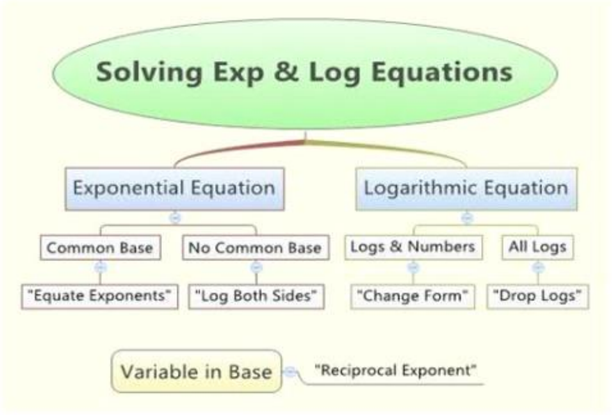
Tuesday, March 5th

Plan For Today:

1. Questions & Review from 8.4?
   - Do 5.3 Check-in Quiz Log Laws
2. Finish Chapter 5: Exponents & Logarithms
   - 5.1: Exponents
   - 5.2: Logarithmic Functions and Graphs
   - 5.3: Properties of Logarithms
   - **5.4: Exponential and Logarithmic Equations**
   - **5.5: Applications of Exponential and Log Equations**
3. Work on Practice Questions from Workbook



Plan Going Forward:

1. Finish going through Ch5 and chapter practice questions in workbook (5.6) and finish working on the practice review questions handout.

- **CHAPTER 5 PROJECT (PART A&B) DUE THURSDAY, MAR. 7TH**
  - PART A IS IN DESMOS: http://tinyurl.com/PC12-Feb2024-Ch5PartA
  - PART B IS ON HANDOUT

- **UNIT 3 EXAM ON CH5 ON THURSDAY, MAR. 7TH**
  - 12 Multiple Choice & 18 marks on the Written
  - ~1.5 hour - please prepare so you are not "learning" while doing the test
  - Closed-book - no notes
  - Rewrite is following Tuesday after class at 12:30pm
  - I will email you on the weekend when marks are posted so you can decide on the rewrite
  - I will go over the marked exam on Tuesday

Please let me know if you have any questions or concerns about your progress in this course. The notes from today will be posted at anurita.weebly.com after class.
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Tuesday, March 5th In-Class Notes

Mar. 5, 2024 **Name:** KEY **TOTAL =** ____ **/ 7 marks**

Check-in Quiz Section 5.3:
Logarithm Laws & Exponential Applications

Complete the following questions SHOWING ALL WORK and steps where applicable.

1. Write the following expressions as a single logarithm in simplest form:
1 mark each = 2 marks

a) $\log_2 24 - \log_2 3 + 2\log_2 2$

$\log_2\left(\frac{24}{3} \times 2^2\right)$

$\log_2(32) = \log_2 2^5$

$= \boxed{5}$

b) $2\log_5 x + \log_5 y - \frac{1}{2}\log_5 z$

$\log_5 x^2 + \log_5 y - \log_5 \sqrt{z}$

$= \boxed{\log_5\left(\frac{x^2 y}{\sqrt{z}}\right)}$

2. Write each expression in terms of individual logarithms of x, y, and z.
1 mark each = 2 marks

a) $\log_3\left(\frac{\sqrt[4]{a}}{b^3 c}\right)$

$\log_3 \sqrt[4]{a} - (\log_3 b^3 + \log_3 c)$

$\log_3 \sqrt[4]{a} - \log_3 b^3 - \log_3 c$

$\boxed{\frac{1}{4}\log_3 a - 3\log_3 b - \log_3 c}$

b) $\log_6\left(\frac{w^3}{(rs)^2}\right) = \log_6\left(\frac{w^3}{r^2 s^2}\right)$

$= \log_6 w^3 - \log_6 r^2 - \log_6 s^2$

$= \boxed{3\log_6 w - 2\log_6 r - 2\log_6 s}$

~~$+ 2\log_6 s$~~

$\log_6 \frac{w^3}{r^2} \cdot s^2$

Page **1** of **2**

3. Simplify and evaluate the following.

1 mark each = 2 marks

a) $\log_3\left(\frac{1}{27}\sqrt{3}\right)$ → $\log_3 \frac{1}{27} + \log_3 \sqrt{3}$

$\log_3\left(3^{-3} \cdot 3^{\frac{1}{2}}\right)$

add exponents: $-3 + \frac{1}{2}$, $-\frac{6}{2}+\frac{1}{2} = -\frac{5}{2}$

$\log_3 3^{-\frac{5}{2}}$

$= -\frac{5}{2}$

b) $\log_4 16 + \log_4\left(\sqrt[5]{64}\right)$

$\log_4 4^2 + \log_4 64^{\frac{1}{5}}$

$2 + \log_4 (4^3)^{\frac{1}{5}}$ $\quad 3 \times \frac{1}{5} = \frac{3}{5}$

$2 + \frac{3}{5}$

$\frac{10}{5} + \frac{3}{5} = \frac{13}{5}$

4. Evaluate the following:

1 mark each = 2 marks

Recall: $A = A_o(x)^{\frac{t}{T}}$

a. A 12.98 gram sample of Carbon-14 that has a half-life of 5740 years. How much of the sample would remain after 207 637 years?

