

College Algebra — Exam 4
MAT 140C, Spring 2023 — D. Ivanšić

Name: _____
Show all your work!

1. (8pts) Evaluate without using the calculator. For each problem, write the question you should ask yourself in order to find the logarithms.

$$\log_3 27 = \qquad \log_2 \frac{1}{8} = \qquad \log_a \sqrt[3]{a^4} = \qquad \log_{\sqrt{a}} a^6 =$$

2. (4pts) Use the change-of-base formula and your calculator to find $\log_4 54$ with accuracy 6 decimal places. Show how you obtained your number.

3. (5pts) If $\log_a 3 = 1.098$ and $\log_a 5 = 1.609$, calculate the following values:

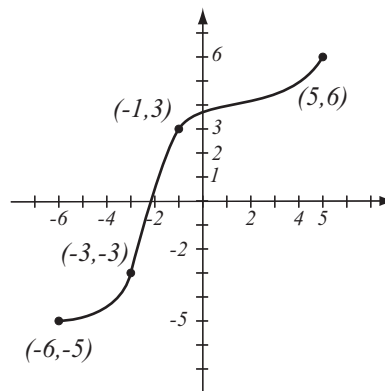
$$\log_a 15 = \qquad \log_a \frac{25}{3} =$$

4. (4pts) Simplify.

$$\ln e^{|x|-1} = \qquad 7^{\log_7 1331} =$$

5. (8pts) If you deposit \$2500 in an account bearing 4.1% interest, compounded quarterly, how much is in the account after 4 years?

6. (6pts) The graph of a function f is given.
- Is this function one-to-one? Justify.
 - If the function is one-to-one, find the graph of f^{-1} , labeling the relevant points, and showing any asymptotes.



7. (9pts) Let $f(x) = \frac{x}{x+3}$.
- Find the formula for f^{-1} .
 - Find the range of f .

8. (6pts) Using transformations, draw the graph of $f(x) = -\ln(x+4)$. Explain how you transform the graph of a basic function in order to get the graph of f . Indicate at least one point on the graph and any asymptotes.

9. (12pts) Write as a sum and/or difference of logarithms. Express powers as factors. Simplify if possible.

$$\ln(e^2 x^3 \sqrt{y}) =$$

$$\log_3 \frac{9x^2 y^4}{xy^6} =$$

10. (12pts) Write as a single logarithm. Simplify if possible.

$$3 \log(w^3 z^2) + 2 \log(w^2 z^{-4}) =$$

$$4 \log_2(x + 5) + 3 \log_2(x - 1) - 2 \log_2(x^2 + 4x - 5) =$$

Solve the equations.

11. (6pts) $16^{2x+1} = 4^{x+3}$

12. (8pts) $4^x = 7^{1-2x}$

- 13.** (12pts) According to census data, the population of Lexington, KY, was 296,000 in 2010 and 323,000 in 2020. Assume that it has grown according to the formula $P(t) = P_0e^{kt}$.
- Find k and write the function that describes the population at time t years since 2010. Graph it on paper.
 - Find the predicted population in the year 2030.

Bonus (10pts) Solve the equation.

$$\log_2(x - 3) + \log_2(x + 1) = 5$$