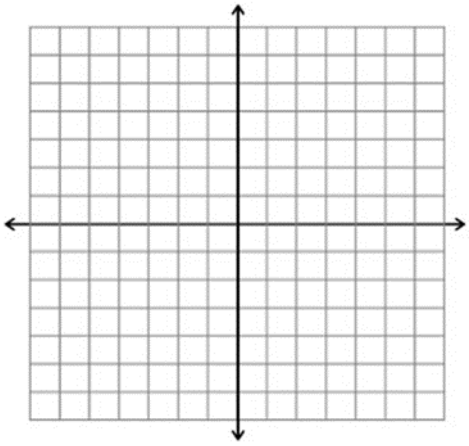
MTH 161, Practice Exam #3, Spring 2019

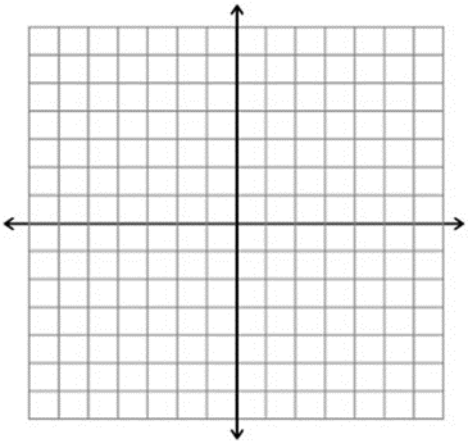
1. Find the function f that is finally graphed after each of the following transformations is applied to $y = 2^x$.
   a. Reflect about the x-axis.
   b. Shift down one unit.
   $f(x) =$_____



2. Sketch a graph of a function which is not one-to-one.

3. A student writes that $(\ln 2)^3 = 3 \ln 2$ by the power property of logarithms. Explain why this is incorrect.

4. Consider the function $f(x) = \ln(2 - x)$. Sketch an accurate graph of the function on graph below.

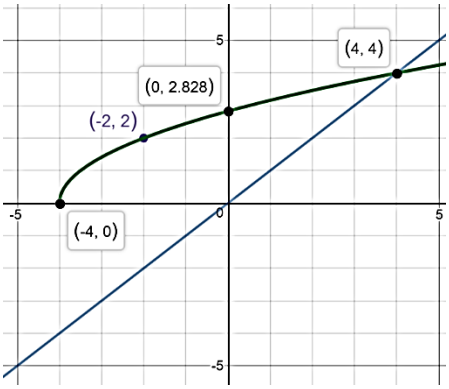


   a. State and label intercepts and asymptotes.

   b. The function is one-to-one. How can you tell from the graph?

   c. Algebraically find the inverse $f^{-1}(x)$.

5. Use the graph below to fill in the function values.



   a. $f(0), f(-2), f^{-1}(2), f^{-1}(4)$

   b. Find the domain and range. How does this relate to the domain and range of $f^{-1}(x)$?

   c. Sketch an accurate graph of f^{-1} on the same graph as f using specific coordinates.

6. Use the properties of logarithms to write the expression $\ln x + \frac{1}{2}\ln(4 - x) - \ln 9$ as a single log expression. Show all intermediate steps.

7. Use properties of logs to expand the expression in terms of logs of the variables and simplify. Show all steps.

   a. $\ln\left(\frac{\sqrt[4]{x}}{8y}\right)$ b. $\log_2(8x^3)$

8. Use the change of base formula to rewrite the expression $\log_2 0.47$ in terms of natural log.

9. An initial investment of $50,000 grows at an annual interest rate of 7% compounded continuously. Use the model $A = Pe^{rt}$ to calculate how long it will take to triple. Show your calculation and express your answer as an exact expression.

10. Find the exact value of the expression.
    a. $3\ln(e^2)$

    b. $\log(10^{14}) - 10^{3\log 2}$

11. Solve the following expressions algebraically. Give exact values.
    a. $2^{3x} = 128$

    b. $\frac{1}{3}\ln(1-x) = 10$

    c. $3 - 5e^{3t} = 10$

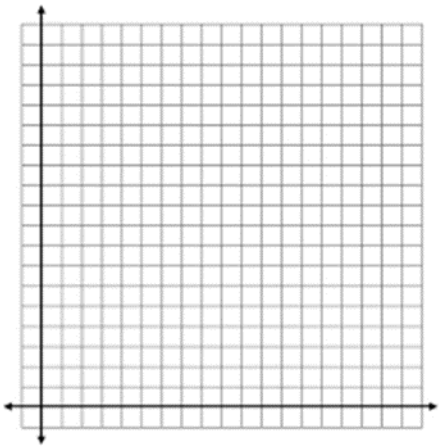
    d. $\ln x + \ln(x+2) = 3$

12. In a group project in learning theory, a mathematical model for the percent P of correct responses after n trials was found to be $P(n) = \frac{0.9}{1+e^{-0.1n}}$.
    a. What percent of the responses are correct in the first trial?
    b. After how many trials will 70% of the responses be correct?

13. A new truck costs $35,000. The value of the truck after t years is modeled by $V(t) = 35000\left(\frac{4}{5}\right)^t$.
    a. Evaluate the function at the given times.

t	$V(t)$
0	
1	
2	
3	

    b. Sketch the graph by hand in an appropriate window range. Label axes.



    c. Find the value of the truck after 7 years. Show work.

    d. Based on the graph, describe how the value of the truck changes as time goes by. Then complete the statement: As time goes by, _____. As $t \to \infty, V(t) \to$_____.

14. Given the graph of $f(x) = \ln x$, then the graph of $y = \ln(x-k)$, $k > 0$, then which of th following is true?
    a. A vertical asymptote at $x = k$.
    b. A horizontal asymptote at $y = k$.
    c. A vertical asymptote at $x = 0$.
    d. A horizontal asymptote at $y = 0$.

15. What logarithmic equation is equivalent to $c^b = a$?

16. What is the first step to solving the equation $2 + \ln(x + 1) = 7$.

17. Which statement is true? Mark all that apply.
    a. $2^x \log_2 x = x$
    b. $\log_2 2^x = x$
    c. $2^{\log_2 x} = x$
    d. $\log_2 x = 2^x$

18. The expression $\log x - 3 \log 2$ is equivalent to $\log(x - 8)$ is true or false?