The point value of each problem is indicated. To obtain full credit you must have the correct answers along with the supporting work. Answers without supporting work will receive no credit, except for multiple choice problems. CIRCLE YOUR ANSWERS.

1. (20 points) Multiple Choice: **Circle your answer.**

   (a) Express the equation $3^x = 7$ in logarithmic form.
   
   (i) $\log_3(x) = 7$ (ii) $\log_x(7) = 3$ (iii) $\log_3(7) = x$ (iv) Not listed

   (b) The domain of the function defined by $f(x) = \log_5(x^2 - 3x)$ is:
   
   (i) $(3, \infty)$ (ii) $(-\infty, 0) \cup (3, \infty)$ (iii) Not listed

   (c) The statement $\log_3(a + b) = \log_3(a) + \log_3(b)$ for all $a, b > 0$ is:
   
   (i) True (ii) False

   (d) Expand $\ln(7e^x)$.
   
   (i) $7x$ (ii) $7 + x$ (iii) $\ln(7) + x$ (iv) Not listed

   (e) Use the Laws of Logarithms to combine the expression $\frac{3}{2} \log(x^2 + 5) - \log(x + 3)$.
   
   (i) $\log\left(\frac{\frac{3}{2}(x^2 + 5)}{x + 3}\right)$ (ii) $\log\left(\frac{(x^2 + 5)^{\frac{3}{2}}}{x + 3}\right)$ (iii) Not listed
2. (20 points)

(a) The function \( f(x) = x^3 \cos(x) \) is:

(i) Even  

(ii) Odd  

(iii) Neither

(b) Use the change of base formula to write \( \log_5(x) \) in terms of \( \ln(x) \).

(i) \( \ln \frac{x}{5} \)  

(ii) \( \ln x \)  

(iii) \( \frac{\ln 5}{\ln x} \)  

(iv) Not listed

(c) The angles in standard position with measures \( \frac{17\pi}{5} \) and \( \frac{2\pi}{5} \) are coterminal.

(i) True  

(ii) False

(d) The reference angle for \( \frac{31\pi}{4} \) is:

(i) \( -\frac{\pi}{4} \)  

(ii) \( \frac{\pi}{4} \)  

(iii) \( \frac{7\pi}{4} \)  

(iv) Not listed

(e) Simplify \( \sin^{-1}(\sin \frac{5\pi}{4}) \).

(i) \( \frac{5\pi}{4} \)  

(ii) \( \frac{\pi}{4} \)  

(iii) \( -\frac{\pi}{4} \)  

(iv) Not listed
3. (20 points)

a) Fill in the blank.

\[ \log_a(a) = \boxed{} \]
\[ \log_a(1) = \boxed{} \]

95° = \boxed{} radians. Give the exact value.

b) Solve the logarithmic equation \( \log_8(x) + \log_8(x + 2) = 1 \). Circle your answer.

c) How tall is a building if the angle of elevation from the ground is 16° at a distance of 200 ft from the base of the building? Round your answer to two decimal places.
4. (20 points)
   a) The doubling time of a population is 17 years.

      - Write a model for the population $n(t)$ in terms of the initial population $n_0$.

      - How long will it take for the population to reach 10,000, if the initial population is 6,000? Round your answer to two decimal places.

   b) A triangle has angles $\angle A = 25^\circ$, $\angle B = 48^\circ$, and side $b = 12$. Find side $a$. Round your answer to two decimal places.

   c) Given $f(x) = -3\sin\left(\frac{5}{2}x - 10\pi\right)$, fill in the blank.

      Amplitude: __________
      Period: __________
      Phase shift: __________
      An appropriate interval on which to graph one complete period: __________
5. (20 points)

(a) Solve the inequality \( \frac{3(x + 1)}{x} \geq \frac{1}{x} \).

(i) \([-\frac{2}{3}, \infty)\)  
(ii) \((\infty, -\frac{2}{3}] \cup (0, \infty)\)  
(iii) Not listed

(b) Find the terminal point on the unit circle determined by \( t = -\frac{5\pi}{3} \).

(i) \(\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)\)  
(ii) \(\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)\)  
(iii) Not listed

(c) Find \( \cos \theta \) if \( \tan \theta = \frac{2}{x} \) and \( \sin \theta > 0 \).

(i) \(\frac{x}{\sqrt{4 + x^2}}\)  
(ii) \(\frac{2}{\sqrt{4 + x^2}}\)  
(iii) \(\frac{\sqrt{4 + x^2}}{x}\)  
(iv) Not listed

(d) The area of a sector of a circle with a central angle of 30° is 36 \( m^2 \). Find the radius of the circle.

(i) 5.86  
(ii) 11.73  
(iii) 1.55  
(iv) Not listed