**Math 223**                    **Final** (8:00 AM version)                    **Oct 23, 2015**

*Name:*                                                                    *Section:*

*Closed book and closed notes.*                    *Answers must include supporting work.*

*Calculators and cell phones out of sight.*

1. (10 pts) Express the angle, $\theta = 300°$, in radians and determine the values:

$\sin\theta$, $\cos\theta$, and $\tan\theta$ .

2. (5 pts) Express the quantity $2\ln x + 3\ln y - \ln z$ as a single logarithm.

3. (15 pts) Find the exact value of each expression.

a) $\log_8 2$    b) $\log_5 \dfrac{1}{125}$    c) $e^{\ln 4.5}$    d) $\arctan 1$    e) $\tan\left(\arctan 10\right)$

4. (10 pts) Find the domain of $f(x) = \ln\left(6 - x - x^2\right)$.

5. (15 pts) Find all $x$ that satisfy the equation.

a) $2\cos x - 1 = 0$ for $x$ in the interval $[0, 2\pi]$.

b) $e^{7-4x} = 6$

c) $e^{e^x} = 10$

6. (10 pts) Simplify the expression $\sin(\tan^{-1} x)$.

7. (10 pts) Sketch the following graphs labeling the x-intercepts and all asymptotes.

a) $y = 1 - 2^{-x}$

b) $y = \tan\left(x - \dfrac{\pi}{2}\right)$ on $[0, 2\pi]$

8. (10 pts) Find each x-value at which $f$ is discontinuous. Explain your answer fully using left and right-hand limits.

$$f(x) = \begin{cases} x + 2 & \text{if } x < 0 \\ 2x^2 & \text{if } 0 \le x \le 1 \\ 3 - x & \text{if } x > 1 \end{cases}$$

9. (15 pts) Find the following limits:

a) $\lim_{x \to 3} \dfrac{x^2 - 9}{x^2 - x - 6}$

b) $\lim_{x \to 4^-} \dfrac{x^2 - 16}{|x - 4|}$

c) $\lim_{h \to 0} \dfrac{\sqrt{9 + h} - 3}{h}$