Potentially useful formulas:
\[ \sin^2 \theta + \cos^2 \theta = 1, \quad \tan^2 \theta + 1 = \sec^2 \theta, \quad 1 + \cot^2 \theta = \csc^2 \theta \]

Area of Sector: \( A = \frac{1}{2} r^2 \theta, \ \theta \text{ in radians} \)

Length of arc: \( S = r\theta, \ \theta \text{ in radians} \)

1. Please write the word “agree” as your answer to question 1 to indicate that you will abide by the University honor code for this exam.

2. Sketch the following graphs: Be sure to label any asymptotes and intercepts for each graph.
   (a) \( y = -\ln x \) (4 pts)
   (b) \( y = 5^x - 1 \) (4 pts)

3. A cup of coffee is placed in a room at 20°C. The temperature \( T \) of the object was measured each hour \( t \). A model for the data is given by: \( T(t) = 20 \left[ 1 + 7 \left( 2^{-t} \right) \right] \).
   (a) What is the initial temperature of the cup of coffee? (4 pts)
   (b) What is the temperature of the coffee after 2 hours? (4 pts)
   (c) How long will it take for the coffee temperature to reach 100°C? Leave your answer in exact form. (4 pts)

4. (a) Simplify (rewrite without logs): \( \ln (e^4) - \log_7(1) - \log_2 (8^{-1}) \) (6 pts)
   (b) Find the function of the form \( y = \log_a(x) \) whose graph is given. (4 pts)
   (c) Rewrite as a sum/difference of logarithms without exponents: \( \ln \left( \frac{b^2}{\sqrt{cd}} \right) \) (6 pts)
5. Solve the following equations:

(a) \( 1 + e^{3x+1} = 35 \) (4 pts)

(b) \( 7x^2 = 7^x \) (4 pts)

(c) \( x \ln 7 - 2 = x + 1 \) (4 pts)

(d) \( \log_3 x + \log_3(x - 8) = 2 \) (4 pts)

(e) \( \ln(x - 3) - \ln 6 = 2 \ln 2 \) (4 pts)

6. Sketch each angle in standard position on the unit circle.

(a) \(-\frac{\pi}{3}\) (2 pts)  
(b) \(\frac{5\pi}{4}\) (2 pts)

7. Find the area of the sector with radius 2 and central angle \(\theta = 70^\circ\). Leave your answer in exact form. (5 pts)

8. The point \( (3, -1) \) is on the terminal side of an angle, \(\theta\), in standard position. Determine the exact values of the following.

(a) \(\cos \theta\) (4 pts)

(b) \(\sec \theta\) (4 pts)

(c) \(\tan \theta\) (4 pts)

9. Write \(\sec \theta\) in terms of \(\tan \theta\) if \(\theta\) is in Quadrant III. (5 pts)

10. Find the following:

(a) \(\cos \left(\frac{3\pi}{4}\right)\) (3 pts)

(b) \(\sin (270^\circ)\) (3 pts)

(c) \(\tan \left(-\frac{2\pi}{3}\right)\) (3 pts)

(d) \(\csc \left(\frac{7\pi}{6}\right)\) (3 pts)

11. A 10-ft ladder leans against a building so that the angle between the ground and the ladder is \(45^\circ\). How high does the ladder reach on the building? (6 pts)