2924 Problem Review Session
September 10, 2019

PROBLEM 1. Use logarithmic differentiation to find dy/dx where $y = x^2 e^{\sin(x)}$. Compare your answer to what you would get using the product rule.

PROBLEM 2. Do the graphs of the exponential function $f(x) = e^x$ and the logarithm function $g(x) = \ln(x)$ have any common tangents?
(a) Make a sketch of the two curves and use it to guess how many lines will be tangent to both curves.
(b) Find the slope/intercept equations for any lines which are tangent to both curves.

PROBLEM 3. Find the limits:
(a) $\lim_{x \to \infty} x^2 \ln(x)$
(b) $\lim_{x \to e} x^2 \ln(x)$
(c) $\lim_{x \to 0+} x^2 \ln(x)$
(d) $\lim_{x \to 0-} x^2 \ln(x)$
(e) $\lim_{x \to 0} \dfrac{\sin(x) - \tan(x)}{x^3}$
(f) $\lim_{x \to 0} \dfrac{1}{\sin(x)} - \dfrac{1}{x}$
(g) $\lim_{x \to \infty} x^{(1/x)}$

PROBLEM 4. Use a calculus analysis to sketch the graph of $f(x) = x^2 \ln(x)$. (Compare with parts (a–d) of the previous problem.)

PROBLEM 5. Let $G(x) = \arctan(tan(x))$.
(a) Complete the description: "*For a real number t, $\arctan(t)$ equals the angle ....*"
(b) Determine the values $G(0)$, $G(\pi/4)$, $G(\pi)$, $G(3\pi/4)$, $G(-3\pi/4)$.
(c) Find the limits $\lim_{x \to \pi/2-} G(x)$ and $\lim_{x \to \pi/2+}$.
(d) Explain that $G(x)$ is an odd function and also a periodic function. (Write equations for both.)
(e) What is the domain of this function?
(f) Sketch the graph of $G(x)$.