Math 121
Quiz #5

Problem 1

Find the derivative of the function

$$f(x) = 1 + 2x - 3x^2 + 4x^{5/2} - 5x^{-2/3} + \frac{6}{x}$$

Answer

This problem needs to be broken into pieces, and each piece needs to be differentiated individually. Luckily, all of these terms can be differentiated with the power rule:

$$\frac{d}{dx}(x^n) = nx^{n-1}.$$

The only thing to note here is that $\frac{6}{x}$ can be rewritten as $6x^{-1}$ so that you can apply the power rule. The answer is:

$$f'(x) = 0 + 2 - 6x + 10x^{3/2} + \frac{10}{3}x^{-5/3} - \frac{6}{x^2}$$

Problem 2

Find the derivative of the function

$$f(x) = e^{-2x} + \log 3x^3 + e^x \log x$$

Answer

Here we need to remember several rules of derivatives:

$$\begin{aligned}
\frac{d}{dx}(e^{ax}) &= ae^{ax} \\
\frac{d}{dx}(\log x) &= \frac{1}{x} \\
\frac{d}{dx}(uv) &= u'v + uv'
\end{aligned}$$

where that last rule is called the product rule and applies to two functions u and v of x. Once again, for this problem f needs to be split into piece and each piece needs to be handled with the appropriate rule. The first term is simple

$$\frac{d}{dx}(e^{-2x}) = (-2)e^{-2x}$$

The second term can be simplified with some log properties

$$\begin{aligned}
\frac{d}{dx}(\log(3x^3)) &= \frac{d}{dx}(\log 3 + 3\log x) \\
&= \frac{3}{x}
\end{aligned}$$

The last term needs to be handled with the product rule:

$$\begin{aligned}
\frac{d}{dx}(e^x \log x) &= \frac{d}{dx}(e^x)\log x + e^x \frac{d}{dx}(\log x) \\
&= e^x \log x + e^x \frac{1}{x}
\end{aligned}$$

Put it all together and you get the answer

$$f'(x) = -2e^{-2x} + \frac{3}{x} + e^x \log x + e^x \frac{1}{x}$$