Physics 211 Group Exam 1, Form 4

Problem 7	Problem 8	Total
/25	/25	/50

Name: _____

Partner #1: _____

Partner #2: _____

Recitation section number: _____

- There are two questions, each worth twenty-five points.

- **You must show your reasoning to receive credit**. A numerical answer with no logic shown will be treated as no answer.

- You are highly encouraged to use both pictures and words to show your reasoning, not just algebra.

- If you run out of room, ask for an extra sheet of paper, or get one from your notebook.

- how your reasoning as thoroughly as possible for partial credit.

- You may use $g = 10\,\mathrm{m/s^2}$ throughout, except where indicated, to minimize arithmetic.

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QUESTION 7

A rocket is dropped from rest out of a window and pointed sideways toward another building. A time τ after it is dropped, its motor fires, giving it an acceleration of $2g$ in the horizontal direction. (Its vertical acceleration is still g downward.)

After the motor fires, the rocket flies along its new path until it strikes another building, located a distance d away.

a) In terms of τ, g, and d, what are the position and velocity of the rocket when the motor fires? (Make sure you specify both $x-$ and $y-$ components, even if some of them are zero.) *(5 points)*

b) In terms of τ, g, and d, how long in total is the rocket in the air before it strikes the second building? *(10 points)*

c) Sketch graphs of v_x, v_y, x, and y as a function of time. Indicate the time τ on each graph. *(10 points)*

QUESTION 8

A ball rolls off a horizontal shelf of height h at speed v_0. Answer the following in terms of h, v_0, and g.

a) How much time does it take the ball to hit the floor? *(5 points)*

b) Where does the ball hit the floor? *(5 points)*

c) What is the ball's speed when it hits the floor? *(5 points)*

d) What direction is the ball moving in when it hits the floor? *(5 points)*

e) Suppose that the edge of the shelf had been curved, so that the ball's initial velocity was instead directed at an angle θ below the horizontal. Explain, using words or algebra as appropriate, what things you would have needed to do differently to solve the previous four parts, and which things would stay the same. *(5 points)*