INSTRUCTIONS: Simplify and box all your answers. Write neatly and show all work. A correct answer with incorrect or no supporting work may receive no credit. Books, notes, electronic devices (such as calculator or unauthorized electronic resources) are not permitted. Give all answers in exact form.

1. Write the word “agree” as your answer to question 1 to indicate that you will abide by the University honor code for this exam. An honor code violation on this exam may result in a zero on the exam or an F in the course.

2. Answer the following for \( f(x) = e^{2x} \):
   (a) Sketch the graph of \( f(x) \). Label any asymptotes and the \( y \)-intercept clearly on the graph. (4 pts)
   (b) Find \( f(\ln(2)) \). (3 pts)

3. Answer the following for \( g(x) = \log(x + 2) \):
   (a) Sketch the graph of \( g(x) \). Label any asymptotes and the \( x \)-intercept clearly on the graph. (4 pts)
   (b) Find the \( x \)-value such that \( g(x) = 2 \). (3 pts)

4. Simplify the following completely:
   (a) \( \log_3(27) - \ln(1) \) (3 pts)
   (b) \( 3\log_3(5x) + \log_2(4^x) \) (3 pts)
   (c) \( \log_4\left(\frac{16}{13}\right) + \log_4(13) \) (3 pts)

5. The state of Colorado is hoping to introduce gray wolves to parts of Western Colorado (where there are none currently). They expect that the gray wolf population growth will follow an exponential growth model. They will start by releasing 150 gray wolves on July 1, 2021. After 6 months they expect the population to reach 217 gray wolves. Using the exponential model \( P(t) = P_0e^{rt} \) where \( t \) has units of months answer the following:
   (a) Find \( P_0 \). (4 pts)
   (b) Find \( r \). (4 pts)

6. Find the function of the form \( y = ax^r \) whose graph is given. (4 pts)
7. Solve the following equations. Leave answers in exact form.

(a) \(9^{x^2-1} = 9^{6(x+1)}\) (4 pts)

(b) \(\log_x(10) = \frac{1}{3}\) (4 pts)

(c) \(\log_2(15) = \log_2(x - 2) + \log_2(x)\) (4 pts)

(d) \(2^x = 3^{x-1}\) (4 pts)

(e) \(\frac{7 + \ln x}{3} = 0\) (4 pts)

8. Sketch each angle in standard position on the \(x,y\)-axes.

(a) \(\frac{5\pi}{6}\) (3 pts) 

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

9. Find the length of the arc for the sector in the given image (the sector is outlined in black, the angle is illustrated in blue). Leave your answer in exact form. (4 pts)

10. The point \((2, -5)\) is on the terminal side of an angle, \(\theta\), in standard position. Determine the exact values of the following.

(a) \(\sin \theta\) (4 pts)

(b) \(\tan \theta\) (4 pts)

(c) \(\cot \theta\) (4 pts)

11. Given \(\cos \theta = \frac{1}{4}\) and \(\theta\) in quadrant IV find \(\sin \theta\). (4 pts)

Exam Continued on Next Page
12. Find the following:

(a) \( \sin(0) \) (3 pts)

(b) \( \cos\left(\frac{11\pi}{6}\right) \) (3 pts)

(c) \( \sin\left(\frac{4\pi}{3}\right) \) (3 pts)

(d) \( \tan(-135^\circ) \) (3 pts)

(e) \( \csc\left(\frac{\pi}{3}\right) \) (3 pts)

13. The height of a building is known to be 23 feet. A person standing a certain distance away measures the angle from their feet to the top of the building to be 30\(^\circ\). How far away is the person from the building? Leave your answer in exact form. (4 pts)

Potentially useful formulas:

(a) Let \( u \) and \( w \) denote positive real numbers, then:
   
   i. \( \log_b(uv) = \log_b(u) + \log_b(v) \)
   
   ii. \( \log_b\left(\frac{u}{v}\right) = \log_b(u) - \log_b(v) \)
   
   iii. \( \log_b\left(u^c\right) = c \log_b(u) \) where \( c \) is any real number.
   
   iv. \( \log_b(u) = \frac{\log_a(u)}{\log_a(b)} \)

(b) \( A = \frac{1}{2}r^2\theta \)

(c) \( S = r\theta \)

(d) \( \sin^2\theta + \cos^2\theta = 1 \)

(e) \( \tan^2\theta + 1 = \sec^2\theta \)

(f) \( 1 + \cot^2\theta = \csc^2\theta \)