Problem 1.

(a) Find $\lim_{x\to+\infty} \frac{(\ln(x))^2}{x}$.

(b) Find $\lim_{x\to 3} \frac{2x^3-9x^2+10x-3}{x^4-8x^3+16x^2-5x+6}$.

(c) Find $\lim_{x\to 0} \frac{2\sin(x)-\sin(2x)}{x-\sin(x)}$.

Problem 2.

(a) Compute $f'(x)$ where $f(x) = e^{\arctan(x^2)}$.

(b) Compute $g'(4)$ where $g(x) = \ln(x^3 + 3x + \sqrt{x})$.

(c) Find the tangent line to $h(x) = \arcsin(e^x)$ at $\ln(1/2)$.

Problem 3.

(a) Find the derivative of $f(x) = \cos(x)^x$.

(b) Let $j(x) = \sqrt[3]{x^5 + x^4 + x^3 + x^2 + 2x}$. Find $(j^{-1})'(4)$.

(c) Compute the following. In all cases your answers should be exact, with no decimals, and no logs or exponentials or trig functions..

$\ln(e^3) + \ln(3) + \ln(e/3) =$

$\arcsin(-\sqrt{2}/2) =$

$\cos(\arcsin(3/7) =$

Problem 4.

(a) Show that the polynomial $x^4 - 6x - 2$ has two real roots, that is, there are two (different!) real numbers a and b such that $a^4 - 6a - 2 = b^4 - 6b - 2 = 0$.

(b) Find the general form of an antiderivative for $3x^2 + \cos(x)$.

(c) Find y' if $e^y + \ln(y) = x^2 + 1$.

Problem 5.

(a) Use two iterations of Newton's Method starting at 2 to estimate $\sqrt[3]{7}$.

(b) Find the formula for the quadratic approximation of $g(x) = x^x$ near 1.

(c) Let $F(2) = 1$ and let $F'(x) = \frac{x+1}{x-1}$. Use three steps of numerical integration/modified Euler's method to estimate $F(5)$.