Exam 2

Name: _____

Each problem is worth 30 points. Complete at least five problems; you may complete the sixth for extra credit. Show all your work.

1. State the constant multiple rule, and prove the rule using the definition of the derivative.

2. Find $\frac{\mathrm{d}}{\mathrm{d}x}\frac{x^3+3x^2+3x+1}{x+1}$ using the definition of the derivative. Check your work using differentiation rules.

3. Approximate the slope of the graph of $\ln x$ at $x = 1$, and use your approximation to find a formula for the tangent line to the graph of $f(x)$ at $x = 1$.

4. Find

$$\frac{\mathrm{d}}{\mathrm{d}x} \frac{\sqrt[3]{x} e^x}{x^2 + 1}$$

5. Suppose the total rainfall t days after the start of March is given by

$$R(t) = \frac{10}{\frac{5}{e^t} + 1}$$

Find $R'(15)$. Give units and interpret your answer.

6. For the function $f(x)$ pictured below, sketch $f'(x)$ and a possible antiderivative $F(x)$. Justify each of your graphs by writing a sentence relating the sign, slope, and concavity of the graph of $f(x)$ with the relevant features of your graphs.