PRACTICE 11/11/11

Projectile Mini-Quiz **Name**_____ **Date** _____

DO ALL WORK, WITH PROBLEMS NUMBERED AND SEPARATED, AND ANSWERS BOXED, ON SEPARATE LINED PAPER, WITH NO TEARS (EITHER PRONUNCIATION)

1) What direction does gravity pull?

2) If there is no net force along the x-axis, what is the acceleration along the x-axis?

3) A ball is rolled off a level table. The table is 1.30 meters off the ground. The ball lands 68.0cm from the edge of the table, horizontally.

a) Sketch a diagram showing the table, the floor, and the path of the ball.

b) How long did it take the ball to fall 1.30 meters?

c) How fast was the ball going when it left the table?

* Bonus: What was the speed and angle of the ball as it hit the ground?

4) A ball is shot into the air at a 67° angle above the horizontal, with a velocity of 36.0 m/s.

a) What are the horizontal and vertical components of the initial velocity?

b) Show that you have checked the logic of your answers for the x and y components by sketching the initial velocity vector at the correct angle, and confirming that the values of vx and vy make sense in the diagram.

c) Explain in a sentence what you know about the ball's velocity, both x and y, when the ball reaches maximum height.

d) Calculate the ball's maximum height.

e) At the time the ball reaches maximum height, how far has the ball traveled horizontally?

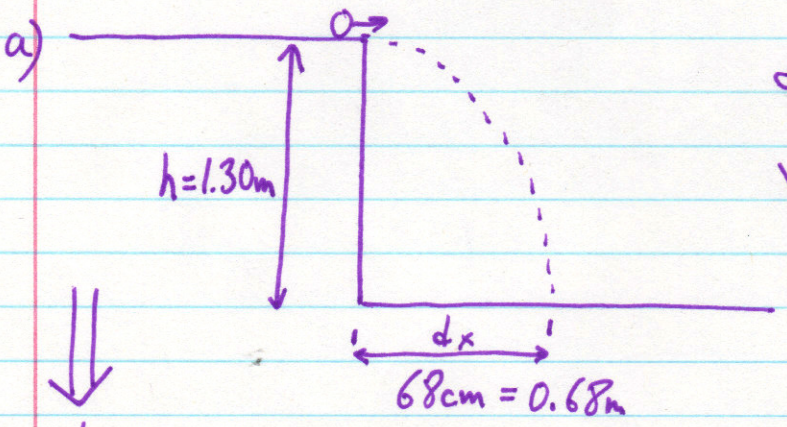
PRACTICE
Projectile Mini-Quiz – SOLUTIONS

① Gravity pulls down. "Down" is defined by "gravitational pull."

② Acceleration = $\frac{\text{net Force}}{\text{mass}}$ Zero net $F_x \Rightarrow$ zero a_x

③

a)



x	y
$d_x = 0.68\text{m}$	$d_y = +1.30\text{m}$
$V_x = ?$	$V_{iy} = 0$
$t =$	$t =$
	$a = 9.81 \frac{m}{s^2}$
	$V_f =$

[Define down as positive because all d, v, and a are down.]

[Ball leaves table horizontally, so V_{iy} = zero.]

b) To find t, use kinematics equations in y-direction. Use eqn without V_f.

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

($V_{iy} = 0$)

$$1.30\text{m} = \frac{1}{2}\left(9.81 \frac{m}{s^2}\right)(t^2)$$

$$\sqrt{\frac{2 \cdot 1.30\text{m}}{9.81 \frac{m}{s^2}}} = \boxed{t = 0.515\text{s}}$$

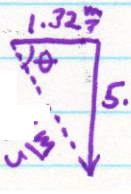
c) $d_x = V_x t$

$$V_x = \frac{d_x}{t} = \frac{0.68\text{m}}{0.515\text{s}} = \boxed{1.32 \frac{m}{s}}$$

$V_x =$

BONUS: Solve for $V_{yf} = V_{yi} + at$

$V_{yf} = 5.05 \frac{m}{s}$



$V_f = 5.22 \frac{m}{s}$ 75° below horiz.

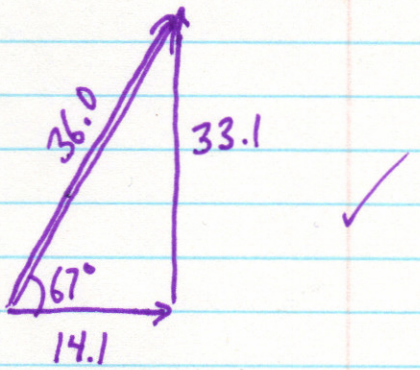
Practice Projectile Mini-Quiz SOLUTIONS

(4)

a) $V_{ix} = 36 \cos 67° = 14.1 \frac{m}{s}$

$V_{iy} = 36 \sin 67° = 33.1 \frac{m}{s}$

b)



✓

c) When the ball reaches maximum height, the y-velocity equals zero (switching from up, positive, to down, negative)

The x-velocity is constant (since we are ignoring air resistance.)

d) Find max height (d_y when $V_{fy} = 0$)

$V_{iy} = 33.1 \frac{m}{s}$

$V_{fy} = 0$

$a_y = -9.81 \frac{m}{s^2}$

$d_y = ?$

$2ad = V_f^2 - V_i^2$ ($V_f = 0$)

$d_y = \frac{-V_{iy}^2}{2a_y} = \frac{-(33.1 \frac{m}{s})^2}{2(-9.81 \frac{m}{s^2})} = \boxed{56.0 m}$ MAX HEIGHT

e) t_{max}: Use $V_{fy} = V_{iy} + a_y t$

$t = \frac{V_f - V_i}{a} = \frac{0 - 33.1}{9.81} = \boxed{3.37 s}$

$d_x = V_x \cdot t$

$= (14.1 \frac{m}{s})(3.37 s)$

$\boxed{d_x = 47.5 m}$ at max height