$A = 12.98(0.5)^{\frac{207637}{5740}} \Rightarrow 1.67 \times 10^{-10}$ grams

$= 0.000\,000\,000\,167$ grams

b. The doubling rate of a particular bacterial cell is 38 minutes. Assume you start with one cell. How many bacteria would be present after 24 hours. *(hint: same units required for time)*

$24\text{ hrs} \times \frac{60\text{ min}}{\text{hr}} = 1440\text{ min}$

$A = 1(2)^{\frac{1440}{38}}$

$A = 2.56 \times 10^{11}$ bacteria

256 000 000 000 bacteria.

Page **2** of **2**

5.4 solving exponential functions with logs.

Recall: if common base is possible solve as follows:

$3^{x+1} = 9^{x-2}$

$3^{x+1} = (3^2)^{x-2}$

$3^{x+1} = 3^{2x-4}$

$x+1 = 2x-4$

$-x = -5$

$x = 5$

if common base is not possible solve with log of both sides

$3^{x+1} = 5^{x-2}$

$\log 3^{x+1} = \log 5^{x-2}$ ① take the log of both sides

$(x+1)\log 3 = (x-2)\log 5$ ② power rule = bring exponent to front of log * with brackets

$x\log 3 + \log 3 = x\log 5 - 2\log 5$ ③ expand brackets by multiplying each term with log

$-x\log 5 \qquad -\log 3$

④ move 'x' terms to one

$-x = -5$

$\boxed{x=5}$

with log

$-x\log 5$

④ move 'x' terms to one side + constants to other side.

$$x\log 3 - x\log 5 = -2\log 5 - \log 3$$

⑤ factor x from terms

$$\frac{x(\log 3 - \log 5)}{\log 3 - \log 5} = \frac{-2\log 5 - \log 3}{\log 3 - \log 5}$$

⑥ ÷ to isolate (solve) for x.

$$\boxed{x = \frac{-2\log 5 - \log 3}{\log 3 - \log 5}}$$ exact answer.

$$\boxed{x \approx 8.4520}$$ 4 decimals. (approximate)

Try #4 p.229. + #11 practice Handout

c) $3^{x-1} = 9\cdot 10^x$

$$\log 3^{x-1} = \log[9\cdot 10^x]$$

$9\cdot 10^2$
$9\cdot 100$
900

$$\log 3^{x-1} = \log 9 + \log 10^x$$

$$(x-1)\log 3 = \log 9 + x\log 10$$

$$x\log 3 - \log 3 = \log 9 + x\log 10$$

$$x\log 3 - x\log 10 = \log 9 + \log 3$$

$$x(\log 3 - \log 10) = \log 9 + \log 3.$$

$$x = \frac{\log 9 + \log 3}{\log 3 - \log 10}$$

$$\boxed{x = \frac{(\log 9 + \log 3)}{(\log 3 - 1)}}$$ ≈ -2.7375

another method.

$$\log_3 3^{x-1} = \log_3[9\cdot 10^x]$$

$$x-1 = \log_3 9 + \log_3 10^x$$

$$x-1 = \log_3 3^2 + x\log_3 10$$

$$x-1 = 2 + x\log_3 10$$

$$x - x\log_3 10 = 2+1$$

$$x(1-\log_3 10) = 3$$

$$\boxed{x = \frac{3}{1-\log_3 10}}$$

Solving Log Equations.

Solving Log Equations.

if you have a log on both side with the same (one log on each side), cancel logs + make arguments equal

if you have one log on one side + terms on other side, change to exponential form to remove log. (BOOT the Base)

Ex3 $\log_3(x+6) - \log_3(x+2) = \log_3 x$

① Log law to combine into single log ($\div$)

$\log_3\left(\frac{x+6}{x+2}\right) = \log_3 x$

② single log on both side = cancel

$\frac{x+6}{x+2} = x$

③ solve for x

$x+6 = x(x+2)$

$x+6 = x^2+2x$ ($-x$, -6)

$0 = x^2+x-6$ factor.

$0 = (x+3)(x-2)$

$x \neq -3$ $\quad x = 2$ ✓

④ write restrictions (NPVs) + check solutions.

$x+6>0$ $\quad x+2>0$ $\quad x>0$

$x>-6$ $\quad x>-2$ $\quad x>0$

final solution $\boxed{x=2}$

$x=-3$ is extraneous

$\therefore$ reject $x=-3$

Ex2. $\log(x+3) = -\log x + 1$ ($+\log x$)

① logs on one side

$\log(x+3) + \log x = 1$

② combine into single log ($\times$)

$\log[x(x+3)] = 1$

$\log_{10}(x^2+3x) = 1$

③ change to exponential form (Boot the base)

$x^2+3x = 10^1$

④ solve for x

$x^2+3x-10 = 0$

$(x+5)(x-2) = 0$

$x \neq -5$ $\quad x = 2$ ✓

reject b/c it's extraneous

⑤ check Restrictions.

