Review of Post Midterm II Material

1. Compute the following antiderivatives.
   a) $\int \sqrt{\sin x}(\cos x)dx$
   b) $\int e^{(\sin x + \cos x)}(\cos x - \sin x)dx$
   c) $\int \cos(e^x)e^x \ dx$

2. a) Do a right-hand sum to estimate the area under the curve $y = 1 - x^2$, above the x-axis, between $x = 0$ and $x = 1$.
   b) Is your estimate in a an over estimate, or an under estimate? Explain how you know.
   c) What is the actual area under the curve $y = 1 - x^2$, above the x-axis, between x=0 and x=1?

3. a) Write in sigma-notation the sum of the first 1000 natural numbers.
   b) Evaluate the sum.

4. a) State the (first) fundamental theorem of calculus.
   b) What theorem do we use to prove the FTC? Trace back the history of the theorems we used to prove the FTC.
   c) Evaluate $\int_1^2 2^x \ dx$.

5. The vertical velocity of a projectile (in m/s) is given by the formula $v(t) = 100 - 9.8t$, where t is measured in seconds since the projectile is fired.
   a) If the projectile is fired from an altitude of 30 m, find a formula for the height, h, of the projectile.
   b) Compute the average height of the projectile over the first 5 seconds.

6. a) State the second fundamental theorem of calculus.
   b) Evaluate the derivative $\frac{d}{dx}(\int_1^x \cos(\cos(t))dt)$.

11. If $\int_1^3 f(x)dx = 5$ and $\int_2^3 f(x)dx = 3$, then find $\int_1^2 f(x)$.