Math 165 Special Assignment #3 Lowman Fall 2010

Due on Thursday, Nov 4, in discussion one week after Quiz 2.

General Instructions: Graph each of the functions given below on a seperate page by using the ten step method used in lectures.

1. Ask: What do you already know in general about $f(x)$?
2. Find all y-intercepts (functions have at most one).
3. Find all x-intercepts. Note, in some cases these are too hard to find using algebra. In this case, it might be better to perform all other steps first to get a good sense where the x-intercepts are and then use graphical or trial and error methods with your calculator.
4. Find all critical numbers, CNs or x_c 's. These occur were $f'(x)$ is zero of undefined.
5. Find all critical points, CPs. These will occur at critical numbers where the function is defined.
6. Use the second derivative test to determine what kind of critical points. As stated in the definition of the second derivative test: If the second derivative test fails then use the first derivative test.
7. Find all inflection points, IPs. Set $f''(x) = 0$ and check the sign of $f''(x)$ on both sides of x to determine if the point is an IP. Find the point $(x, f(x))$
8. End behavior: Left and right.
   Left End: $x \to -\infty, f(x) \to ?$. Should get either $(+/-)\infty$ or a horozontal asymptote, HA
   Right End: $x \to +\infty, f(x) \to ?$ Should get either $(+/-)\infty$ or a horozontal asymptote.
   If there is a horizontal asymptote, you must give the equation of the line for the asymptote. In addition, you must determine from which side of the HA the graph is approaching.
9. Find all vertical asymptotes, VAs. These occur at values of x where $f(x)$ goes to $(+/-)\infty$. You must determine which way the function is going to ∞ on each side of each VA.
10. Use all of the above to make a nice graph. Make sure you clearly indicate all of the above on the graph.

$$f(x) = \frac{x}{(1+x)^2} \tag{1}$$

$$f(x) = \frac{-x}{(1+x)^2} \tag{2}$$

$$f(x) = \frac{x}{(1-x)^2} \tag{3}$$

$$f(x) = \frac{-x}{(1-x)^2} \tag{4}$$

$$f(x) = x^4 - x^2 \tag{5}$$

$$f(x) = e^{-x^2} \tag{6}$$

$$f(x) = \ln x \tag{7}$$

$$f(x) = \frac{-3x^2}{x^2 - 2x - 15} \tag{8}$$

Note: For all of the functions listed above, the steps $\mathbf{1-10}$ are enough to make a good graph and no extra information is needed to completely determine the general shape of the graph. However, if after doing the above ten steps to graph a function, you would still like more information about the graph of $\boldsymbol{f(x)}$ you can always:

- Find more points on the graph by evaluating the function an other values of $\boldsymbol{x}$.
- You might consider making a small table of points to get more information about a specific part of the graph.
- Find all intervals where $\boldsymbol{f(x)}$ is increasing/decreasing
- Find all intervals where $\boldsymbol{f(x)}$ is concave up/down