Name: ____________________________ **Panther ID:** ______________

Worksheet week 8 Calculus I Fall 2014

1. A boat sails directly toward a 200-meters skyscraper that stands on the edge of the harbor. The "angular size" θ of the building is defined by the angle (in radians) formed by the lines from the top and the bottom of the building to the observer in the boat (picture will be drawn in class). If the boat is approaching the harbor at a constant rate of 4 meters/second, at what rate is the angular size of the building θ changing with respect to time at the moment when $\theta = \pi/6$? Give your answer in both *radians/second* and *degrees/second*. Be careful to get a correct sign for your answer and explain also why the sign that you got makes sense.

2. A plane traveling horizontally at 80 m/s over flat ground at an elevation of 3000 m releases an emergency packet. The trajectory of the packet is given by

$$x = 80t, \quad y = -4.9t^2 + 3000, \quad \text{for } t \geq 0,$$

where the origin is the point on the ground directly beneath the plane at the moment of the release, and t is the time in seconds since the moment of release.

(a) Graph the trajectory of the packet and find the coordinates of the point where the packet lands.

(b) Find dx/dt, dy/dt, explain their practical meaning and why the formulas you got for each of them makes sense.

(c) Find the angle at which the released package hits the ground.

3. The flight of a bee follows the parametric curve $x = t - \cos t$, $y = 3 - 2\sin t$, where $0 \leq t \leq 4\pi$ is the time in seconds. Use the command – plot($x = t - \cos t$, $y = 3 - 2\sin t$) – to draw this curve in wolframalpha. Be careful that the horizontal line drawn by the program is **not** the x-axis, but is actually the line $y = 1$.

(a) At what times is the bee flying horizontally? Find the (x, y) coordinates of the corresponding points.

(b) At what times is the bee flying vertically? Find the (x, y) coordinates of the corresponding points.