8.1 Day 1: Understanding Logarithms

To evaluate logarithms and solve logarithmic equations.

RECALL: In section 1.4 we learned what the inverse of a function is.

- What is the inverse of the equation y = 2x – 5?

- What properties do their sets of ordered pairs have?

- What properties do their respective graphs have?

LOGARITHMIC FUNCTION:

- A logarithmic function is the INVERSE of an exponential function.
- Recall that an exponential function is written as $y = c^x$ where where $c > 0$ and $c \neq 1$. , therefore the inverse function (called the logarithmic function) would be written as: $\boxed{}$ where $c > 0$ and $c \neq 1$. X must also be positive (x>0)
- The problem becomes an algebraic issue as there is no way to solve for y in this new equation (no way to get the y by itself). Therefore we have a completely different way to write this equation that means the same thing mathematically BUT ALLOWS US TO SOLVE FOR Y!

$\boxed{} = \boxed{}$

This new equation is read as follows: y equals the log of x to the base c.

NOTE: What this new equation is asking can be described by looking back at it's original left version – "what exponent (y) do I give to my base (c) to get my answer (x)?"

Example #1: Rewrite each of the following in logarithmic form:

Exponential Form	Logarithmic Form
$2^3 = 8$	
$2^4 = 16$	
$2^0 = 1$	
$2^{-1} = \frac{1}{2}$	
$3^4 = 81$	
$\left(\frac{3}{4}\right)^2 = \frac{9}{16}$	
$\left(\frac{1}{2}\right)^{-5} = 32$	

Example #2: Evaluate the following logarithms:

a) $\log_2 8$

b) $\log_3 81$

c) $\log_9 9$

d) $\log_3 \frac{1}{9}$

e) $\log_5(-25)$

f) $\log_{10} 1000$

g) $\log_6 1$

h) $\log_2 \sqrt{8}$

i) $\log_3 9\sqrt{3}$

k) $\log_{\frac{1}{2}}(64)$

l) $\log_{\sqrt{5}} 125^{\frac{3}{2}}$

SOME RULES THAT MIGHT HELP YOU WITH SOME OF THE ABOVE EXAMPLES:

- $\log_c 1 = 0$ since in exponential form $c^0 = 1$.
- $\log_c c = 1$ since in exponential form $c^1 = c$
- $\log_c c^x = x$ since in exponential form $c^x = c^x$
- $c^{\log_c x} = x, x > 0$, since in logarithmic form $\log_c x = \log_c x$

Example #3:

Evaluate $\log 100$.

NOTE:

- The Base seems to be missing in this question.
- Mathematicians often numbers in the most basic situations – for example x really should be x^1, the $\sqrt{x}$ really should be $\sqrt[2]{x}$
- When a base appears to be missing from a logarithm, the base that has been excluded is always base 10. This question really should look like $\log_{10} 100$
- Logarithms that are to the base 10 can be solved by the same method we used in example 1, however they are known as THE COMMON LOG and are also built into your calculator. You should see a LOG button on your calculator. To evaluate a number to the Common Log/Base 10, you can just press log 100 and get the answer.

Example #4: Solve the following logarithmic equations

a) $\log_x 64 = 2$

b) $\log_3 (x+4) = 2$

c) $\log_{125} x = \frac{2}{3}$

8.1 Day 1 ASSIGNMENT

8.1 FA: P380 #2, 3, 4, 8a, 9a, 12

8.1 MLA: P380 #6, 7, 13, 14a, 20, 17

8.1 ULA P380 #5, 18, 19,

8.1 Day 2 Graphs of Logarithmic Functions

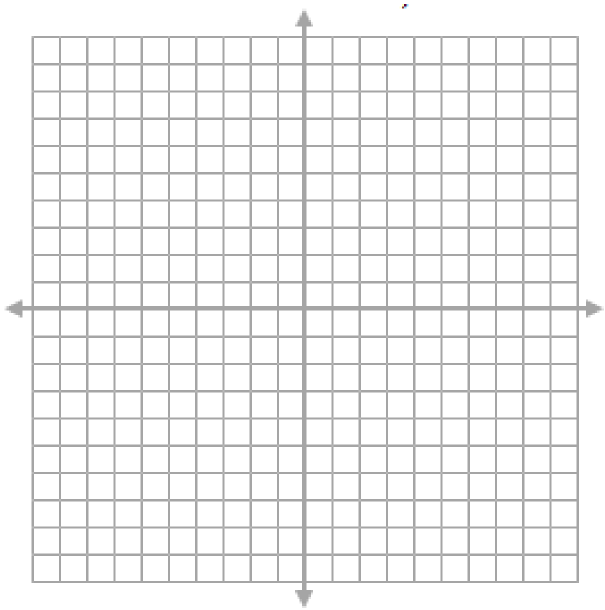
To graph logarithmic functions

Example #1:

a) Use a table of values to graph $y = 2^x$

$y = 2^x$

x	f(x)
-2	
-1	
0	
1	
2	
3	



Identify the following for $y = 2^x$:

