UNIT 2 - LESSON 7

SECONDARY MATH III // UNIT 2
Inverse & Exponential Functions – Lesson 7

Period Date

Name

READY

Topic: Converting between exponential and logarithmic forms of equations. Evaluating logarithms.

Recall $a^b = c$ is equivalent to $log_a c = b$.

Convert to logarithmic form. State whether or not the equation is a true statement. If false, make a correction so that it is a true statement.

1. $2^9 = 512$ $\log_2 512 = 9$; True
2. $10^{-2} = 0.1$ $\log 0.1 = -2$; False $10^{-2} = 0.01$ or $10^{-1} = 0.1$
3. $\left(\frac{2}{3}\right)^{-1} = \frac{3}{2}$ $\log_{\frac{2}{3}} \frac{3}{2} = -1$; True

Convert to exponential form. State whether or not the equation is a true statement. If false, make a correction so that it is a true statement.

4. $log_4 2 = -2$ $4^{-2} = 2$; False $\log_4 2 = \frac{1}{2}$
5. $log_{\frac{1}{3}} 3 = -1$ $\left(\frac{1}{3}\right)^{-1} = 3$; True
6. $log_{\frac{2}{5}} \frac{8}{125} = 3$ $\left(\frac{2}{5}\right)^3 = \frac{8}{125}$; True

Evaluate the following logarithms.

7. $log 10 = 1$
8. $log 10^{-7} = -7$
9. $log 10^{75} = 75$
10. $log_3 27 = 3$

* Common log

11. $log_3 3^5 = 5$
12. $log_8 16 = 4/3$ $8^x = 16$, $2^{3x} = 2^4$, $x = 4/3$
13. $log_4 64 = 3$
14. $log_m m^n = n$

SET

Topic: Solving exponential equations using multiple representations

Fill in the missing values of the tables below. If needed, round to the nearest hundredth.

15.

x	$y = 10^x$
-2	0.01
1	10
0	1
2	100
4	10000

16.

x	$y = 3 \cdot 10^x$
-1	0.3
0	3
1.50	94.87
2	300
2.70	1503.56

some way

$94.87 = 3 \cdot 10^x$
$\frac{94.87}{3} = 10^x$
$\log\left(\frac{94.87}{3}\right) = x$

17. The graph of $f(x) = 10^{-x}$ is given below. Use the graph to solve the equation for x and label the solutions.

a. $40 = 10^{-x}$ $\log 40 = -x$

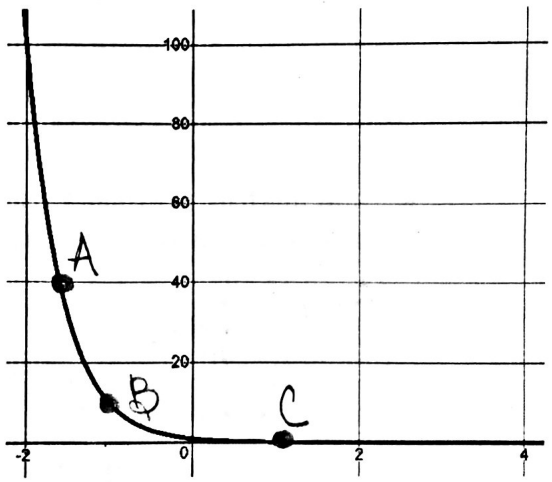
$x = -1.6021$. Label the solution with an A on the graph.

b. $10^{-x} = 10$ $-x = 1$ $x = -1$

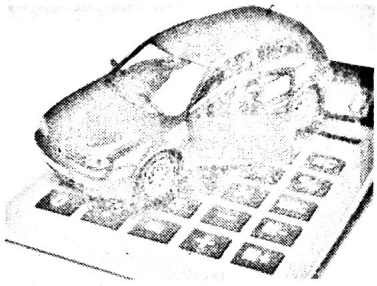
$x = -1$. Label the solution with a B on the graph.

c. $0.1 = 10^{-x}$ $\frac{1}{10} = 10^{-x}$ $10^{-1} = 10^{-x}$ $-1 = -x$

$x = 1$. Label the solution with a C on the graph.



18. Your Uncle Thom, Edna's husband, is concerned that now that they are getting older, they need a safer car to drive. They like to travel a lot, so he is looking for a small SUV. He is trying to decide between buying a new or used car. After doing some research, he finds out that most cars lose value each year by a process known as depreciation. You may have heard before that a new car loses a large part of its value in the first 2 or 3 years and continues to lose its value, but more gradually, over time. That is because the car does not lose the same amount of value each year, but it loses approximately the same percentage of its value each year.



a. What kind of model would be useful for calculating the value of a car over time?

An exponential decay model.

b. Uncle Thom is looking at purchasing a Subaru Outback for $26,232. The 2018 Subaru Outback is predicted to depreciate at a rate of 15% each year. What percentage of the car's value remains each year?

Depreciates 15%
∴ 85% of the car's value remains

c. What would be the value of the car after 8 years? Show your thinking.

$f(x) = 26,232(.85)^x$ Where x = # of years, y = value of car

$f(8) = 26,232(.85)^8$

$= \$7147.97$

d. When will the depreciated value of the car be worth $5000? Show your thinking.

$5000 = 26,232(.85)^x$

$\frac{5000}{26,232} = .85^x$

$\log_{.85}\left(\frac{5000}{26,232}\right) = x$

$\ln(.191) / \ln .85 = x$

e. How much money could Uncle Thom save if he buys this car used in two years, rather than buying it new? What advice might you give Uncle Thom about buying new vs. used cars?

Value in 2 years $F(2) = 26,232(.85)^2$
$= \$18,952.62$

$\therefore$ save $26,232 - 18952.62$
$= \$7279.38$

Advice varies
- Costs less used
- Lasts longer new
⋮

GO

Topic: Solving simple exponential equations.

* Use the idea that $a^x = a^y$ if and only if $x = y$ to solve the following exponential equations. } work for #19-22

19. $3^{x+4} = 243$
$3^{x+4} = 3^5$
$x+4=5$
$x=1$

20. $\left(\frac{1}{2}\right)^x = 8$
$2^{-x} = 2^3$
$-x=3$
$x=-3$

21. $\left(\frac{3}{4}\right)^x = \frac{27}{64}$
$\left(\frac{3}{4}\right)^x = \left(\frac{3}{4}\right)^3$
$x=3$

22. $10^x = 10000$
$10^x = 10^4$
$x=4$

23. $125 = 10^x$
$\log 125 = x$
$2.0969 = x$

24. $10^{x+2} = 347$
$\log 347 = x+2$
$\log(347) - 2 = x$
$.5403 = x$

25. $5 \cdot 10^{x+2} = 0.25$
$10^{x+2} = .05$
$\log .05 = x+2$
$\log(.05) - 2 = x$
$-3.3010 = x$

26. $10^{-x-1} = \frac{1}{36}$
$\log\left(\frac{1}{36}\right) = -x-1$
$x = -\log\left(\frac{1}{36}\right) - 1$
$x = .5563$

27. $-(10^{x+2}) = 16$
$10^{x+2} = -16$
No solution