**Meramec College Algebra TEST 4 Spring 2008**

NAME: _____Score_____/100

Please print

**SHOW ALL YOUR WORK IN A NEAT AND ORGANIZED FASHION** Course Average _____

**Questions 1-20 are 2 pts each, 21 – 32 are 5 pts each.**

1. T F The ln function has an inverse
2. T F The $\log_7$ and ln functions have the same x-intercepts.
3. T F If kt and ph are functions then (kt + ph)(x) = kt(x) + ph(x).
4. T F The base for the exp function is 10
5. T F $\ln \circ \exp(3x + 7) = 3x + 7$
6. T F The graph of ln is entirely above the x-axis.
7. T F The graph of exp is entirely above the x-axis.
8. T F If the graph of a function fails the horizontal line test, the function has no inverse.
9. T F If the graph of a function is a non-horizontal line, the function has an inverse.
10. T F ln(x+y) = ln(x) + ln(y)
11. T F If t is a real number, then ln(t) is a positive real number.

**Fill in the blanks**

12. The zero of the ln function is 1
13. The y-intercept of log is there is none
14. The domain of exp is The Real numbers
15. The domain of ln is The Positive Real Numbers
16. If f and g are functions such that $f \circ g(x) = x$ and $g \circ f(x) = x$, then f and g are inverses
17. If the rule for a function f is $f(x) = 3^{x-5}$, then f(8) = 27
18. What is the rule for the $\exp_2$ function? $\exp_2(x) = 2^x$
19. The inverse $f^{-1}$ of a function f is the inverse with respect to composition
20. If q and p are functions, the rule for the composition $p \circ q$ is $p \circ q(x) = p(q(x))$

**For the remaining problems you must show your work to receive credit.**

21. Solve the equation $3e^x = 10$

$$e^x = \frac{10}{3}$$

$$\ln\left(e^x\right) = \ln\left(\frac{10}{3}\right)$$

$$x = \ln\left(\frac{10}{3}\right)$$

22. The rule for the function f is $f(x) = 7x + 9$. Find the rule for its inverse $f^{-1}$. Show the steps.

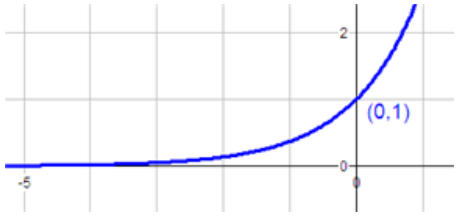
$y = 7x + 9$
$x = 7y + 9$
$x - 9 = 7y$
$y = \frac{x - 9}{7}$
$f^{-1}(x) = \frac{x - 9}{7}$

23. Solve the equation $\ln(3x - 2) = 1$

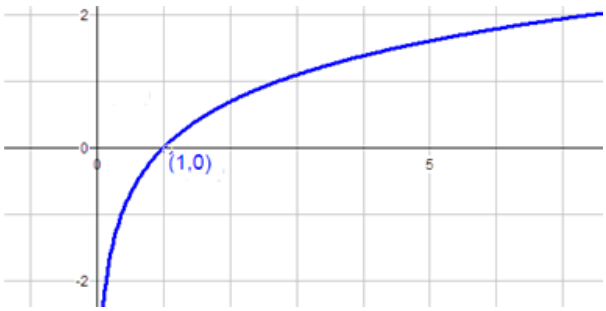
$\ln(3x - 2) = 1$
$\exp(\ln(3x - 2) = \exp(1)$
$3x - 2 = e^1$
$3x = e + 2$
$x = \frac{e + 2}{3}$

24. Suppose the process of solving the equation $\ln(2x - 3) + \ln(x + 4)^3 = 5\ln(x) + \ln(2x + 7)$ produces the real number 1 as a possible solution. **Explain why 1 is not a solution of the equation.**
**NOTE:** Do not substitute 1 into the equation and determine that a false statement results—that procedure will fail and is a waste of your time.
Because if $x = 1$, then $2x - 3 = -1 < 0$ is not in the domain of the ln function.

25. Sketch the graph of exp.




26. Sketch the graph of ln



27. Write $e^3 = y$ in logarithmic form

$\exp(3) = y$

$\ln(\exp(3)) = \ln(y)$

$3 = \ln(y)$

28. If f and g are functions such that f(2) = 7, f(4) = 3, g(2) = 4, and g(7) = 4, then $f \circ g(2) = 3$.

$f \circ g(2) = f(g(2)) = f(4) = 3$

29. Suppose f and g are functions whose rules may be written as $f(x) = 2x^2 - 1$ and $g(x) = 3x + 2$. Find the rule for the composition $g \circ f$. Write the rule correctly as a rule.

$g \circ f(x) = g(f(x)) = g(2x^2 - 1) = 3(2x^2 - 1) + 2 = 6x^2 - 3 + 2 = 6x^2 - 1$

30. The rule for a function f is $f(x) = \sqrt{x - 5}$. Find two functions g and h (give their rules) such that $f = g \circ h$ Let $g(x) = \sqrt{x}$ and let h(x) = x - 5

31. Simplify ln(x) + ln(x + 1).

$\ln(x) + \ln(x + 1) = \ln[x(x + 1)] = \ln(x^2 + x)$

32. The rules for two function f and g are $f(x) = \frac{x}{x-2}$ and $g(x) = \frac{x+2}{x}$. Show that f and g are not inverses of each other.

$$f \circ g(x) = f(g(x)) = f\left(\frac{x+2}{x}\right) = \frac{\frac{x+2}{x}}{\frac{x+2}{x} - 2} = \frac{\frac{x+2}{x}}{\frac{x+2}{x} - \frac{2x}{x}} = \frac{\frac{x+2}{x}}{\frac{-x+2}{x}} = \left(\frac{x+2}{x}\right)\left(\frac{x}{-x+2}\right) = \frac{x+2}{-x+2} \neq x$$

Because $f \circ g(x) \neq x$, f and g are not inverses of each other.