CALCULUS I
FALL 2009

FINAL EXAM
PRACTICE PROBLEMS 1

Exercise 1. Evaluate the following limits, if they exist.

a. $\lim_{x\to 0} \dfrac{\sqrt{3+x}-\sqrt{3}}{x}$ **b.** $\lim_{x\to 0} e^{1/x}$ **c.** $\lim_{x\to 3} (2x + |x-3|)$

d. $\lim_{x\to -\infty} \sqrt{x^2+x+1}+x$ **e.** $\lim_{t\to 2} \dfrac{t^2-4}{t^3-8}$ **f.** $\lim_{\theta\to 0} \dfrac{\sin\theta}{\theta+\tan\theta}$

Exercise 2. Find $\dfrac{dy}{dx}$.

a. $y = e^{\pi}$ **b.** $y = \ln\left|\dfrac{x^2-4}{2x+5}\right|$ **c.** $y = e^{-x}(x^2-2x+x)$

d. $y = \sqrt{\sin\sqrt{x}}$ **e.** $y = e^{x\tan x}$ **f.** $xy^4 + x^2y = x + 3y$

Exercise 3. A 10 foot ladder rests against a vertical wall. The base of the ladder begins to slide away from the wall at a rate of 2 ft/s.

a. How fast is the top of the ladder falling when the base of the ladder is 6 ft from the wall?

b. As the top of the ladder approaches the ground, what does its speed approach? Is this realistic? Why or why not?

Exercise 4. Find the local and absolute extreme values of $f(x) = (x^2+2x)^3$ on the interval $[-2, 1]$.

Exercise 5. Carefully sketch the graph of $y = e^{2x-x^2}$.

Exercise 6. A metal storage tank with volume V is to be constructed in the shape of a right circular cylinder surmounted by a hemisphere. What dimensions will require the least amount of metal?