Logarithms (8.1)   *p380*   *day 1*

Math contest with a questionnaire

What is the lesson for all of us?

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5. In a certain chemical reaction the original concentration of 0.03 is reduced to 0.01 in 4 minutes.
   a. What is the continuous rate of decrease in the concentration per minute?
   b. What will the concentration be in 10 minutes?

6. A manufacturer of snow blowers determines that he will use this function to quote the wholesale price for his most popular product: $P(x) = 500 - 0.5e^{0.004x}$, where x is the number of snow blowers ordered.
   a. What will the price per snow blower be if a company orders 1000?
   b. The West Royalty Hardware Company orders 500 snow blowers and the Coady Tool Company orders 1500. What will be the difference in the unit price of these two orders?
   c. If the unit price quoted is $488, how many units were ordered?

7. Given the half-life of a radioactive substance is 10 minutes, how much will be left of a 5 gram sample after 20 minutes?

8. A radioactive substance decays from 3 grams to 2 grams in 1 hour. Find the half-life.

day 1

The population of a cert according to the law of

The population of a cert past 20 years at the rate

There were 1000 bacter continuous rate of incre

If the growth of a certain hour, how long will it ta

$$.01 = 0.03e^{r4}$$
$$P(10) = 0.03e^{-0.27c(10)}$$

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ex1: On Oct 30 there was an earthquake in Turkey with a magnitude 6.6 on the Richter scale. Yesterday there was an earthquake of 4.5 in Chile. How much stronger was the Turkish one?

$$\frac{10^{6.6}}{10^{4.5}}$$

$$= 10^{6.6-4.5}$$

$$= 10^{2.1}$$

$$\boxed{= 125 \text{ times}}$$

4.5
5.5

4)
5)
6

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Many things work on an exponential scale. Especially things that measure intensity.

examples: sound - dB
                 earthquakes - Richter scale
                 pH

Because they increase so rapidly, we find it easier to represent them on a <u>logarithmic</u> scale.

try solving: $10^x = 80595$ to 4 decimal places   **4.9063**

on a calculator: $\log 80595$ **4.9063**

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ex2: Write in logarithmic form.

$$2^6 = 64 \qquad \log_2 64 = 6$$

$$10^3 = 1000 \qquad \log 1000 = 3$$

$$7^{-1} = \frac{1}{7} \qquad \log_7 \tfrac{1}{7} = -1$$

The **log** gives the **exponent** of the **base**

$$\log_5 125 = 3$$

exponent ↓

base ↑

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ex3: Write in exponential form.

$$\log 10000 = 4 \qquad \log_5 \frac{1}{25} = -2$$

$$10^4 = 10\,000 \qquad 5^{-2} = \frac{1}{25}$$

note: assume base 10 unless you see otherwise

ex4: Evaluate

$$\log_2 32 \qquad \log 100 \qquad \log_2 128$$
$$= 5 \qquad\quad = 2 \qquad\quad = 7$$

$$\log 0.001 \qquad \log_4 4^5 \qquad \log_3 \frac{1}{81}$$
$$= -3 \qquad\quad = 5 \qquad\quad = -4$$

2, 3, 4

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ex5: Find x

$$\log_3 27 = x \qquad \log_x 49 = 2 \qquad \log_8 x = \frac{1}{3}$$

$3^x = 27$ $x^2 = 49$ $8^{\frac{1}{3}} = x$

$\boxed{x = 3}$ $\boxed{x = 7}$ $\boxed{x = 2}$

B^eN   log bNe

B^e=N $\log_b N = e$
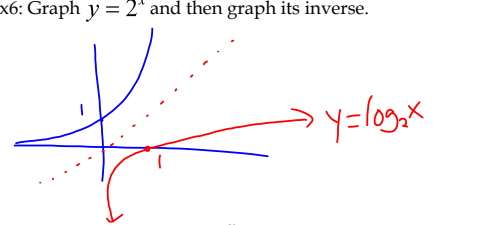
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ex6: Graph $y = 2^x$ and then graph its inverse.

$y = \log_2 x$

note: $x = 2^y$ is the same as $y = \log_2 x$

both are inverses of $y = 2^x$

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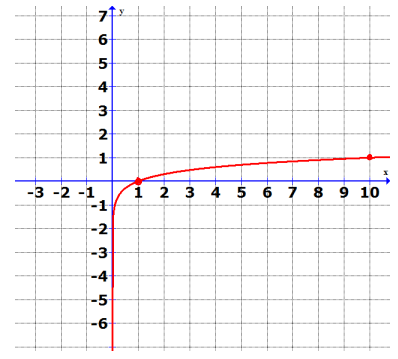
A look at the graph of $y = \log x$

discuss:

x-intercept 1

y-intercept n/a

domain $x > 0$
$(0, \infty)$

range $y \in \mathbb{R}$
$(-\infty, \infty)$

key point at (10, 1)

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hw: p380#15, 17, 19