

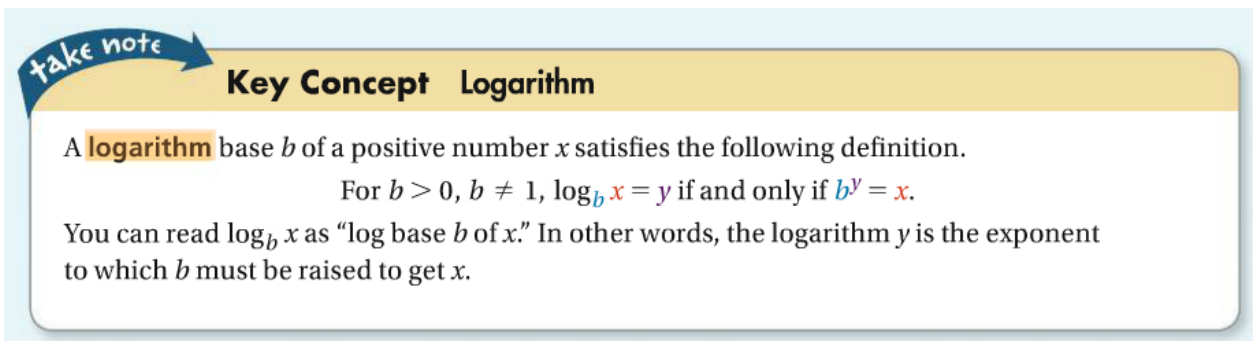
Aim: What is a logarithm and how do we calculate it? (Section 7.3)

Do Now: Graph the function $y = 4^x$ by using a table. What is the inverse of the function?

I – Logarithmic Functions as Inverses

1- What is a logarithm? (Google it)

2-



Take note

Key Concept Logarithm

A **logarithm** base b of a positive number x satisfies the following definition.

For $b > 0$, $b \neq 1$, $\log_b x = y$ if and only if $b^y = x$.

You can read $\log_b x$ as “log base b of x .” In other words, the logarithm y is the exponent to which b must be raised to get x .

3- Write each equation in logarithmic form.

1. $32 = 2^5$ 2. $243 = 3^5$ 3. $625 = 5^4$

4- Write each equation in exponential form.

4. $\log_3 9 = 2$ 5. $\log_5 125 = 3$ 6. $\log_8 512 = 3$

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II - Evaluate each logarithm.

7. $\log_9 27$

$$\begin{aligned}\log_9 27 &= x \\ 27 &= 9^x \\ 3^3 &= (3^2)^x \\ 3^3 &= 3^{2x} \\ 3 &= 2x \\ x &= \end{aligned}$$

8. $\log_8 256$

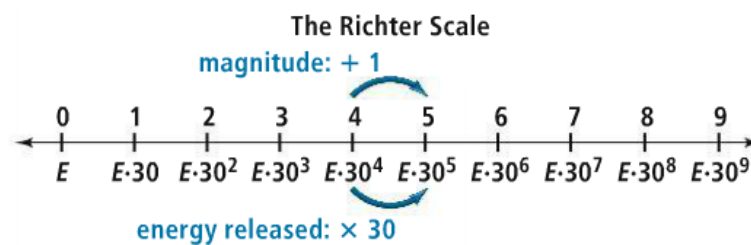
$$\begin{aligned}\log_8 256 &= x \\ 256 &= 8^x\end{aligned}$$

9. $\log_{125} \frac{1}{25}$

$$\log \frac{I_1}{I_2} = M_1 - M_2$$

The formula $\log \frac{I_1}{I_2} = M_1 - M_2$ is used to compare the intensity levels of earthquakes. The variable I is the intensity measured by a seismograph. The variable M is the measurement on the Richter scale. Use the formula to answer the following problem.

Many measurements of physical phenomena have such a wide range of values that the reported measurements are logarithms (exponents) of the values, not the values themselves. When you use the logarithm of a quantity instead of the quantity, you are using a **logarithmic scale**. The Richter scale is a logarithmic scale. It gives logarithmic measurements of earthquake magnitude.



10. In 1906, an earthquake of magnitude 8.25 hit San Francisco, California. Indonesia was hit by an earthquake of magnitude 8.5 in 1938. Compare the intensity of the two earthquakes.

Aim: What is a logarithm and how do we calculate it? (Section 7.3)

III – Translating $y = \log_b x$

1-

Take note

Concept Summary Families of Logarithmic Functions

Parent functions:	$y = \log_b x, b > 0, b \neq 1$
Stretch ($ a > 1$) Compression (Shrink) ($0 < a < 1$) Reflection ($a < 0$) in x -axis	$y = a \log_b x$
Translations (horizontal by h ; vertical by k)	$y = \log_b (x - h) + k$
All transformations together	$y = a \log_b (x - h) + k$

2 - Identify each function as a compression, a stretch, or a translation of the parent function.

11. $y = 4 \log_3 x$

12. $y = \log_2 x + 10$

13. $y = 0.25 \log_4 x$

3- Transform the function $y = \log_5 x$ as indicated below.

14. stretch by a factor of 3 and translate 6 units up

15. compress by a factor of 0.4 and reflect in the x -axis

16. **Error Analysis** A student drew the graph below to represent the function $y = \log_4 x$. What mistake did the student make when she drew her graph?

