
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 other unauthorized electronic resources) are not permitted. **Give all answers in exact form.**

Potentially useful formulas:

Let u and w denote positive real numbers, then:

(a) $\log_b(uv) = \log_b(u) + \log_b(v)$

(b) $\log_b\left(\frac{u}{v}\right) = \log_b(u) - \log_b(v)$

(c) $\log_b(u^c) = c \log_b(u)$ where c is any real number.

(d) $\log_b(u) = \frac{\log_a(u)}{\log_a(b)}$ for $a > 0, a \neq 1$.

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

(f) $S = r\theta$

NOTE: YOU MAY TEAR OFF THIS FIRST PAGE AND USE (FRONT AND BACK) AS SCRATCH PAPER.

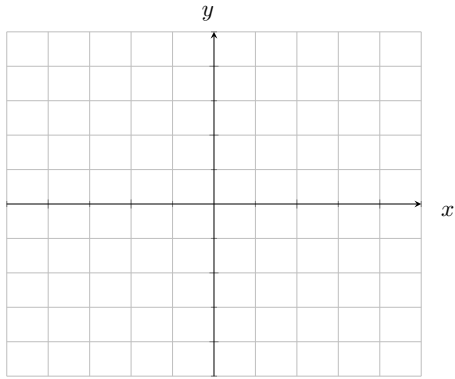
- i. DO NOT START UNTIL INSTRUCTED BY A PROCTOR.
- ii. THE EXAM IS ON BOTH SIDES OF EACH FOLLOWING EXAM PAGE
- iii. WRITE YOUR NAME ON THE NEXT PAGE. JUST BEFORE YOU UPLOAD TO GRADESCOPE WRITE DOWN YOUR UPLOAD TIME ON THE NEXT PAGE.
- iv. WHEN YOU FINISH (IF BEFORE THE EXAM END TIME) PLEASE QUIETLY COLLECT YOUR THINGS AND LINE UP AT THE BACK OF THE ROOM. A PROCTOR WILL INDICATE WHEN IT'S YOUR TURN TO EXIT THE ROOM AND UPLOAD TO GRADESCOPE.

Name:

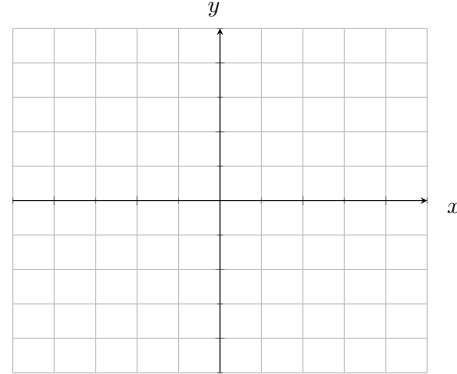
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1. Sketch the following graphs: Be sure to label any asymptotes and intercepts for each graph.

(a) $f(x) = \ln(x + 1)$ (4 pts)



(b) $g(x) = 3^{-x}$ (4 pts)



(c) What is the domain of $f(x)$ in part (a) (2 pts)?

2. (a) Simplify (rewrite without logs): $-\log_4(64) - e^{\ln(5)} + \log_5(25^x) + \log(1)$ (4 pts)

(b) Rewrite as a single logarithm without negative exponents: $2 \log(x) - \frac{1}{4} \log(x) + 3 \log(y)$ (4 pts)

(c) Rewrite as a sum/difference of logarithms without any exponents: $\ln\left(\frac{xe^x}{\sqrt[3]{yz}}\right)$ (4 pts)

3. Solve the following equations for x . If there are no solutions write “no solutions” (be sure to justify answer for full credit).

(a) $4^{5-x} = 16$ (4 pts)

(b) $\log_3(x) = 2$ (4 pts)

(c) $3^{2x+1} = 2$ (4 pts)

(d) $\ln 2 + \ln(x) = \ln(x^2 - 3)$ (4 pts)

(e) $\log(x + 1) = 3 \log(2x^{1/3})$ (4 pts)

4. A hot cup of coffee is left in a room. Its temperature in Fahrenheit, $T(t)$, at time t in hours, is expected to cool according to the exponential model:

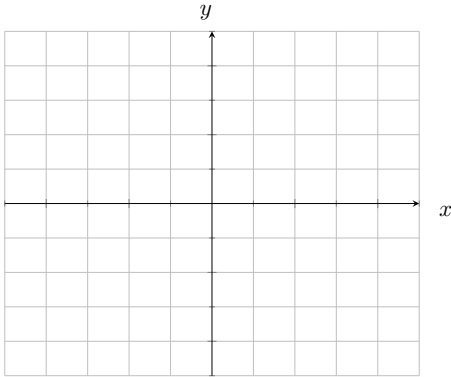
$$T(t) = 66 + 112e^{-0.05t}$$

Answer the following:

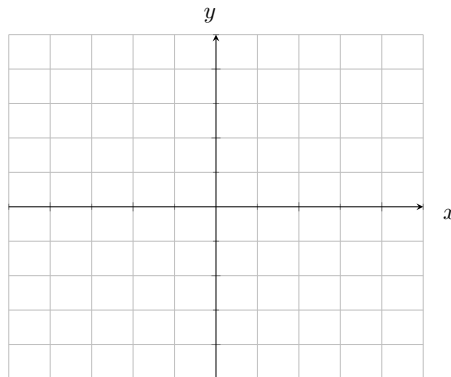
- (a) Find the initial temperature of the cup of coffee. (3 pts)
- (b) Find the temperature of the cup of coffee after 5 hours. (3 pts)
- (c) According to the model is it possible for the cup of coffee to cool to 66° F? If so, find the time t which gives a temperature of 66° F. Be sure to justify your answer. (3 pts)

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

(a) $\frac{3\pi}{4}$ (3 pts)



(b) $-\frac{5\pi}{3}$ (3 pts)



6. Let $\left(x, \frac{1}{3}\right)$ be a point on the unit circle that lies on the terminal side of an angle θ in standard position. Suppose we also know $\cos \theta < 0$. Use this information to answer the following:

(a) Considering all given information, what quadrant does θ lie in? (4 pts)

(b) Find the value for x . (4 pts)

(c) Find $\sin \theta$ (4 pts)

(d) Find $\csc \theta$ (2 pts)

7. Find the exact value of each of the following. If a value does not exist write DNE.

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

(b) $\sin(90^\circ)$ (4 pts)

(c) $\tan\left(-\frac{5\pi}{4}\right)$ (4 pts)

(d) $\sec(60^\circ)$ (4 pts)

(e) $\csc\left(\frac{7\pi}{6}\right)$ (4 pts)

8. The radius of the sector of a circle with a central angle of 70° is 2 inches. Find the area of the sector. (4 pts)

9. You are standing in a flat non-sloping backyard. You measure the angle from your feet to the top of a house to be 30° . You know your distance to the base of the house is 50 ft. How high is the top of the house? (5 pts)