

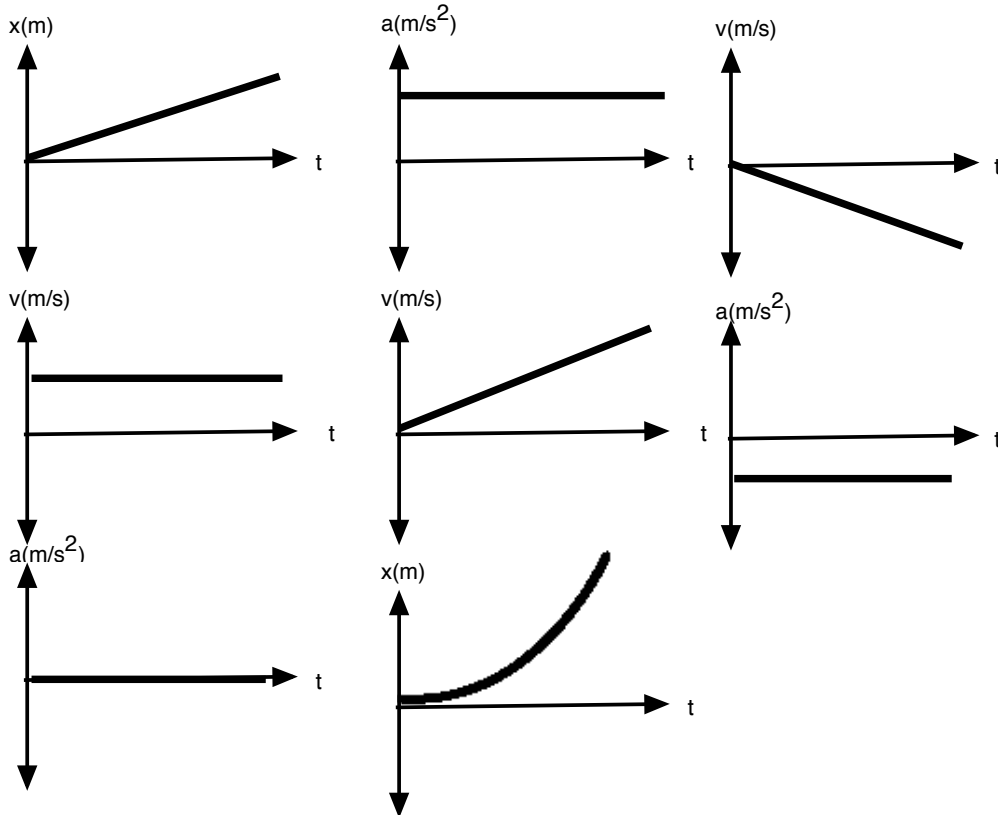
Your Name: \_\_\_\_\_

**PHY203**  
**Exam #1**  
**Chapters 1-3**  
**Fri., 2/14/14**

# **Solutions**

1. Given the sketches of 1D motion depicted in the uppermost figures, sketch the plots underneath.

**5 points per plot**



2. A bike rider starts from rest at a position of 35.0 m from the beginning of a straight road. First, the rider accelerates at  $+0.750 \text{ m/s}^2$  for 25.0 seconds. Then the rider continues at constant speed for 45.0 s. Then the rider accelerates at  $-1.50 \text{ m/s}^2$  for a distance of 50.0 m.

a. Find the velocity of the rider after the initial period of acceleration (1st 25.0 s).

$$v = 0 + (0.750 \text{ m/s}^2)(25.0 \text{ s}) \quad \mathbf{5}$$
$$v = +18.8 \text{ m/s}$$

b. Find the position of the rider after the initial period of acceleration.

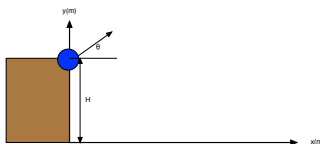
$$x_1 = 35.0 + 1/2(0.750 \text{ m/s}^2)(25.0)^2 \quad \mathbf{10}$$
$$= 269 \text{ m}$$

c. Find the position of the rider after the constant velocity period.

$$x_2 = 269\text{m} + (18.8 \text{ m/s})(45.0) \quad \mathbf{10}$$
$$= 1.12 \times 10^3 \text{ m}$$

d. Find the final velocity of the rider.

$$v^2 = (18.8)^2 + 2(-1.50)(50.0) \quad \mathbf{10}$$
$$v = 14.3 \text{ m/s}$$



3. A cannon ball is launched from a cliff with a height of 250 m with an initial speed of 32.0 m/s at angle of  $\theta=40.0^\circ$  with respect to the horizontal direction, as shown above. (Ignore air resistance.)

a. Write the initial velocity of the ball in vector notation using the coordinate system above.

$$v_{x0} = (32.0 \text{ m/s})(\cos 40^\circ) = 24.5 \text{ m/s}$$

$$v_{y0} = (32.0 \text{ m/s})(\sin 40^\circ) = 20.6 \text{ m/s}$$

$$\mathbf{v} = 24.5 \mathbf{i} + 20.6 \mathbf{j} \text{ m/s} \quad \mathbf{10}$$

b. At the highest point the ball reaches, write the velocity of the ball in vector notation using the coordinate system above.

$$\mathbf{v} = 24.5 \mathbf{i} + 0 \mathbf{j} \text{ m/s} \quad \mathbf{5}$$

c. At the highest point the ball reaches, write the acceleration of the ball in vector notation using the coordinate system above.

$$\mathbf{a} = 0 \mathbf{i} + -9.81 \mathbf{j} \text{ m/s}^2 \quad \mathbf{5}$$

d. To find the height of the ball at its highest point, which of the kinematic equations will work best? (Pick A,B, or C and for x- or y- motion.) Explain briefly.

C in the y-direction: The y component of velocity is 0 at the highest point. Equation C uses this and gives the change in y-position.

**10**

e. Find the height (*from ground level*) at which the ball is at its highest point.

$$0 = (20.6)^2 + 2(-9.81)(\Delta y)$$

$$\Delta y = 21.6 \text{ m}$$

$$y = 21.6 \text{ m} + 250 \text{ m} = 272 \text{ m}$$

**10**