Math 76 **Hints and answers to practice problems for test 1**

1. To find the inverse of a function, follow the procedure described on p.416 of your textbook. Graphs of exponential and log functions are given in sections 7.2 and 7.3.
   (a) $f^{-1}(x) = \ln(x+2)$
   (b) $f^{-1}(x) = -\log_2(x)$
   (c) $f^{-1}(x) = e^{x-2} - 3$

2. See sections 7.3 and 7.5.
   (a) -3 (b) 1 (c) 2 (d) $\frac{\pi}{2}$ (e) $\frac{\pi}{3}$ (f) $\frac{3}{5}$

3. Use L'Hospital's rule, see section 7.7.
   (a) $\frac{5}{6}$ (b) 0 (c) $\frac{1}{2}$ (d) 0 (e) e^{-3}

4. (a) Make the substitution $u = x^2$. $-\frac{1}{2}\cos(x^2) + c$
   (b) See example 3 on page 519. $\frac{\pi}{6} - \frac{\sqrt{3}}{8}$
   (c) Section 8.4: rational functions. In this case, just divide and evaluate. No partial fraction decomposition is necessary. See example 1 in section 8.4.
   $4x - \ln|x+1| + c$
   (d) Use integration by parts with $u = x$, $dv = e^x dx$. e^2
   (e) See examples 1 and 2 in section 8.2. $\frac{16}{15}$
   (f) Make the substitution $u = \tan x$. Do not forget to change the limits of integration (or change back to x and use the old limits). $e - 1$
   (g) Use integration by parts twice. The first time set $u = x^2$, $dv = \sin(2x)dx$.
   $-\frac{1}{2}x^2\cos(2x) + \frac{1}{2}x\sin(2x) + \frac{1}{4}\cos(2x) + c$
   (h) Make the trig substitution $x = 2\sin t$. Follow example 1 in section 8.3.
   $-\frac{\sqrt{4-x^2}}{4x} + c$
   (i) See section 8.4, rational functions, case II: repeated linear factors.
   $\ln|x| - \frac{3}{x} - \ln|x+4| + c$
   (j) Integrate by parts with $u = (\ln(5x))^3$ and $dv = dx$.
   $(\ln(5x))^3x - 3(\ln(5x))^2x + 6\ln(5x)x - 6x + c$
   (k) See section 8.4, rational functions, case III: irreducible quadratic factors.
   $2\ln(x^2+1) + 3\arctan x + c$
   (l) See example 2 in section 8.2. $\frac{1}{3}\sin^3 x - \frac{1}{5}\sin^5 x + c$
   (m) Make a substitution. $\frac{1}{12(2-3s)^4} + c$
   (n) Make a trig substitution. $\ln\left|\frac{\sqrt{x^2+9}}{3} + \frac{x}{3}\right| + c$
   (o) Make a substitution to obtain a rational function. $-\frac{2}{3}\ln(e^x+3) + \frac{5}{3}x + c$
   (p) Rational function (divide first). $x + 4\ln|x+2| - 9\ln|x+3| + c$
   (q) Use the substitution $u = 4x^2 - 1$ or a trig substitution. $\frac{(\sqrt{4x^2-1})^3}{12} + c$