

More Formulas

Change the Base

Formula

$$\log_a b = \frac{\log b}{\log a}$$

Calculator is
in base 10.

Example:

$$\log_3 5 = x$$

$$\frac{\log 5}{\log 3} = x$$

$$\log(5)/\log(3)$$

1.46

Convert to Exp.

Formula

$$\log_a b = c$$

$$a^c = b$$

$$\log_5 12 = x$$

$$\cancel{\log_5} 12 = x$$

Base

→ 5

Base of the exponential

$$12 = 5^x$$

Convert to Log

$$a^x = b$$

$$\log_a b = x$$

$$3^x = 8$$

$$\log_3 8 = x$$

Convert to Log

$$a^x = b$$

$$\log_a b = x$$

$$3^x = 8$$

$$\log_3 8 = x$$

Solve for x .

* change the base formula

$$\log_3 8 = x$$

$$\frac{\log 8}{\log 3} = x$$

$$\boxed{\frac{\log(8)}{\log(3)}} \\ 1.8$$

Two ways to solve

$$5^x = 12$$

① $5^x = 12$
convert to log.

$$\log_5 12 = x$$

Change base formula

$$\frac{\log 12}{\log 5} = x$$

calculator

$$\frac{\log(12)/\log(5)}{1.54}$$

② $5^x = 12$
 $\log 5^x = \log 12$

property of log

$$\log a^x = x \log a$$

$$x \log 5 = \log 12$$

$$\frac{x \log 5}{\log 5} = \frac{\log 12}{\log 5}$$

$$x = \frac{\log 12}{\log 5}$$

$$\frac{\log(12)/\log(5)}{1.54}$$

calculator

Practice

$$8^x = 14$$

①

$$\log_8 14 = x$$

Change the base

$$\frac{\log 14}{\log 8} = x$$
$$1.27 = x$$

②

$$\log 8^x = \log 14$$
$$\frac{x(\log 8)}{(\log 8)} = \frac{\log 14}{\log 8}$$
$$x = \frac{\log 14}{\log 8}$$
$$x = 1.27$$

$$\textcircled{1} \quad 4^3 = X$$

$$\textcircled{2} \quad 7^x = 2$$

Evaluate

$$\textcircled{3} \quad \log_5 3$$

$$\textcircled{4} \quad \log_x 125 = 5$$

$$\textcircled{1} \quad 4^3 = x$$

$$64 = x$$

$$\log 4^3 = \log x$$

What is 4^3 ? = 64

$$4^3 = 64$$

$$4^3 = x$$

$$64 = x$$

$$\textcircled{2} \quad 7^x = 2$$

$$\log_7 2 = x$$

$$\frac{\log 2}{\log 7} = x$$

$$\log 7^x = \log 2$$

$$x \log 7 = \log 2$$

$$x = \frac{\log 2}{\log 7}$$

$$x = 0.35$$

Evaluate

$$\textcircled{3} \log_5 3 = ?$$

$$\log_5 3 = x$$

$$\frac{\log 3}{\log 5} = 0.68$$

$$\boxed{\log(3) / \log(5)}$$

$$\textcircled{4} \log_x 125 = 5$$

$$x^5 = 125$$

↑
Guess
and
check

... but it is a
number between 2 and 3.

