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# MATH 11010: Exam #4 (Spring 2013)

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- Find the inverse for  $f(x) = \frac{9x + 2}{4x + 5}$
- Give an example of a function that is not a one-to-one function and explain why it is not one-to-one.
- Find the domain of  $y = \log_8(3x - 11)$
- Evaluate. **Exact Answer Only.**
  - $\log_{125} 5 =$
  - $\log_{1/2} 128 =$
- Rewrite each expression in exponential form.
  - $\log(x + 2) = 2$
  - $\log_2 8x = 5$
- Rewrite each expression in logarithmic form.
  - $x = e^8$
  - $9^{3/2} = 27$
- Sketch the graph of each function. You must include the horizontal asymptote and label one point on the graph.
  - $f(x) = 6^{x+1} - 3$
  - $f(x) = \left(\frac{3}{4}\right)^{x-4} + 2$
- Rewrite the following expression as a single logarithm.
$$3 \log_2(x - 4) - 4 [\log_2(x + 1) + 2 \log_2(x + 7)]$$
- Use the Laws of Logarithms to rewrite the expression in a form with no logarithm of a product, quotient, or power where possible. In other words, write the following expression in expanded form.

$$\ln \frac{x^6(x^2 + 8)^3}{\sqrt[4]{x + 6}}$$

10. Solve for  $x$ . You must show all work. Exact answer(s) only.

$$5 - \log_3(x - 9) = 0$$

11. Solve:  $\log_3(10x - 9) + \log_3 x = 2$

12. Solve:  $\log_3(6 - 2x) - \log_3(x^2 + 3x) = 0$

13. Solve for  $x$ . Give an exact answer and a decimal approximation, accurate to four decimal places.

$$9^{5x+4} = 8$$

14. Solve for  $x$ . Give an exact answer and a decimal approximation, accurate to four decimal places.

$$3(7 + e^{4x-1}) = 39.$$

15. Solve for  $x$ . Give an exact answer and a decimal approximation, accurate to four decimal places.

$$6e^{8x} - 19e^{4x} + 15 = 0$$

16. If \$23,000 is invested in an account paying 3.2% interest compounded continuously, find the amount in the account after 6 years. (Round answers to two decimal places.)

17. If \$5,000 is invested in an account paying  $4\frac{3}{4}\%$  interest per year, compounded quarterly, find the number of years required for the investment to be \$15,750? (Round answer to two decimal places.)

18. The half-life of a radioactive isotope is 125 years. Suppose we begin with a 60 g sample.

- Find the decay rate  $k$ , accurate to four decimal places.
- Find a function that models the mass remaining after  $t$  years.
- After how long will only 12 g of the sample remain?

19. Under ideal conditions, a certain bacteria population grows exponentially at a relative growth rate of 110% per day. Four days after the culture is formed, the count shows 145,250 bacteria. Find the initial number of bacteria in the culture. Round answer to the nearest whole unit.

20. Given that  $\log_a 2 \approx 0.356$ ,  $\log_a 5 \approx 0.827$ ,  $\log_a 9 \approx 1.129$ , find

$$\log_a \frac{10}{3},$$

if possible. Round answer to three decimal places.

## ANSWERS

1.  $f^{-1}(x) = \frac{5x - 2}{9 - 4x}$
2. Any graph that passes the vertical line test but fails the horizontal line test.
3.  $x > \frac{11}{3}$
4. (a)  $\frac{1}{3}$  (b)  $-7$
5. (a)  $x + 2 = 10^2$  (b)  $8x = 2^5$
6. (a)  $8 = \ln x$  (b)  $\log_9 27 = \frac{3}{2}$
7. (a) increasing function passing through  $(-1, -2)$  and horizontal asymptote at  $y = -3$   
(b) decreasing function passing through  $(4, 3)$  and horizontal asymptote at  $y = 2$
8.  $\log_2 \frac{(x - 4)^3}{(x + 1)^4(x + 7)^8}$
9.  $6 \ln x + 3 \ln(x^2 + 8) - \frac{1}{4} \ln(x + 6)$
10.  $x = 252$
11.  $x = \frac{3}{2}$ ; (NOTE:  $x = -\frac{3}{5}$  does not check)
12.  $x = -6, x = 1$
13.  $x = \frac{\log 8}{5 \log 9} - \frac{4}{5} \approx -0.6107$
14.  $x = \frac{1 + \ln 6}{4} \approx 0.6979$
15.  $x = \frac{\ln \frac{5}{3}}{4} \approx 0.1277$ ;  $x = \frac{\ln \frac{3}{2}}{4} \approx 0.1014$
16. \$27,868.42
17. 24.30 years
18. (a)  $k = 0.0055$   
(b)  $A = 60e^{-0.0055t}$   
(c) 292.63 years
19. 1783 bacteria
20. 0.619