R: $x+3>0$ $\quad x>0$

$x>-3$

$\boxed{x=2}$

Using log laws to solve the log equation:

SOLVING LOG EQUATIONS:

1. Use the log laws to condense each side of the = sign to a single log or number.

$$log_a b = log_a c \quad OR \quad log_a b = C$$

2. A) If one log on each side, cancel the logs.

$$log_a b = log_a c$$
$$\cancel{log_a} b = \cancel{log_a} c$$
$$b = c$$

   B) If log on one side and a number on the other side, BOOT the log to change to exponential form.

$$log_a b = C$$

$$a^C = b$$

3. Solve the equation.
4. Write restrictions or do a check to determine if there are any extraneous roots.

Solving a logarithmic equation by changing to exponential form = BOOT THE LOG

Solve the log equation by combining to a common of base:

Recall solving an exponential by changing to a common base. You can then make the exponents equal and solve.

What if you can't get a common base? Log both side and use the power law to solve.

SOLVING EXPONENTIAL EQUATIONS WITH LOGS:

1. Simplify equation by trying to get a single base on both sides of the equal sign.

$$M^{a+b} = N^{c+d}$$

Recall: if there is a single common base on each side of the = sign, cancel the bases and make the exponents equal to solve.

$$M^{a+b} = M^{c+d}$$

$$\cancel{M}^{a+b} = \cancel{M}^{c+d}$$

$$a + b = c + d$$

2. If you cannot get a common base, take the log of both sides.

$$\log M^{a+b} = \log N^{c+d}$$

3. Use the power law to bring the exponent to the front of the log.

$$\log M^{a+b} = \log N^{c+d}$$

$$(a+b)\log M = (c+d)\log N$$

4. Expand the brackets by distribution, collect the common variables to one side, factor and solve for x.

$$(a+b)\log M = (c+d)\log N$$

$$a\log M + b\log M = c\log N + d\log N$$

Exponential Equation with Different Bases

1. Isolate the exponential part of the equation. If there are two exponential parts put one on each side of the equation.
2. Take the logarithm of each side of the equation.
3. Apply power property to rewrite the exponent.
4. Solve for the variable.

Example:

$$3^x - 1 = 4$$
$$3^x = 5$$
$$\log 3^x = \log 5$$
$$x \log 3 = \log 5$$
$$x = \frac{\log 5}{\log 3}$$

Example:

$$5^{x-1} - 2^x = 0$$
$$5^{x-1} = 2^x$$
$$\log 5^{x-1} = \log 2^x$$
$$(x-1)\log 5 = x \log 2$$
$$x \log 5 - \log 5 = x \log 2$$
$$x \log 5 - x \log 2 = \log 5$$
$$x(\log 5 - \log 2) = \log 5$$
$$x = \frac{\log 5}{\log 5 - \log 2}$$