$$\frac{\log 125}{\log x} = 5$$

$$5(\log x) = \log 125$$

$$\log x = \frac{\log 125}{5} \text{ Evaluate}$$

$$\log x = 0.42$$

$$\log_{10} x = 0.42$$

~~$$\log_{10} x = 0.42$$~~

$$x = 10^{0.42}$$

$$x = 2.63$$

change to
exponential

calculator

$10^{0.42}$
2.63

$$\cancel{\log_{10}} x = 0.42$$

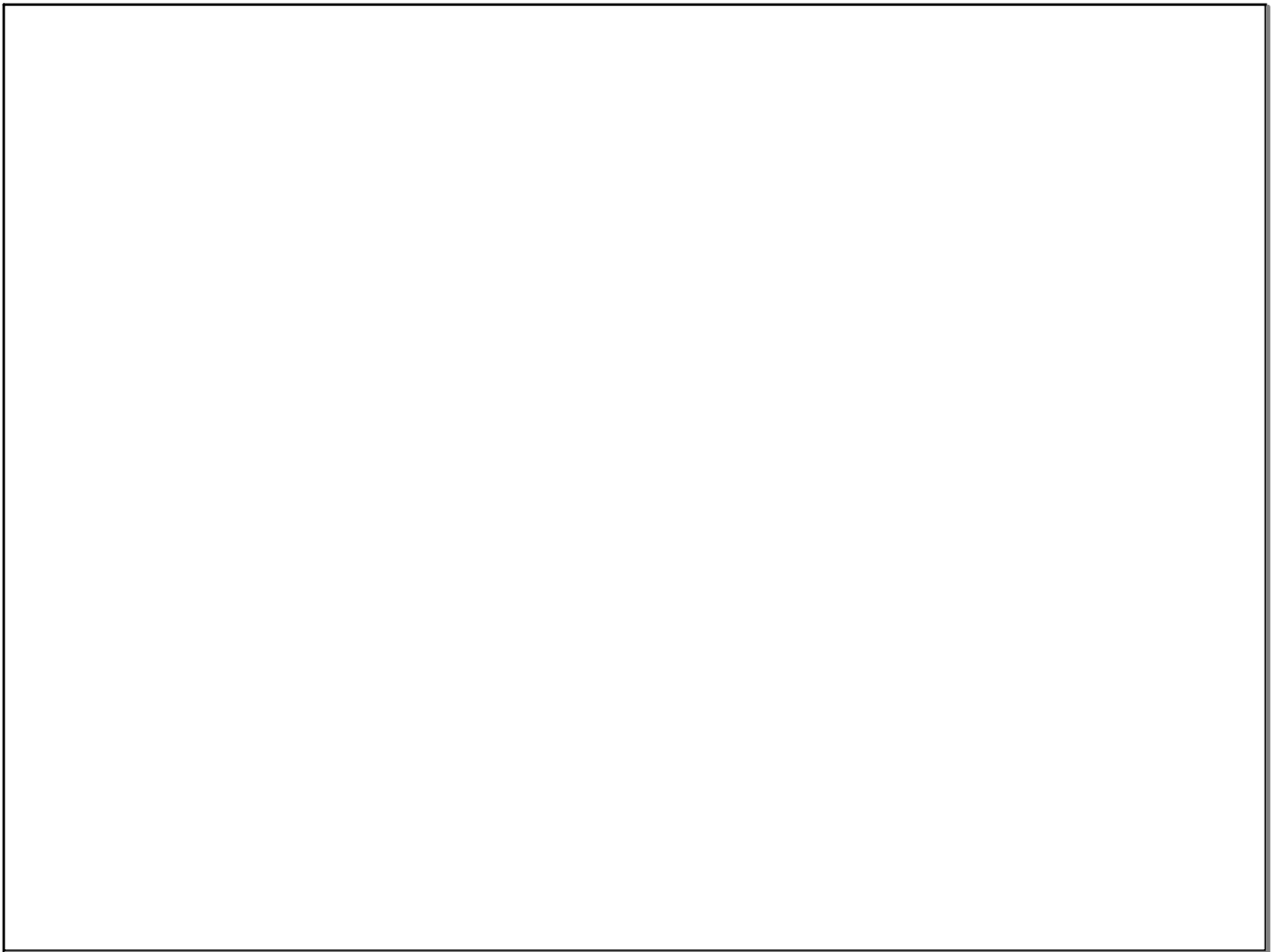
$$x = 10^{0.42}$$

$$x = 2.63$$

change to
exponential

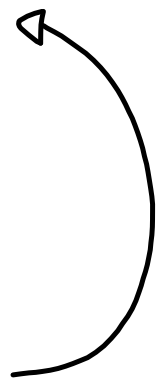
calculator

$10^{0.42}$
2.63



$$\textcircled{1} \quad 4^3 = X$$

$$64 = X$$

$$\log_4 X = 3$$


$$\textcircled{2} \quad 7^x = 2$$

$$\log_7 2 = x$$

$$\frac{\log 2}{\log 7} = x$$

$$\boxed{\begin{array}{l} (\log 2) / (\log 7) \\ 0.356 \end{array}}$$

$$\text{or} \quad \log 7^x = \log 2$$

$$x (\log 7) = \log 2$$

$$x = \frac{\log 2}{\log 7}$$

Evaluate

$$\textcircled{3} \log_5 3$$

$$\frac{\log 3}{\log 5}$$

$$\log(3) / \log(5)$$
$$0.682$$

$$\textcircled{4} \log_x 125 = 5$$

$$x^5 = 125$$

$$\log x^5 = \log 125$$

$$5 \log x = \log 125$$

Guess & check

You will learn
later on how
to solve.

