Math 2260, Spring 2014, Practice Sheet for Exam 1

---

1. Compute the following integrals (various difficulty levels):

   i. $\int \sin^3 x dx$

   ii. $\int \sin^4 x dx$

   iii. $\int \sin^3 x \cos^2 x dx$

   iv. $\int \tan^2(2x) dx$

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

   vi. $\int x^5 \sqrt{x^2+1} dx$

   vii. $\int \frac{2x}{x(x-5)} dx$

   viii. $\int \frac{x^4+x+x^2}{x^2+1} dx$

   ix. $\int \frac{x^2-4}{(x^2+1)x} dx$

   x. $\int \frac{6x^2-4x+3}{2x^3-2x^2+3x-5} dx$

   xi. $\int sec^3 x dx$

   xii. $\int_1^3 \frac{3}{\sqrt{x-2}} dx$

   xiii. $\int_0^{3/2} \frac{dx}{\sqrt{9-x^2}}$

   xiv. $\int_0^{3/2} \frac{dx}{9-x^2}$

2. Suppose that $f(x)$ is a function with an asymptote at $x = 1$, so that as x approaches 1 from the right, $f(x)$ approaches ∞. Does it follow that

$$\int_1^5 f(x)$$

diverges? Why or why not?

3. Challenging integral:

$$\int x \arctan x dx$$

4. Explain why the integral

$$\int_1^\infty \frac{\sin x}{x^2} dx$$

converges. (hint: what if the $\sin x$ wasn't there?)

5. Use the previous problem to explain why

$$\int_1^\infty \frac{\sin x}{x} dx$$

also converges. (hint: use integration by parts)

6. Consider the graph of the function $y = e^x$ from $x = 0$ to $x = \infty$. If we were to take the area between this graph and the x-axis, and revolve it around the x-axis, would the total volume of the resulting solid be finite or infinite? If it is finite, what is the total area?