ESP Math 182 **Spring 2019**

Worksheet 3

22 January 2019

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1. Take the derivative with respect to x, and the definite integral from 0 to t with respect to x, of the following functions.

   (a) x

   (b) e

   (c) x^e

   (d) e^x

   (e) e^e

   (f) ee^{ex}

2. Let $f(x) = 4 - x^2$ and $g(x) = x - 2$.

   (a) What is the definition of a *graph*?

   (b) Where do the graphs of f and g meet? Do they bound a finite area?

   (c) Find the area of the region bounded by the curves f and g.

3. Let $f(x) = \arcsin(3x + 1)$.

   (a) What is the domain of f? On what sub-interval of this domain is f differentiable?

   (b) Write down the equation of the tangent line to f at the point $x = -\frac{1}{6}$, if it exists.

4. Let $n \geqslant 1$ be an integer.

   (a) Draw the graph of $y = x^n$ on $x \in [0, 1]$ for $n = 1, 2, 3$.

   (b) Find the integral of $y = x^n$ on $x \in [0, 1]$ for any $n \geqslant 1$.

   (c) What happens to your answer above when $n \to \infty$? Does this make sense?

5. What is the area bounded between the curves $3+\sin(x)$ and $3-\sin(x)$ from $x = 0$ to $x = k\pi$, for any integer k?

6. Find a constant c such that $\lim_{t\to 3}\left[\dfrac{4t^2 + ct + 7c - 6}{2t^2 - 5t - 3}\right]$ exists.

7. Prove that $e^\pi > \pi^e$. Hint: take the natural logarithm of both sides and view the statement as two functions compared at a certain value.