ESP Math 179 **Fall 2015**

Worksheet 25

19 November 2015

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1. **Warm up 1:** Fill in the blanks with $\leqslant$, $\geqslant$, or $=$.

$$\int_a^b f(x)-g(x)dx \quad \_\_\_ \quad \left|\int_a^b f(x)-g(x)\ dx\right| \quad \_\_\_ \quad \int_a^b |f(x)-g(x)|\ dx \quad \_\_\_ \quad \int_a^b |f(x)|+|g(x)|\ dx$$

Warm up 2: Find functions $f(x)$, $g(x)$, so that all of the integrals above are different.

2. Which of the following expressions do not make mathematical sense, and why?

   (a) $\displaystyle\int_{-2}^{-4} 4y^2+5y$

   (b) $\displaystyle\iiint abc\ da\ db\ dc$

   (c) Evaluate $\displaystyle\text{ꝛb}\int g(z)\Big\rbrace dz$.

   (d) $\displaystyle\lim_{n\to\infty}\left[\int_{-n}^{n}\frac{1}{x^2}dx\right]=\left(\left(\frac{-1}{n}+C\right)-\left(\frac{-1}{-n}+C\right)\right)=\frac{-2}{n}=\frac{-2}{\infty}=0$

3. Evaluate the following integrals using the fundamental theorem of calculus.

   (a) $\displaystyle\int_0^1 x+1\ dx$

   (b) $\displaystyle\int_0^1 (x+1)^2\ dx$

   (c) $\displaystyle\int_0^1 (x+1)^3\ dx$

   (d) $\displaystyle\int_0^1 (x+1)^4\ dx$

   (e) Let $f(n)=\displaystyle\int_0^1 (x+1)^n\ dx$. In terms of $f(n)$, can you guess what $f(n+1)$ will be?

4. Compute the derivative, with repsect to t, of the following functions.

(a) $g(t) = \int_0^{t^2} e^{-x}\, dx$

(c) $\phi(t) = \int_a^{t^4} f(x)\, dx$

(b) $h(t) = \int_7^{t^3} \sec^2(x)\, dx$

(d) $\psi(t) = \int_a^{b(t)} f(x)\, dx$

5. So far you have seen finite bounds for definite intgerals. This question wil ask you consider infinite bounds.

(a) Explain what you think $\int_0^{\infty} f(x)\, dx$ means. Use symbols and expressions you know.

(b) Apply part (a) to guess what an answer for $\int_0^{\infty} e^{-x}\, dx$ would be.