Math 1720 Midterm 1 Review Problems
(Section 7.4 not included in this review, but it is examinable for the midterm.)

0.
(a) Find
$$\log_{27}(9).$$
(b) Find all solutions to the equation
$$\ln(2 - x) + \ln(5 - x) = 2\ln(5).$$
(c) Find all solutions to the equation
$$e^{x^3} = 6^x.$$

1.
(a) Find and simplify
$$\int_{-1}^{1} 6^{2x} \, dx$$
(b) Find and simplify
$$\int_{3}^{10} \frac{5}{2 - x} \, dx$$
(c) Find
$$\int_{0}^{\pi/2} e^{3\sin(x)} \cos(x) \, dx$$
(d) Find
$$\int \frac{e^x - e^{-x}}{e^x + e^{-x}} \, dx$$

2.
(a) Find
$$\frac{d}{dx}\left(\frac{x^3}{\ln(x^3)}\right).$$
(b) Find
$$\frac{d}{dx}\left(\sqrt{x}^{\sqrt{x}}\right).$$
(c) Let $a = (e^{13} + 6/\pi)$. Find
$$\frac{d}{dx}\left(a^x x^{\ln(a)}\right).$$

3. Let $f(x) = \sqrt{x^6 - 4}$. Find the longest intervals over which f has an inverse, and find the formula for the inverse over each such interval.

4. Let $f(x) = e^{-x^2}$. (a) Does f have an inverse over the interval $(-2, 5)$? (b) Find the formula for the inverse of f over the interval $D = [5, 10]$, and find the domain and range of the inverse.

5. Suppose that f is a differentiable function, and that f is one-to-one, and

- $f(2) = 4$; $f'(2) = -1$

- $f(3) = 2$; $f'(3) = -3$

- $f(4) = -2$; $f'(4) = 0$

(a) Why does f^{-1} exist?

(b) Let $g = f^{-1}$. Find $g'(2)$, if you have sufficient information. Find $g'(3)$, if you have sufficient information.

(c) Sketch a plausible graph of $y = f(x)$ over the interval $[0, 5]$. (So it should agree with all information given.) Then sketch the graph of $y = g(x)$, having the correct relationship to the graph of $y = f(x)$.