Solve $6^x - 15 = 0$

1. Isolate the exponential expression of the equation.

$$6^x = 15$$

2. Take the common logarithm of each side.

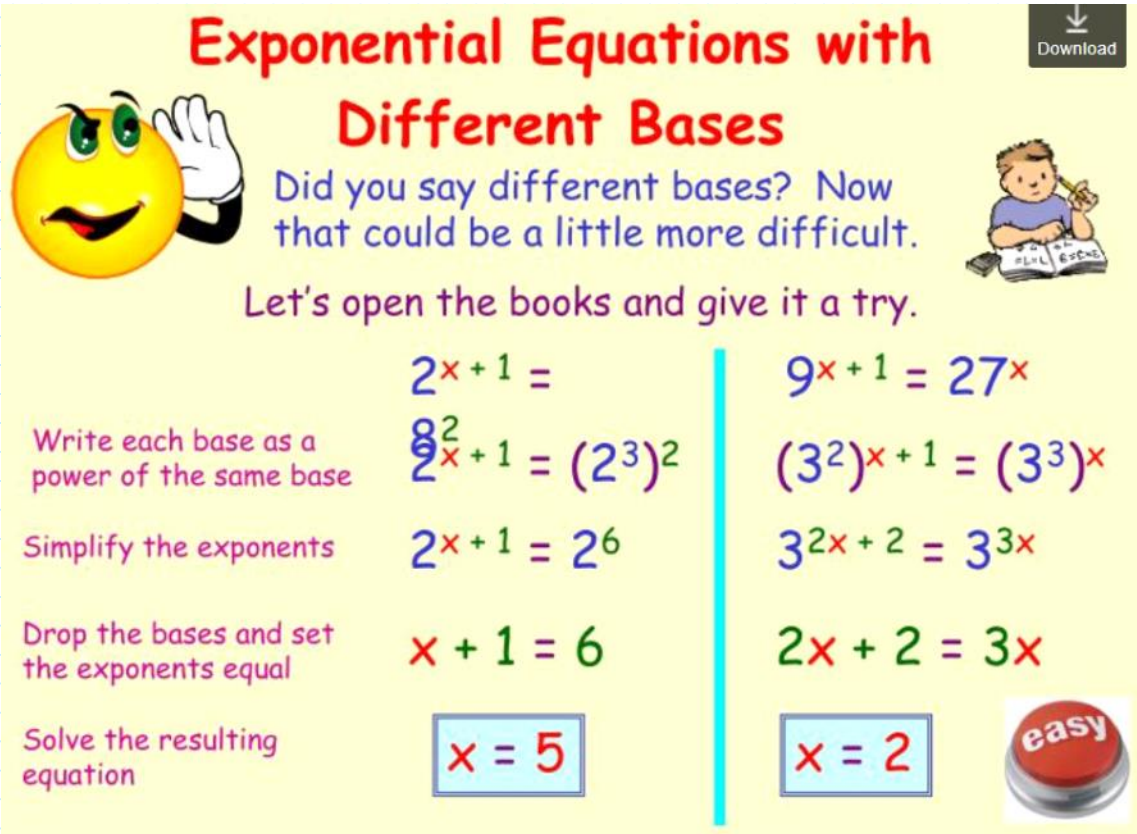
$$\log 6^x = \log 15$$

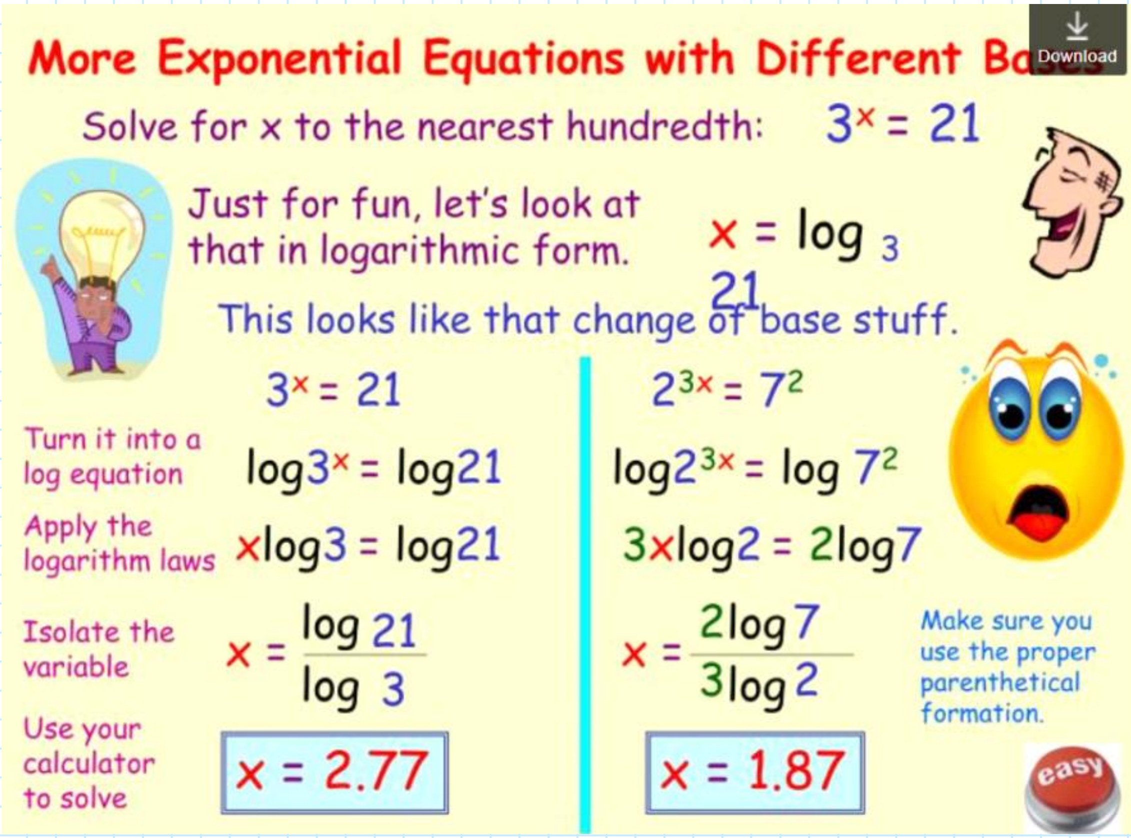
3. Use the power property

$$x \log 6 = \log 15$$

4. Solve for the variable

$$x = \frac{\log 15}{\log 6}$$



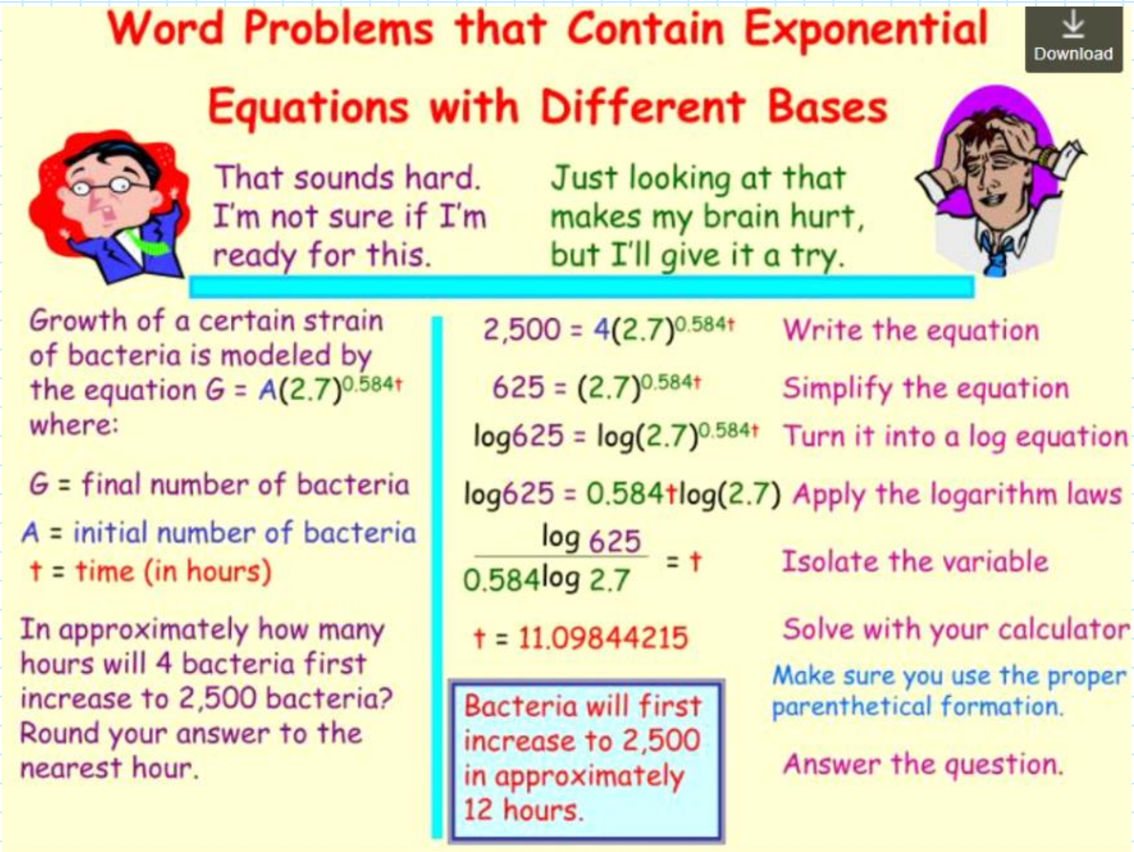


Revisiting Exponential Application Questions & Formulae

Compound Interest: $A = A_{\circ}\left(1+\frac{r}{n}\right)^{nt}$

General Growth/Decay: $A = A_{\circ}\left(b\right)^{\frac{t}{n}}$

General Earthquake/pH: $I = \left(10\right)^{high-low}$



JAN02 30

That's a Def-Con 3 problem. It's worth 4 points on the regents exam.

Remember: Don't worry about the words, just look for numbers, formulas, and equations.

Depreciation (the decline in cash value) on a car can be determined by the formula $V = C(1 - r)^t$, where V is the value of the car after t years, C is the original cost of the car, and r is the rate of depreciation. If a car's cost, when new, is $15,000, the rate of depreciation is 30%, and the value of the car now is $3,000, how old is the car to the *nearest tenth of a year*?

$3{,}000 = 15{,}000(1 - .30)^t$	Write the equation
$.2 = (1 - .30)^t$	Simplify the equation
$.2 = (.7)^t$	
$\log(.2) = \log(.7)^t$	Turn it into a log equation
$\log(.2) = t\log(.7)$	Apply the logarithm laws
$\frac{\log(.2)}{\log(.7)} = t$	Isolate the variable
$t = 4.512338026$	Solve with your calculator
	Make sure you use the proper parenthetical formation.
The car is approximately 4.5 years old	Answer the question.

JAN06 32

Difficulty level
DefCon 3
4 points

The current population of Little Pond, New York is 20,000. The population is *decreasing*, as represented by the formula $P = A(1.3)^{-0.234t}$, where P = final population, t = time, in years, and A = initial population.

What will the population be 3 years from now? Round your answer to the *nearest hundred people*.

To the *nearest tenth of a year*, how many years will it take for the population to reach half the present population?

Part 1

$P = 20{,}000(1.3)^{-0.234(3)}$	Plug in the given v
$P = 16{,}635.72614$	Solve with your calculator
The population will be approximately 16,600	Answer the question.

