Directions: Closed book, closed notes, no calculators. Show work to get credit. Each problem is 5 points, for a total of 20 points.
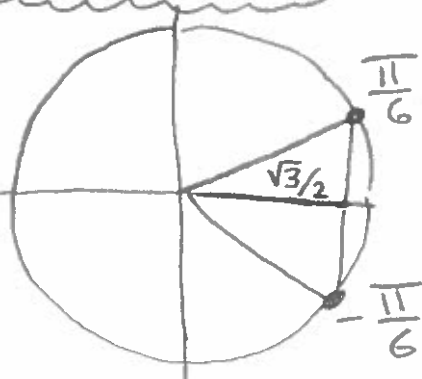
By submitting this quiz you affirm that you agree with this statement: *On my honor, I have neither given nor received unauthorized aid on this assignment, and I pledge that I am in compliance with the VCU Honor System.*

1. Find all solutions of this equation: $2\cos(x) = \sqrt{3}$ $\longrightarrow$ $\left\{\cos(x) = \dfrac{\sqrt{3}}{2}\right\}$

From the unit circle, the solutions are

$$x = \pm\frac{\pi}{6} + 2k\pi \quad \text{for} \quad k = 0, \pm 1, \pm 2 \ldots$$

2. Find the inverse this function: $f(x) = 3 + \ln(x-1)$

$$y = 3 + \ln(x-1)$$
$$x = 3 + \ln(y-1)$$
$$x - 3 = \ln(y-1)$$
$$e^{x-3} = e^{\ln(y-1)}$$

$$e^{x-3} = y - 1$$
$$y = e^{x-3} + 1$$
$$\boxed{f^{-1}(x) = e^{x-3} + 1}$$

3. Solve this equation: $2^{x-1} = 5^x$ (It's OK to have logarithms in your answer.)

$$\ln(2^{x-1}) = \ln(5^x)$$
$$(x-1)\ln(2) = x\ln(5)$$
$$x\ln(2) - \ln(2) = x\ln(5)$$
$$x\ln(2) - x\ln(5) = \ln(2)$$

$$\longrightarrow x(\ln(2) - \ln(5)) = \ln(2)$$
$$\boxed{x = \frac{\ln(2)}{\ln(2) - \ln(5)}}$$

4. Simplify: $\ln(9) - 2\ln(3x) + \ln(x^2)$

$$= \ln(9) - \ln\left((3x)^2\right) + \ln(x^2)$$
$$= \ln\left(\frac{9}{9x^2}\right) + \ln(x^2)$$
$$= \ln\left(\frac{9x^2}{9x^2}\right) = \ln(1) = \boxed{0}$$