Math 125 Carter Test 2 Fall 2005

General: Do all your work and write your anwsers inside the blue book. Do not write on the test. Write your name on only the outside of the blue book. Good luck! Remember that a number of examples of Frank Lloyd Wright's architecture can be found in Oak Park, Illinois.

1. For each of the following compute the derivatve of y with respect to x. That is find y', $f'(x)$, or $\frac{dy}{dx}$ (Same things — different notation). Do not simplify your answer! *(8 points each)*

   (a) $f(x) = x^3 - 4x^2 + 12x - 4$

   (b) $y = \frac{x}{x^2-100}$

   (c) $y = (x^3 + 3x - 4)^{-5}$

   (d) $f(x) = e^{2x}\cos(3x)$

   (e) $f(x) = \cosh(x)\sin(2x + 5)$

2. Compute the equation of the line tangent to the curve at the particular point, P *(10 points each).*

   (a) $y = x^2$ $P = (63, 3969)$

   (b) $f(x) = \sqrt{(1 - x^2)}$ $P = (3/5, 4/5)$

3. *(10 points)* Proof the power rule for positive integer exponents, $N = 1, 2, \ldots$. *i.e.* Prove

$$\frac{d}{dx}x^N = Nx^{n-1}.$$

4. *(10 points)* Sand falls into the shape of a conical pile at the rate of $3m^3$ per minute. The proportion of the radius to the height is always $1/2$. At what rate is the height increasing when the height is 10 meters? The volume of a cone is $V = \frac{\pi}{3}r^2h$ where r denotes the radius and h denotes the height.

5. *(10 points)* An anvil thrown upward from the edge of a 496 foot cliff moves vertically along a straight line according to the equation,

$$s(t) = -16t^2 + 80t + 496$$

   where $t \geq 0$ is measured in seconds, and the vertical position, s, is measured in feet.

   (a) Sketch a graph of the velocity as a function of time. Include an appropriate domain.

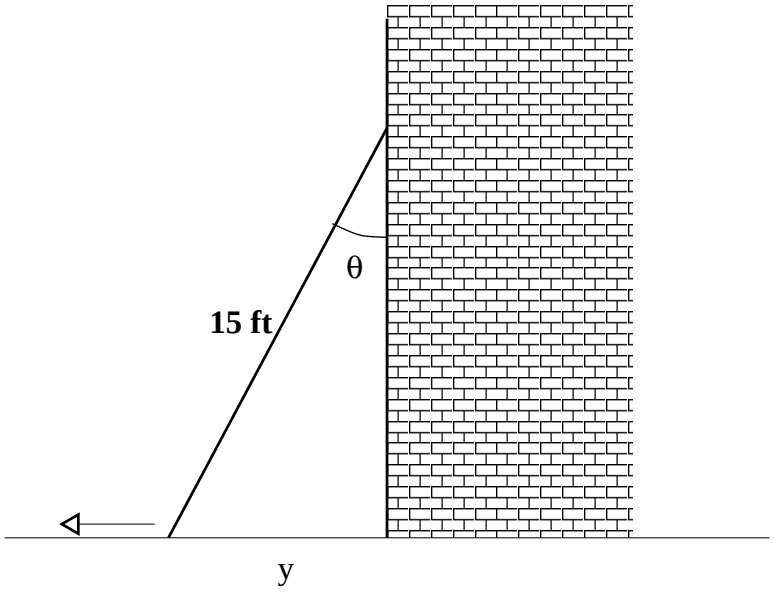
   (b) When does the anvil reach its acme (highest point)?

   (c) What is the velocity of the anvil as it hits the ground ($s(t) = 0$)?

(d) When does the anvil pass the edge of the cliff?

(e) What happens to the Coyote?

6. *(10 points)* The diagram below indicates a 15 foot ladder leaning against a wall. The bottom of the ladder slides away from the wall. Find the rate of change of the distance from the wall with respect to the angle θ when the angle is $\pi/3$.



Find $\left.\dfrac{d\,y}{d\,\theta}\right|_{\theta = \frac{\pi}{3}}$