Part b

$10{,}000 = 20{,}000(1.3)^{-0.234t}$	Write the equation
$1 = 2(1.3)^{-0.234t}$	Simplify the equation
$\log 1 = \log 2(1.3)^{-0.234t}$	Turn it into a log equation
$\log 1 = \log 2 + \log(1.3)^{-0.234t}$	Apply the logarithm laws
$\log 1 = \log 2 - 0.234t\log(1.3)$	
$\log 1 - \log 2 = -0.234t\log(1.3)$	Isolate the variable
$\frac{\log 1 - \log 2}{-0.234\log 1.3} = t$	
$t = 11.2903$	Solve with your calculator
	Make sure you use the proper parenthetical formation.
It will take approximately 11.3 years	Answer the question.

Extra Log Solving Practice

Name : ______________________ Score : __________________

Logarithmic & Exponential Form

Express each equation in logarithmic form.

1) $2^3 = r$	2) $a^7 = 128$
3) $u^{\frac{1}{4}} = 3$	4) $7^6 = s$
5) $4^z = 64$	6) $3^{-d} = \frac{1}{9}$
7) $x^{\frac{1}{6}} = 2$	8) $6^3 = r$

Express each equation in exponential form.

9) $\log_8 512 = h$	10) $\log_a 36 = 2$
11) $\log_4\left(\frac{1}{16}\right) = -y$	12) $\log_{64} p = \frac{1}{6}$
13) $\log_x 81 = 4$	14) $\log_{49} 7 = f$
15) $\log_{11} n = 2$	16) $\log_8 k = \frac{1}{2}$

15) $\log_{11} n = 2$	16) $\log_8 k = \frac{1}{2}$

Printable Math Worksheets @ www.mathworksheets4kids.com

Name : ______________________ Score : __________________

Answer key

Express each equation in logarithmic form.

1) $2^3 = r$ **$\log_2 r = 3$**	2) $a^7 = 128$ **$\log_a 128 = 7$**
3) $u^{\frac{1}{4}} = 3$ **$\log_u 3 = \frac{1}{4}$**	4) $7^6 = s$ **$\log_7 s = 6$**
5) $4^z = 64$ **$\log_4 64 = z$**	6) $3^{-d} = \frac{1}{9}$ **$\log_3 \left(\frac{1}{9}\right) = -d$**
7) $x^{\frac{1}{6}} = 2$ **$\log_x 2 = \frac{1}{6}$**	8) $6^3 = r$ **$\log_6 r = 3$**

Express each equation in exponential form.

9) $\log_8 512 = h$ **$8^h = 512$**	10) $\log_a 36 = 2$ **$a^2 = 36$**
11) $\log_4 \left(\frac{1}{16}\right) = -y$ **$4^{-y} = \frac{1}{16}$**	12) $\log_{64} p = \frac{1}{6}$ **$64^{\frac{1}{6}} = p$**

$4^{-y} = \frac{1}{16}$	$64^{\frac{1}{6}} = p$
13) $\log_x 81 = 4$ $x^4 = 81$	14) $\log_{49} 7 = f$ $49^f = 7$
15) $\log_{11} n = 2$ $11^2 = n$	16) $\log_8 k = \frac{1}{2}$ $8^{\frac{1}{2}} = k$

Name : ____________________ Score : ________________

Single Logarithm and Expansion

Expand each expression :

1) $\log_a \left(\frac{x^2 y^3}{m\,n}\right)$ = ______________________________

2) $\log_3 \sqrt{5a^7}$ = ______________________________

3) $5 \log_4 \left(\frac{a^2 b}{n^3}\right)$ = ______________________________

4) $\log_2 \left(\frac{b}{c}\right)^4$ = ______________________________

5) $4 \log_a \left(\frac{p^6 q^3}{r^2 s}\right)$ = ______________________________

Rewrite each expression in single logarithm:

6) $(4 \log x + 5 \log y) - \log z$

6) $(4 \log_5 x + 5 \log_5 y) - \log_5 z$ = ____________________

7) $(3 \log_7 m + 12 \log_7 n) - 3 \log_7 p$ = ____________________

8) $\frac{1}{3}(4 \log_2 s + \log_2 t)$ = ____________________

9) $40 \log_3 t - (8 \log_3 w + 16 \log_3 x)$ = ____________________

10) $6 (\log_8 5 - \log_8 m)$ = ____________________

Name : ____________________ Score : ____________________

Answer key

Expand each expression :

1) $\log_a \left(\frac{x^2 y^3}{m n}\right)$ = $(2 \log_a x + 3 \log_a y) - (\log_a m + \log_a n)$

2) $\log_3 \sqrt{5a^7}$ = $\frac{1}{2}(\log_3 5 + 7 \log_3 a)$

3) $5 \log_4 \left(\frac{a^2 b}{n^3}\right)$ = $(10 \log_4 a + 5 \log_4 b) - 15 \log_4 n$

4) $\log_2 \left(\frac{b}{c}\right)^4$ = $4 (\log_2 b - \log_2 c)$

5) $4 \log_a \left(\frac{p^6 q^3}{r^2 s}\right)$ = $(24 \log_a p + 12 \log_a q) - (8 \log_a r + 4 \log_a s)$

5) $4 \log_a \left(\frac{p^6 q^3}{r^2 s}\right)$ = $(24 \log_a p + 12 \log_a q) - (8 \log_a r + 4 \log_a s)$

