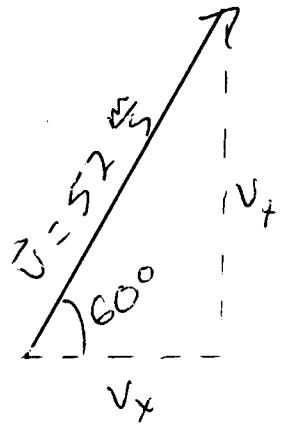
e) How long in flight?

$t = 2 \cdot 7.7\,s = 15.4\,s$

f) Total Distance in x direction

$x = v_x \cdot t = 130 \frac{m}{s} \cdot 15.4\,s = 2002\,m$

(3)



a) $\vec{V}_f = 52\frac{m}{s} \cdot \sin 60° = \boxed{45\frac{m}{s}}$

b) $\vec{V}_x = 52\frac{m}{s} \cdot \cos 60° = \boxed{26\frac{m}{s}}$

c) How long to top?

Use $V_{f_y} = V_{o_y} + gt$, set $V_{f_y} = 0$

$0 = V_{o_y} t + gt$

$-V_{o_y} = gt$, so $t = \frac{-V_{o_y}}{g} = \frac{-45\frac{m}{s}}{9.8\frac{m}{s^2}} = \boxed{4.6s}$

d) How high?

Use $y_f = {}^{\text{zero}}y_o + V_{o_y} t + \frac{1}{2} g t^2$

$y_f = 45\frac{m}{s} \cdot 4.6s + \frac{1}{2}\left(-9.8\frac{m}{s^2}\right) \cdot (4.6s)^2$

$207\,m - 104\,m = \boxed{103\,m}$

e) How long airborne?

$4.6s \times 2 = \boxed{9.2s}$

f) Total Distance = ?

$x = V_x \cdot t = 26\frac{m}{s} \cdot 9.2s = \boxed{239\,m}$