Math 151 - Week-In-Review 11

Topics for the week:

4.4 Indeterminate Forms and L'Hopital's Rule
4.7 Optimization

4.4 Indeterminate Forms and L'Hopital's Rule

1. Evaluate the following limit: $\lim_{x \to 0} \dfrac{e^x - \cos x}{x^2 + 3x}$

2. Evaluate $\lim_{x \to \frac{\pi}{2}^-} (\sec(x) - \tan(x))$

3. Evaluate $\lim_{x \to 0^-} \left(\frac{x - \sin(x)}{x^3} \right)$

4. Evaluate $\lim_{x \to 0^+} (x \cot(x))$.

5. Evaluate $\lim_{x\to\infty}\left(\frac{x^2}{2^x}\right)$.

6. Evaluate $\lim_{x\to\infty}\left(x-\sqrt{x^2+1}\right)$

7. Evaluate $\lim\limits_{x\to\left(\frac{\pi}{4}\right)^+}\Big((\tan(x))^{\tan(2x)}\Big)$.

8. Evaluate $\lim\limits_{x\to\infty}\left(1+\dfrac{1}{2x}\right)^{3x}$.

4.7 Optimization

9. The state is building a new highway that you pass near the town you live in. On the map your house is located at the point $(4, -2)$ and the new highway is to follow the line $y = 8x + 18$. What is the closest distance the highway will be from your house, if one unit on the map is 100 ft?

10. A piece of wire 12 inches long is being used to make up to two figures: an square and a circle. How should the wire be divided so that the total area enclosed is a maximum? A minimum?

11. What are the dimensions of the largest rectangle that can be inscribed in the area bounded by the curve $y = 12 - x^2$ and the x-axis?

12. A box with a square base and open top must have a volume of 64 m^3. Determine the dimensions of the box that minimized the amount of material used.

13. A family of functions, $s(t) = At^p e^{-kt}$, are called surge functions because the function has a "surge" prior to decaying slowly. One example of this is the concentration of medication in the blood system after an injection. If we assume $A = 4$, $p = 1$, and $k = 1$, determine the time, t, in which $s(t)$ is maximized.