Math 1314
The Product and Quotient Rules
In this lesson, we continue with more rules for finding derivatives. These are a bit more complicated.

Rule 7: The Product Rule

$$
\frac{d}{d x}[f(x) g(x)]=f(x) g^{\prime}(x)+g(x) f^{\prime}(x)
$$

Example 1: Use the product rule to find the derivative if $f(x)=\left(5 x^{3}-3\right)\left(x^{2}+6\right)$.

Example 2: Find the derivative if $f(x)=x^{3} e^{x}$.

Example 3: Find the derivative if $f(x)=x \ln x$.

## Rule 8: The Quotient Rule

$$
\frac{d}{d x}\left[\frac{f(x)}{g(x)}\right]=\frac{g(x) f^{\prime}(x)-f(x) g^{\prime}(x)}{[g(x)]^{2}}, g(x) \neq 0
$$

It is easier for some students to remember this using this device:

$$
\frac{d}{d x}\left[\frac{h i}{l o}\right]=\frac{l o d e h i-h i d e l o}{l o l o}
$$

where "de hi" refers to the derivative of the numerator and "de lo" refers to the derivative of the denominator.

Example 4: Find the derivative if $f(x)=\frac{7 x-4}{5 x+2}$.

Example 5: Find the derivative if $f(x)=\frac{x^{2}}{x+1}$.

From this lesson, you should be able to
State the product rule and the quotient rule
Apply the product rule where appropriate
Apply the quotient rule where appropriate