Rewrite each expression in single logarithm:

6) $(4 \log_5 x + 5 \log_5 y) - \log_5 z$ = $\log_5 \left(\frac{x^4 y^5}{z}\right)$

7) $(3 \log_7 m + 12 \log_7 n) - 3 \log_7 p$ = $3 \log_7 \left(\frac{m n^4}{p}\right)$

8) $\frac{1}{3}(4 \log_2 s + \log_2 t)$ = $\log_2 \sqrt[3]{s^4 t}$

9) $40 \log_3 t - (8 \log_3 w + 16 \log_3 x)$ = $8 \log_3 \left(\frac{t^5}{w x^2}\right)$

10) $6 (\log_8 5 - \log_8 m)$ = $\log_8 \left(\frac{5}{m}\right)^6$

Name : ______________ Score : ______________

Logarithm - Solve

Solve for x.

Example 1:

$\log_{64} 4 = x$

$64^x = 4$

$4^{3x} = 4$

$x = \mathbf{\frac{1}{3}}$

Example 2:

$\log_5 x^{\frac{1}{2}} = 2$

$5^2 = x^{\frac{1}{2}}$

$5^4 = x$

$x = \mathbf{625}$

Solve for x.

1) $\log_4 2 = x$

2) $\log_x 64^{\frac{1}{3}} = 2$

x =

x =

3) $\log_6 \left(\frac{1}{6}\right) = x$

x =

4) $\log_2 \left(\frac{1}{16}\right) = x$

x =

5) $\log_{\frac{1}{2}} \left(\frac{1}{8}\right) = x$

x =

6) $\log_x 3 = \frac{1}{4}$

x =

7) $\log_x 6 = \frac{1}{2}$

x =

8) $\log_3 x^{\frac{1}{3}} = 2$

x =

9) $\log_4 x = 3$

x =

10) $\log_{125} 25 = x$

x =

Name : ____________________   Score : ________________

Logarithmic Equation

Solve for x.

Example 1:

$$\log_{64} 4 = x$$
$$64^x = 4$$
$$4^{3x} = 4$$
$$x = \frac{1}{3}$$

Example 2:

$$\log_5 x^{\frac{1}{2}} = 2$$
$$5^2 = x^{\frac{1}{2}}$$
$$5^4 = x$$
$$x = 625$$

$64^x = 4$
$4^{3x} = 4$
$x = \frac{1}{3}$

$5^2 = x^{\frac{1}{2}}$
$5^4 = x$
$x = 625$

Solve for x.

1) $\log_4 2 = x$

$x =$ $\frac{1}{2}$

2) $\log_x 64^{\frac{1}{3}} = 2$

$x =$ 2

3) $\log_6 \left(\frac{1}{6}\right) = x$

$x =$ −1

4) $\log_2 \left(\frac{1}{16}\right) = x$

$x =$ −4

5) $\log_{\frac{1}{2}} \left(\frac{1}{8}\right) = x$

$x =$ 3

6) $\log_x 3 = \frac{1}{4}$

$x =$ 81

7) $\log_x 6 = \frac{1}{2}$

$x =$ 36

8) $\log_3 x^{\frac{1}{3}} = 2$

$x =$ 729

9) $\log_4 x = 3$

$x =$ 64

10) $\log_{125} 25 = x$

$x =$ $\frac{2}{3}$

Name : ______________________   Score : ________________

Logarithm - Solve

Logarithm - Solve

Solve for x.

Example 1:

$$\log_3\left(\frac{1}{3}\right) = x-5$$
$$(3)^{x-5} = \left(\frac{1}{3}\right)$$
$$(3)^{x-5} = 3^{-1}$$
$$x = \mathbf{4}$$

Example 2:

$$\log_8 (2x)^3 = 2$$
$$8^2 = (2x)^3$$
$$(8^2)^{\frac{1}{3}} = 2x$$
$$4 = 2x$$
$$x = \mathbf{2}$$

Solve for x.

1) $\log_{36} 6 = x+3$

x =

2) $\log_{3x} 64 = 2$

x =

3) $\log_{32}\left(\frac{1}{4}\right) = x-1$

x =

4) $\log_3\left(\frac{1}{9}\right) = 2x$

x =

5) $\log_{\frac{1}{32}}\left(\frac{x}{8}\right) = \frac{1}{5}$

x =

6) $\log_{25} 625 = 2x+3$

x =

7) $\log_{x+1} 16 = 4$

x =

8) $\log_6 (4x)^{\frac{1}{2}} = 2$

x =

9) $\log_9 (x-1) = 3$

x =

10) $\log_{2x} 2^{-4} = 2$

x =

Name : ____________________ Score : ____________________

Answer key

Solve for x.

Example 1:

$\log_3 \left(\frac{1}{3}\right) = x-5$

$(3)^{x-5} = \left(\frac{1}{3}\right)$

$(3)^{x-5} = 3^{-1}$

$x = \mathbf{4}$

Example 2:

$\log_8 (2x)^3 = 2$

$8^2 = (2x)^3$

$(8^2)^{\frac{1}{3}} = 2x$

$4 = 2x$

$x = \mathbf{2}$

Solve for x.

