31B/1 - Practice Midterm 1

14 May 2011

1.a. (**10 points**) Let $f(x) = x^2 + 4x + 1$, and let $g(x)$ be the inverse of $f(x)$, defined on $[-2, \infty)$. Compute $g'(6)$.

1.b. (**10 points**) Compute the derivative of $\cos^{-1}(x)$ at $x = \frac{\sqrt{2}}{2}$.

2.a. (**10 points**) Suppose that you create an annuity with an initial investment of $P(0) = 10000$, an interest rate of $r = .1$, and a continuous withdrawal of $N = 5000$ per year. When does the annuity run out of money?

2.b. (**10 points**) What is the minimal initial investment so that the annuity never runs out of money?

3. (**20 points**) Compute
$$\lim_{t \to \infty} \frac{\ln(t+2)}{\log_2 t}.$$

4. (**20 points**) Compute the indefinite integral
$$\int 2^x \cos x\, dx.$$

5. (**20 points**) Compute the indefinite integral
$$\int \sqrt{x^2 + 9}\, dx.$$