

College Algebra — Exam 4  
MAT 140C, Spring 2024 — 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.

$$\log_3 9 = \qquad \log_4 \frac{1}{64} = \qquad \log_b \sqrt[3]{b^5} = \qquad \log_{\sqrt{a}} a^3 =$$

2. (4pts) Use the change-of-base formula and your calculator to find  $\log_7 0.07$  with accuracy 6 decimal places. Show how you obtained your number.

3. (5pts) If  $\log_a 2 = 0.3155$  and  $\log_a 5 = 0.7325$ , calculate the following values:

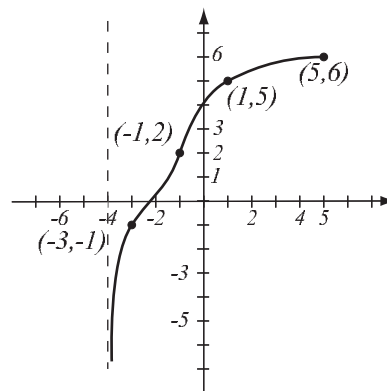
$$\log_a \frac{5}{2} = \qquad \log_a 100 =$$

4. (4pts) Simplify.

$$\log_4 4^{1-3x} = \qquad e^{\ln(2a-3b)} =$$

5. (8pts) If you deposit \$4,000 in an account bearing 3.4% interest, compounded daily, how much is in the account after 5 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  $f(x) = \frac{2x - 5}{x + 6}$ .
- Find the formula for  $f^{-1}$ .
  - Find the range of  $f$ .

8. (6pts) Using transformations, draw the graph of  $f(x) = 3^{x-2} + 1$ . 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.

$$\log_2 \left( 16\sqrt[4]{x^7}y^3 \right) =$$

$$\log_5 \frac{125x^7y^4}{y^7} =$$

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

$$2\log_6(s^7t^4) + 3\log_6(s^{-4}t^3) =$$

$$2\log(x^2 - x - 20) + \log(x - 5) - 3\log_2(x + 4) =$$

Solve the equations.

**11.** (6pts)  $27^{2x+1} = 3^{1-4x}$

**12.** (8pts)  $6^{x-3} = 10^{2x+1}$

**13.** (12pts) Census data has the population of the state of Missouri as 5,989,000 in 2010 and 6,155,000 in 2020. Assume that it has grown according to the formula  $P(t) = P_0e^{kt}$ .

a) Find  $k$  and write the function that describes the population at time  $t$  years since 2010. Graph it on paper.

b) Find the predicted population in the year 2032.

**Bonus** (10pts) Among the four “and” statements below, two are false regardless of which  $a, b, c, d$  are chosen, and two can be true (with the right choice of  $a, b, c, d$ ). Which ones are which and why? (*Hint: use rules for working with logarithms. Note you are not asked to find  $a, b, c, d$ , so don't try. If you can find a reason why the two equations in a statement do not agree with each other, then you have found a false statement.*)

$$\log_a 3 = 0.251 \text{ and } \log_a 9 = 0.502$$

$$\log_b 4 = 1.731 \text{ and } \log_b 16 = 3.03$$

$$\log_c 5 = 1.325 \text{ and } \log_c(5c) = 2.021$$

$$\log_d 7 = 2.513 \text{ and } \log_d(7d) = 3.513$$