1) $\log_{36} 6 = x+3$

$x = -\frac{5}{2}$

2) $\log_{3x} 64 = 2$

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

3) $\log_{32} \left(\frac{1}{4}\right) = x-1$

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

4) $\log_3 \left(\frac{1}{9}\right) = 2x$

$x = -1$

5) $\log_{\frac{1}{32}} \left(\frac{x}{8}\right) = \frac{1}{5}$

$x = 4$

6) $\log_{25} 625 = 2x+3$

$x = -\frac{1}{2}$

7) $\log_{x+1} 16 = 4$

$x = 1$

8) $\log_6 (4x)^{\frac{1}{2}} = 2$

$x = 324$

9) $\log_9 (x-1) = 3$

$x = 730$

10) $\log_{2x} 2^{-4} = 2$

$x = \frac{1}{8}$

x = 730

x = $\frac{1}{8}$

Name : ____________________ Score : ________________

Logarithm - Solve

Solve for x.

Example 1:

$\log_{64} 4 = x+2$

$(64)^{x+2} = 4$

$4^{3x+6} = 4$

$3x+6 = 1$

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

Example 2:

$\log_4 4x^{\frac{1}{2}} = 2$

$4^2 = (4x)^{\frac{1}{2}}$

$4^4 = 4x$

$x = 64$

Solve for x.

1) $\log_4 2 = x-5$

x =

2) $\log_{x+2}(27) = 3$

x =

3) $\log_2 \left(\frac{1}{4}\right) = 2x+1$

x =

4) $\log_4 \left(\frac{1}{16}\right) = \frac{x}{2}$

x =

5) $\log_{\frac{1}{3}} \left(\frac{1}{9}\right) = 4x$

x =

6) $\log_{5x} 8 = 3$

x =

7) $\log_{x-1}(16) = \frac{1}{2}$

x =

8) $\log_3 (x+4)^{\frac{1}{3}} = 1$

x =

x =

x =

9) $2\log_4(x-2) = 4$

x =

10) $\log_{128} 2 = x+3$

x =

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Answer key

Solve for x.

Example 1:

$\log_{64} 4 = x+2$

$(64)^{x+2} = 4$

$4^{3x+6} = 4$

$3x+6 = 1$

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

Example 2:

$\log_4 4x^{\frac{1}{2}} = 2$

$4^2 = (4x)^{\frac{1}{2}}$

$4^4 = 4x$

$x = 64$

Solve for x.

1) $\log_4 2 = x-5$

$x = \frac{11}{2}$

2) $\log_{x+2}(27) = 3$

$x = 1$

3) $\log_2\left(\frac{1}{4}\right) = 2x+1$

$x = -\frac{3}{2}$

4) $\log_4\left(\frac{1}{16}\right) = \frac{x}{2}$

$x = -4$

5) $\log_{\frac{1}{3}}\left(\frac{1}{9}\right) = 4x$

$x = \frac{1}{2}$

6) $\log_{5x} 8 = 3$

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

x = $\frac{1}{2}$

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

7) $\log_{x-1}(16) = \frac{1}{2}$

x = 257

8) $\log_3 (x+4)^{\frac{1}{3}} = 1$

x = 23

9) $2 \log_4 (x-2) = 4$

x = 18

10) $\log_{128} 2 = x+3$

x = $-\frac{20}{7}$

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Logarithmic Equation

Solve for x.

1) $2 \log_3 x = \log_3 (12x-36)$

x =

2) $\log_2 (x-11) + \log_2 (x-2) = \log_2 10$

x =

3) $\log_7 \left(\frac{x+8}{x+6}\right) = 2$

x =

4) $\log_4 (x-5) + \log_4 (x+5) = \log_4 24$

x =

x =

x =

5) $2 \log_3 (x-1) = \log_3 3$

x =

6) $2 \log_8 x = \log_8 (7x-12)$

x =

7) $\log_3 (x+2) + \log_3 (x-3) = \log_3 14$

x =

8) $2 = \log_4 \left(\frac{x+7}{x+5}\right)$

x =

Name : ______________________ Score : ________________

Answer key

Solve for x.

1) $2 \log_3 x = \log_3 (12x-36)$

x = 6

2) $\log_2 (x-11) + \log_2 (x-2) = \log_2 10$

x = 12

3) $\log_7 \left(\frac{x+8}{x+6}\right) = 2$

4) $\log_4 (x-5) + \log_4 (x+5) = \log_4 24$

$(x+6)$

x = **–4**

x = **7**

5) $2 \log_3 (x-1) = \log_3 3$

x = **2**

6) $2 \log_8 x = \log_8 (7x-12)$

x = **4, 3**

7) $\log_3 (x+2) + \log_3 (x-3) = \log_3 14$

x = **5**

8) $2 = \log_4 \left(\frac{x+7}{x+5}\right)$

x = **–3**