

Name _____ Date _____ Period _____

For problems 1 – 4, solve each equation. Do not use logarithms.

1.

$$\frac{5^{3x-1}}{5^{2x-5}} = 5^{7x+6}$$

2.

$$64^x = 16^{3x+1}$$

3.

$$\left(\frac{1}{216}\right)^{3-x} = 36^{3x+6}$$

4.

$$32^{x+6} \cdot \frac{1}{\sqrt{2}} = 8^{x-1}$$

Evaluate each logarithm. You need to show all work and not use a calculator.

5. $\log_3 81$	6. $\log_8 \sqrt{2}$
7. $\log_2 \frac{1}{16}$	8. $\ln \sqrt[3]{e^2}$

Condense each into a **single** simplified logarithm.

9. $\log_{12} 18 + 3 \log_{12} 2$	10. $\ln(x^2 - 9) - \ln(x^2 + 7x + 12)$
11. $\log x - 3 \log y + \frac{1}{2} \log x - 2 \log w$	12. $3 \log_4(x^2) + \frac{1}{2} \log_4 \sqrt{x}$

Expand each logarithm **completely**. Final answers should not have any exponents anywhere.

13. $\log_4(2w^4)^3$	14. $\log\left(\frac{m^5}{\sqrt{n}}\right)^3$
15. $\ln(x^7\sqrt[3]{1-x})$	16. $\ln\left(\frac{x\sqrt{x^2-1}}{(x-3)^2}\right)$

Solve each equation. Round your answer to three decimal places. You may only use the natural log, if needed.

17. $e^{2x-1} = 3$	18. $4^{x+8} = 5$
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19. $\frac{1}{4} = \log_{16}(17 - 5x)$	20. $\ln(2x - 5) = 3$
21. $\log 12 + \log 5 = \log 4 + \log(m + 2)$	22. $\log_2(3x - 2) - \log_2(x - 5) = 4$
23. $3^{1-x} = 5^{2x+1}$	24. $\log_4 x + \log_4(x + 2) = \log_4 60 - \log_4 4$

25.

$$\log_3(2a - 15) = 2$$

26.

$$3^{2x-1} = 19$$

27.

$$\log_2 x - \log_2(x - 4) = 4$$

28.

$$\ln(x + 7) - \ln 6 = 2$$

29. The population of a colony of mosquitoes obeys the law of uninhibited growth. There are 1000 mosquitoes at 2:00 pm on April 25 and there are 1800 at 2:00 pm on April 26.

(a) Write a function that relates the time in days to the population of mosquitoes.

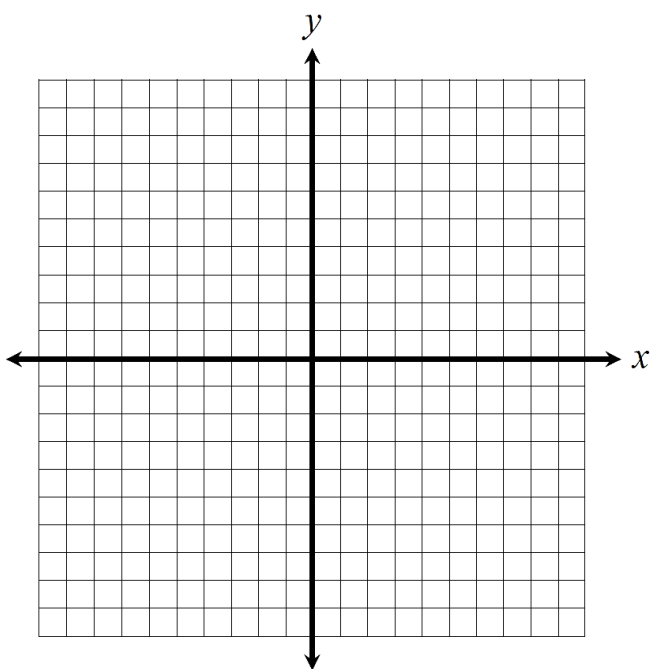
(b) Predict the size of the colony at 8:00 pm on April 27.

(c) On what day and at what time do you predict there to be 10,000 mosquitoes?

30. You are walking home and stumble upon a dead body! You call the police immediately and then it occurs to you that you may be considered a suspect in the murder. You want to prove that you should not even be considered as a suspect, so you plan to determine when the murder occurred. You look down at your phone and the time is exactly 8:30 pm and the temperature outside is 75°F . Surprisingly enough, you have a thermometer in your pocket and decide to take two temperature readings of the body. The 8:30 pm reading says 97°F . Twenty minutes later, the temperature reading is 94°F . At what time did the murder occur, assuming the victim had a body temperature of 98.6°F upon demise?

31. An endangered species of fish has a population that is decreasing exponentially. The population 5 years ago was 1800. Today, only 800 of the fish are alive. Once the population drops below 100, the situation will be irreversible. When will this happen?
32. The hotel Bora-Bora is having a pig roast. At noon, the chef puts the pig in a large earthen oven, which reads 750°F . The pig's original temperature was 75°F . At 2:00 pm, the chef checked the pig's temperature and was upset because it had reached only 100° . At what time may the hotel serve its guests, assuming that pork is done when it reaches 175°F ?

33. Create a table of values and sketch the graph of the function $f(x) = \log_2(x + 3) - 1$. Then, state the characteristics.



Domain: _____

Range: _____

End Behavior:

As $x \rightarrow$ _____, $f(x) \rightarrow \infty$

As $x \rightarrow$ _____, $f(x) \rightarrow -\infty$

Asymptote: _____