ESP Math 182 **Spring 2019**

Worksheet 8

12 February 2019

---

1. **Warm up:** List as many trigonometric identities as you can remember (without looking at your notes or the internet!)

2. Solve the following trigonometric integrals.

   (a) $\int \sec(x)\tan(x)\,dx$

   (b) $\int \csc(x)\,dx$

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

   (d) $\int \cos^3(x)\,dx$

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

   (f) $\int \tan^5(x)\,dx$

   (g) $\int (\sin(x)+\cos(x))^2\,dx$

   (h) $\int (2+\tan(x))^2\,dx$

   (i) $\int \dfrac{\cos^2(x)}{1+\sin(x)}\,dx$

   (j) $\int \sec^2(x)\sqrt{\tan(x)-2}\,dx$

   (k) $\int e^x\tan(e^x)\,dx$

   (l) $\int \dfrac{\cos(2x)}{\cos(x)+\sin(x)}\,dx$

3. (a) What is a polynomial?

   (b) Show by differentiation that if $P_n(x)$ is a polynomial of degree n which satisfies the equation $P_n(x) + P_n'(x) = x^n$, then $\int x^n e^x dx = P_n(x)e^x + C$.

4. Let $\Gamma(x) = \displaystyle\int_0^\infty e^{-t}t^{x-1}dt$ for $x > 0$.

   (a) Use integration by parts to show that $\Gamma(x+1) = x\Gamma(x)$ for $x > 0$.

   (b) Show that $\Gamma(1) = 1$.

   (c) Show that $\Gamma(n) = (n-1)!$ for all $n \in \mathbf{N}$ (the set of natural numbers).