Name:

Welcome to MATH 3323, this is a class where you will put to use every trick you learned in calculus (and a few more you haven't learned yet) towards the challenging but ever-rewarding enterprise of solving differential equations.

As a first day warm up here are 6 calculus questions. Besides a warm up this should give you an idea of the type of computations that are commenplace when solving differential equations.

It is ok if you do not answer most of problems as this quiz is worth 0 points, so relax!. I don't think its reasonable to do even half of them in the alloted time. **On the other hand**, if you solve **2 problems** you will earn **one bonus point** (read the syllabus later for an explanation of how bonus points work).

You have 30 minutes and may not use any calculators or smartphones (I will post this list of problems in the class website later). Have fun!

(1) Compute the derivative of the following functions

a) $f(x) = \ln((2+x)^2 - 1)$ b) $f(x) = \dfrac{2}{x(1-2x)}$ c) $f(x) = \dfrac{1}{(x-4)(x-2)}$.

(2) Compute the following definite and indefinite integrals

a) $\displaystyle\int x^2 - x \, dx$ b) $\displaystyle\int_0^\infty \dfrac{1}{(x+1)^2} \, dx$ c) $\displaystyle\int x \cos(x) \, dx$ d) $\displaystyle\int_0^\infty e^{-x} \, dx$

(3) Simplify the rational function $\frac{x^4 - 1}{x - 1}$

(4) Find the numerical value of the series $\displaystyle\sum_{n=0}^\infty \left(\tfrac{1}{2}\right)^n$

(5) Simplify the following expressions

$$\text{a) } \sin(x)^2 + \cos(x)^2 \qquad \text{b) } 1 + \frac{1}{\tan(x)^2}$$

(6) (a) You are given a differentiable function $f(x)$ and all you know about it is that the tangent line at each point on the graph of f is always horizontal, and that $f(0) = 0$. Can you determine the value $f(1)$ from this? If you can, indicate the numerical value.

(b) Give an example of a function $f(x)$ with the property that $f'(x) = f(x)$.

(this is an extra sheet)