Math 113 2013 Exam 2 Review Problems

For problems 1-9, find the derivative of the function. In each case, completely factor the final answer if possible.

1. \[
\frac{x^2 + 1}{(3x^2 + 1)^3}
\]

2. \[e^{3x^2}\]

3. \[\ln|\cos(x^3)|\]

4. \[\frac{1}{\sqrt{x^2 + 1}}\]

5. \[4^{3x+2}\]

6. \[x^{2x+1}\]

7. \[\sin^{-1}(x^2 - 1)\]

8. \[\tan^{-1}(x^3 + 1)\]

9. \[\sec^{-1}(x^3 + 1)\]

10. Find \(\frac{dy}{dx}\) if \(y^3 + xy^2 + y - 3x^4 = 2\). Find the slope of the curve (i.e. the slope of the tangent line to the curve) at \((0,1)\).
11. Let \( g(x) = f^{-1}(x) \) be the inverse of the function \( f(x) = x + e^{x-1} \). Find \( f(1), g(2) \) and \( g'(2) \).


13. Find the absolute maximum and minimum of \( x^3 - 3x \) on the interval \([-1, 4]\).

14. If the derivative of a function \( f(x) \) is

\[
f'(x) = \frac{x(x - 3)}{x + 1}
\]

find the intervals of increase and decrease, and the local extrema of the function \( f(x) \).

15. Find the intervals of increase and decrease, and the local extrema of the function \( x^3 + 3x^2 - x - 3 \).

16. Find the absolute maximum or minimum of the function \( x^3 + 3x^2 + x + 3 \)
   (a) on \((-\infty, \infty)\), (b) on \([-1, \infty)\), if any.

17. Find the intervals of increase and decrease, intervals of concave up and concave down, local extrema, inflection points of the function \( x^2e^{-x} \).