1. (30 pts) Which of the following statements are identities? Circle **T**(RUE) or **F**(ALSE) and briefly explain each FALSE answer.

T - F (a) $\sin^2(x) - \cos^2(x) = \cos(2x)$

T - F (b) $e^{(xy)} = e^x + e^y$;

T - F (c) $\log(x + y) = \log(x) + \log(y)$, $x > 0, y > 0$

T - F (d) $\tan(x + \pi) = \tan(x)$

T - F (e) $\sin(\cos^{-1}x) = \sqrt{1 - x^2}$, $0 < x < 1$

T - F (f) $(x + yi)(x - yi) = x^2 - y^2$

2. (10 pts) If $f(x) = \dfrac{2x + 1}{3x - 4}$, what is $f^{-1}(x)$?

A) $f^{-1}(x) = \dfrac{4x - 1}{3x + 2}$

B) $f^{-1}(x) = \dfrac{3x - 4}{2x + 1}$

C) $f^{-1}(x) = \dfrac{-4x - 1}{3x - 2}$

D) $f^{-1}(x) = \dfrac{5}{3x - 2}$

E) $f^{-1}(x) = \dfrac{4x + 1}{3x - 2}$

3. (10 pts) A tower is 75 feet tall. What is the angle of elevation to the top from a point on the level of its base and 60 feet away from the base?

   A) $38.66°$

   B) $0.896°$

   C) $45°$

   D) $30°$

   E) $51.34°$

4. (10 pts) What is the solution for the inequality $\frac{x+1}{x-3} \leq 0$?

   A) $(-1, 3)$

   B) $[-1, 3]$

   C) $[-1, 3)$

   D) $(-\infty, -1] \cup (3, +\infty)$

   E) None of these

5. (10 pts) Given two vectors $\mathbf{u} =< 1, -2 >$, $\mathbf{v} =< 2, -3 >$, which of the following is the vector $2\mathbf{u} - \mathbf{v}$?

   A) $< 0, 1 >$

   B) $< 0, -1 >$

   C) $< 4, -1 >$

   D) $< 4, -7 >$

   E) $< 0, -7 >$

6. (10 pts) The formula $A = Pe^{rt}$ is used to compute investment growth that is compounded continuously. If an investment takes 16 years to triple, what is the interest rate?

   A) Not enough information to find out

   B) 0.069%

   C) 6.500%

   D) 6.866%

   E) 7.107%

7. (20 pts) Find all roots, real and complex, of $x^3 - 3x^2 + 5x - 3 = 0$. Your must show your work to receive full credit.

8. (20 pts) Find, EXACTLY, all solutions to the equation $2\sin(3x) = 1$.

9. (20 pts) A lighthouse keeper 100 feet above the water sees a boat sailing in a straight line direatly towards her. As she watches, the angle of depression changes from 30° to. How far did the boat travel during this time?

10. (20 pts)(a) Change the complex number $z = 1 - i$ into polar form.

(b) Use DeMoivre's Theorem to compute $(1 - i)^{10}$ and express your answer in $a + bi$ form.

11. (20 pts)How long does it take an object to reach the ground if it is thrown downward from the top of a 780-foot building, with initial velocity of 56 feet per second?

Note: The position of the object above ground (in feet) after t seconds is given by $h(t) = -16t^2 + v_0 t + h_0$ where h_0 is the initial position of the object at $t = 0$, v_0 is the initial velocity of the object at $t = 0$.