MATH 111-007 RECITATION 5

(1) The <u>Product</u> Rule operates on a <u>product</u> and yields a <u>sum</u>.
$$\frac{d}{dx}\left(f\left(x\right)g\left(x\right)\right) = f'\left(x\right)g\left(x\right) + f\left(x\right)g'\left(x\right).$$

(2) The <u>Chain</u> Rule operates on a <u>composite</u> function and yields a <u>product</u>.
$$\frac{d}{dx}\left(f\left(g\left(x\right)\right)\right) = f'\left(g\left(x\right)\right)g'\left(x\right).$$

Problem 1. Find the derivative of the following functions. If you scored lower than a 6 in Quiz 4, please write out the inner and outer functions, and do it properly using the two rules outlined above.

(1) $h\left(z\right) = \sin\left(\frac{1}{z-1}\right).$

(2) $p\left(q\right) = e^{\frac{1}{q^2}}.$

(3) $g\left(t\right) = \cos^2\left(4\sqrt{t}\right).$

(4) $f\left(x\right) = \left(\frac{1+\sin\left(3x\right)}{3-2x}\right)^{-1}.$

Problem 2. Find the equation of the tangent line to $y = \sqrt{x^2 - x + 7}$ at $x = 2$. In addition, find the equation of the normal (perpendicular to the tangent) at the same point.

Problem 3. Find $\frac{d^{111}y}{dx^{111}}$ for $y = xe^x$.

Problem 4. Find $\frac{dy}{dx}$ for $y^2 = x$.

Problem 5. Find the equation of the tangent line of the curve $x^2y^2 = 9$ at $(-1,3)$.

Problem 6. Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for the curve $3 + \sin y = y - x^3$. Write the solutions in terms of x and y only.