

1. After becoming annoyed with her attempts to get them to speak during class, Katie's students push her out of the window of Deady 307. The distance  $x$  (in feet) that Katie's body is from Deady and her height  $y$  (in feet) above the ground are related by

$$y = 75 - 3x^2.$$

At the instant Katie's body is 2 feet from the building, the distance between her body and Deady is increasing at a rate of 3.7 feet per second. How fast is the angle between Katie's body and the window changing when her body is 2 feet from the building?

2. Frank and Claire are standing 200 ft apart on the White House lawn when Frank starts jogging. He jogs north at a rate of 8 ft/s. Twelve seconds later, Claire starts jogging south at a rate of 10 ft/s. How fast is the distance between the couple changing 3 seconds after Claire starts jogging?

[Hint: Use one big triangle.]

- Two sides of a triangle are 4 m and 5 m in length, and the angle between them is increasing at a rate of 0.06 radians per second. Find the rate at which the area of the triangle is increasing when the angle between the sides of fixed length is  $\pi/3$ .

- George Michael sells frozen bananas at the Bluth Frozen Banana stand. When he sells the frozen bananas for \$2 each, he can sell 40 bananas per hour. George Michael has found that if he increases the price by 50 cents, his sales decrease by 8 bananas per hour. If it costs \$0.75 to make each frozen banana, how much should George Michael sell the bananas for in order to maximize profit?

[Recall that profit is revenue minus cost. You should start by finding the demand function.]

5. A farmer has 1200 ft of fencing and wants to fence off a rectangular pen that borders a straight river. He is planning on keeping a centaur in the pen, and obviously doesn't need fencing along the river since centaurs can't swim. What dimensions of the pen would maximize the area?

6. Which points lying on the graph of  $y = x^2 + 1$  are closest to the point  $(0, 2)$ ?