Review of Prerequisite Material
Math 2254 Worksheet 1

Important Note: If this is more than a "cobweb removal" exercise for you - if you are really struggling with a lot of these questions - come see me ASAP!!! If your Calc I background is weak, then your success in this course will rely on you coming to see me EARLY and OFTEN!

Question 1. Some specific algebra skills we will need:

(a) Solve for x in

$$y = \frac{4x - 1}{2x + 3}$$

(b) Solve for x in

$$y = x^6 - 1$$

(c) Simplify:

$$\frac{2^n}{4^{n-1}}$$

(d) Simplify:

$$\frac{x^{-2}y^3}{\sqrt{x^5 y^{-4}}}$$

(e) Simplify:

$$\frac{\frac{(n+1)^2}{3^{n+1}}}{\frac{n^2}{3^n}}$$

(f) Complete the square: $x^2 - 3x + 5$ (that is, write it in the form $a(something)^2+$ constant)

(g) One more complete the square: $4x^2 + 5x + 1$

Question 2. You will need to be good friends with trig functions!

(a) Sketch the graph of each of the six basic trig functions.

(b) Use the graphs to find $\sin \frac{\pi}{2}$, $\sec 2\pi$, and $\tan(-\pi)$.

(c) Use a (non-calculator!) method of your choice to evaluate $\sin(-\pi/3), \cos(3\pi/4), \tan(5\pi/3), \cot(-\pi/4), \sec(2\pi/3)$, and $\csc \pi$.

(d) Evaluate the following limits, if they exist:

$$\lim_{x \to (\pi/2)^+} \tan x \qquad \lim_{x \to \infty} \sin x \qquad \lim_{x \to 0} \cos x$$

Question 3. You need to know your trig forwards AND backwards...

(a) Evaluate: $\tan^{-1} 1$, $\arcsin(-\frac{1}{2})$, and $\sec^{-1} \sqrt{2}$

(b) Sketch the graph of $y = \sin^{-1} x$, $y = \cos^{-1} x$, and $y = \tan^{-1} x$.

Question 4. And who could forget exponential and logarithmic functions?

(a) Simplify the following:

(a) $\ln e^{\sin x}$

(b) $\log_2 \frac{1}{8}$

(c) $\ln 8 - \ln 2$

(b) Sketch the graph of $y = \ln x$, $y = (\frac{1}{2})^x$, and $y = e^x$.

(c) Evaluate:

$$\lim_{x \to 0^+} \ln x \qquad\qquad \lim_{x \to 0^+} 2^x$$

Question 5. Some notation review: Write the sum below without a Σ:

$$\sum_{n=1}^{4} \frac{1}{n^2}$$

Question 6. Now on to calculus! For each of the functions $f(x)$ below, find $f'(x)$.

(a) $f(x) = 3x^4 - 7x^2 + x - 1$

(b) $f(x) = (2x + 7)^{10}$

(c) $f(x) = 3x\sqrt[3]{1 - x}$

(d) $f(x) = \frac{x+1}{x^2-7}$

(e) $f(x) = (2x + 2)^4\sqrt{x + 1}$

Question 7. Find y':

(a) $y = \cos(3x + 2)$

(b) $y = 5\tan^2 x$

(c) $y = \sin x \tan(\frac{1}{x})$

(d) $y = \frac{\cot x}{1-x^2}$

(e) $y = \csc(\sin^2(3x))$

Question 8. I know logs and exponentials and inverse trig functions are your favorite... Differentiate the following functions:

(a) $f(x) = 3^{\log_2 x}$

(b) $s(t) = (2 + 5t)e^{-3t}$

(c) $f(x) = \sin^{-1}(2x+1)$

(d) $g(x) = x^{1-e}$

(e) $g(t) = e^{\sin t}(\ln t^2 + 1)$

(f) $s(t) = e^t \tan^{-1} t^2$

(g) $f(\theta) = 2^{\sin 5\theta}$

(h) $h(x) = \log_3(1 + x \ln 3)$

Question 9. Find an equation for the line tangent to the curve $y = 2\cos(2x)$ at $x = 0$.

Question 10. Evaluate the following limits at infinity. Hint for some (but NOT all!) of them: L'Hopital's rule exists!

(a) $\lim_{x\to\infty} \frac{3x^9-2x^2+1}{2x^9+100x^4-x}$

(b) $\lim_{x\to\infty} \frac{\sin x}{x^2-3}$

(c) $\lim_{x\to\infty} \frac{e^x}{x^2+1}$

(d) $\lim_{x\to\infty} \frac{\ln x}{x^2+1}$

Question 11. How about antiderivatives? Find *all* functions $F(x)$ with the given derivative $f(x)$:

(a) $f(x) = 3x^2 - 5x + 2$

(b) $f(x) = 2\sin x - \cos x$

(c) $f(x) = 4e^x + x$

(d) $f(x) = 2\sqrt{x}$

(e) $f(x) = \frac{7}{1+x^2}$