# Homework Assignment #1: Calculus Review

This is a calculus based probability & statistics class! As such, this first Homework Assignment will be an opportunity for you to review problems from calculus. Remember, this Homework Assignment is **not collected or graded**! But you are advised to do it anyway because the problems for Homework Quiz #1 will be chosen from these problems![1]

1. Find the derivative of the following:
   (a) $f(x) = 4x^5 + 3x^2 + x^{1/3}$
   (b) $\log(4x) - \log(2x)$
2. Find the critical points of $f(x) = 4x^3 + 3x^2$ and decide whether each is a maximum, minimum or point of inflection.
3. Find the points on the graph of $f(x) = \frac{1}{3}x^3 + x^2 - x - 1$ where the slope is:
   (a) -1
   (b) 2
   (c) -2
4. Find the first three terms of the Taylor series for $f(x) = e^x$ centered at the point $x = 0$.
   Do you see a pattern? Write the formula for the full Taylor series centered at 0. There are two series you should know by heart. This is one of them!
5. Determine whether the following series converge or diverge. If they converge, determine its sum:
   (a)
   $$\sum_{n=1}^{\infty} \frac{(-4)^n}{9^n}.$$
   (b)
   $$\sum_{n=1}^{\infty} \frac{(-4)^{2n}}{3^n}.$$
   (These series are geometric series! And this is the second type of series you should know by heart!)
6. Determine the value of the following integral:
   $$\int_{-1}^{1} |x| dx.$$
7. Determine the value of the following integral:
   $$\int_{-\infty}^{\infty} x^2 e^{-x^2} dx.$$
   Hint: You should remind yourself what integration by parts is and the following information will likely be useful:
   $$\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}.$$

[1] Course instructors reserve the right to *slightly* modify the questions from these when they make the Homework Quiz!

8. Let $\lambda > 0$ by a fixed constant. Calculate

$$\int_0^\infty \lambda x e^{-\lambda x} dx.$$