ESP Math 182 **Spring 2015**

Worksheet 9

10 February 2015

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1. **Warm Up 1:** Evaluate the following integrals.

   (a) $\int x \ln(x)\, dx$

   (b) $\int e^{4x} \cos(3x)\, dx$

   (c) $\int x^2 \sin(x)\, dx$

   (d) $\int x \cos(x^2)\, dx$

   (e) $\int \cos(\sqrt{x})\, dx$

2. **Warm Up 2:** Evaluate the following integrals. You will need to decide which method to use first.

   (a) $\int x \sin(3x+4)\, dx$

   (b) $\int \dfrac{x^2 - \sqrt{x}}{2x}\, dx$

   (c) $\int \dfrac{dx}{\sqrt{4-x^2}}$

   (d) $\int (\ln(x))^2\, dx$

   (e) $\int \cos^{-1}(x)\, dx$

   (f) $\int \tan(x)\, dx$

   (g) $\int x\sqrt{x+2}\, dx$

3. Recall the product rule $\frac{d}{dx}(f(x)g(x)) = \frac{d}{dx}(f(x))g(x) + f(x)\frac{d}{dx}(g(x))$.

   (a) Use the product rule to prove the integration by parts formula

$$\int f(x)g'(x)\,dx = f(x)g(x) - \int f'(x)g(x)\,dx.$$

   (b) Use the product rule to prove the integration by parts formula

$$\int f(x)g(x)\,dx = f(x)\int g(x)\,dx - \int f'(x)\int g(x)\,dx\,dx.$$

4. (a) Use the product rule to show that

$$\frac{d}{dx}\sin x\cos x = 2\cos^2 x - 1.$$

   (b) Use this to find $\int \cos^2 x\,dx$.

5. Using the arc length formula, prove that the circumfrence of a circle of radius r is $2\pi r$.