11) $\log_2 5x^2 - \log_2 9 = \log_2 50$

12) $\log_8 2 + \log_8 (x^2 + 1) = \log_8 12$

13) $343^{-x} = \frac{1}{7}$

14) $3^{2a-3} = 3^{2a}$

15) $2^{2x} = 8$

16) $2^{3m} = 2^{3m+2}$

17) $216^p = 36^p$

18) $216^{-x-3} = \frac{1}{6}$

Solve each equation. Round your answers to the nearest ten-thousandth.

19) $-5 \cdot 2^{6x} = -44$

20) $8e^{m+7} = 83$

21) $-6 \cdot 19^{-9x} = -23$

22) $15^{n-10} - 1 = 97$

23) $5^{k+10} + 7 = 78$

24) $-16^{n+10} = -42$

More Formulas

Change the Base

$$\log_a b = \frac{\log b}{\log a}$$

$$\log_5 2 = x$$

$$\log_{10} = \log$$

$$\frac{\log_{10} 2}{\log_{10} 5} = x$$

$\log(2) / \log(5)$ 0.430 <u>calculator</u>

... if answer = 0.456

mistake $\log[2 / \log(5)]$

Must close
parenthesis

$$\log\left(\frac{2}{\log 5}\right)$$

Convert to Exp.

$$\log_5 x = 3$$

~~\log_5~~ $\rightarrow 5$

$$x = 5^3$$

$$\log_a b = x$$
$$b = a^x$$
$$a^x = b$$

Convert to Log

$$a^x = b$$
$$\log_a b = x$$

$$5^x = 12$$

$$\log_5 12 = x$$

Convert to Log

$$a^x = b$$

$$\log_a b = x$$

$$3^x = 8$$

$$\log_3 8 = x$$

Two ways to solve

$$5^x = 12$$

↳ convert to log

$$\log_5 12 = x$$

use change the base

$$\frac{\log 12}{\log 5} = x$$

calculator

$$\frac{\log(12)/\log(5)}{1.54}$$

$$1.54 = x$$

$$5^x = 12$$

$$5^x = 12$$

$$\log 5^x = \log 12$$

property of log

$$\log a^x = x \log a$$

$$\log 5^x = \log 12$$

$$x(\log 5) = \frac{\log 12}{\log 5}$$

$$x = \frac{\log 12}{\log 5}$$

$$\frac{\log(12)/\log(5)}{1.54}$$

$$x = 1.54$$

Practice

$$8^x = 14$$

$$8^x = 14$$

$$\log_8 14 = x$$

$$\frac{\log 14}{\log 8} = x$$

$$1.27 = x$$

$$8^x = 14$$

$$\log 8^x = \log 14$$

$$x \frac{\log 8}{\log 8} = \frac{\log 14}{\log 8}$$

$$x = \frac{\log 14}{\log 8}$$

$$x = 1.27$$

$$\textcircled{1} \quad 4^3 = X$$

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Evaluate

$$\textcircled{3} \quad \log_5 3$$

$$\textcircled{4} \quad \log_x 125 = 5$$

$$\textcircled{1} \quad \textcircled{4^3} = x$$

$$4^3 = 64$$

$$x = 64$$

$$\boxed{4^3} = x$$

$$64 = x$$

$$\log_4 x = 3$$

$$4^3 = x$$

$$64 = x$$

$$\textcircled{2} \quad 7^x = 2$$

$$\log_7 2 = x$$

$$\frac{\log 2}{\log 7} = x$$

$$\log 7^x = \log 2$$

$$x (\log 7) = \log 2$$

$$x = \frac{\log 2}{\log 7}$$

$$x = 0.36$$

Evaluate

$$\textcircled{3} \log_5 3 = x$$

$$\frac{\log 3}{\log 5} = 0.68$$

$$\textcircled{4} \log_x 125 = 5$$

$$x^5 = 125$$



Guess & Check

Some number between
 $x=2$ and $x=3$

$$\log x = \log_{10} x$$

change
to
exponential

$$\frac{\log 125}{\log x} = 5$$

$$\frac{\log 125}{5} = \frac{5(\log x)}{5}$$

$$\frac{\log 125}{5} = \log x$$

$$\log x = \frac{\log 125}{5}$$

↓ decimal

$$\log x = .42$$

$$\log_{10} x = .42$$

$$\log_{10} x = .42$$

$$x = 10^{.42}$$

$$x = 2.63$$

11) $\log_2 5x^2 - \log_2 9 = \log_2 50$

12) $\log_8 2 + \log_8 (x^2 + 1) = \log_8 12$

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