- Domain
- Range
- X intercept
- Y intercept
- Whether the graph represents an **INCREASING** or a **DECREASING** function
- The equation of the horizontal asymptote

REMEMBER THAT THE LOGARITHMIC FUNCTION IS THE INVERSE OF THE EXPONENTIAL FUNCTION

b) Let's graph $y = \log_2 x$ on the same axis

x	f(x)

Identify the following for $y = \log_2 x$:

- Domain
- Range
- X intercept
- Y intercept
- Whether the graph represents an **INCREASING** or a **DECREASING** function
- The equation of any asymptote:

8.1 Day 2 ASSIGNMENT

8.1 Day 2 FA: P380 #1, 8b, 9b, 10

8.1 Day 2 MLA: P280 #14b, 15, 16, 17

PC 30

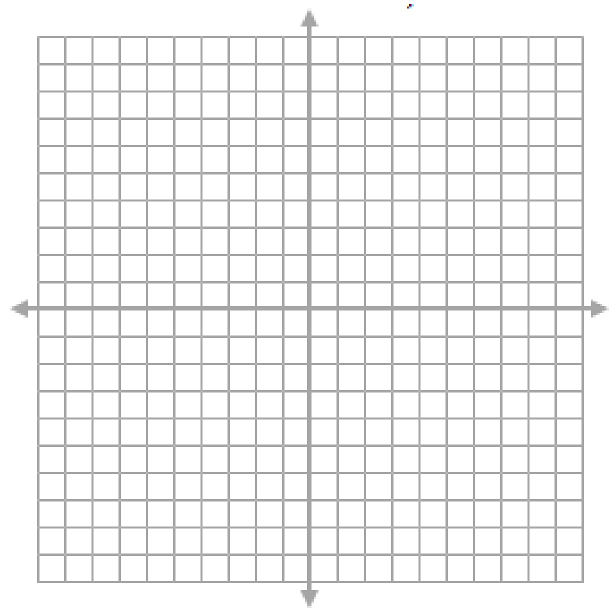
8.2 Transformations of Logarithmic Functions

To use transformations to graph logarithmic functions

Given the base function $y=\log_c x$, multiple transformations can be applied to create the general transformation equation of $y=a\log_c\left(b\left(x-h\right)\right)+k$

Example #1: Use your previous knowledge about transformations to predict the transformations of the graph of $y=\log_3(x+9)+2$

a) Write the mapping notation and use tables to sketch the graph.



b) Identify the following for $y=\log_3(x+9)+2$:

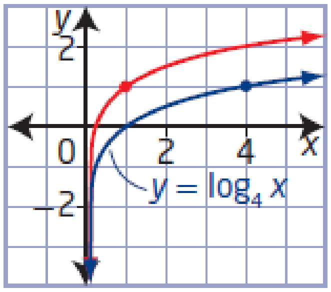
- Domain
- Range
- X intercept
- Y intercept
- Whether the graph represents an **INCREASING** or a **DECREASING** function
- The equation of any asymptote:

QUESTION: What characteristics of log function indicate it will be a decreasing function?

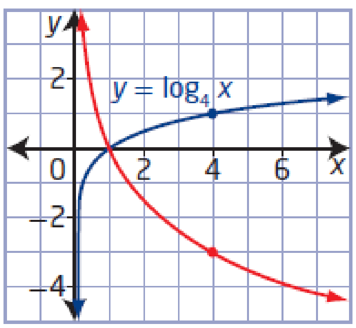
Example #3: Describe the transformations that would occur in the following function: $y = -\log_2(2x+6)$

Example #4: The lighter (red) graph can be generated by stretching the darker (blue) graph of $y = \log_4 x$. Write the equation that describes the lighter (red) graph.

a)



b)



c) Only a horizontal translation has been applied to the graph of $y = \log_4 x$ so that the graph of the transformed image passes through the point (6, 2). Determine the equation of the transformed image.

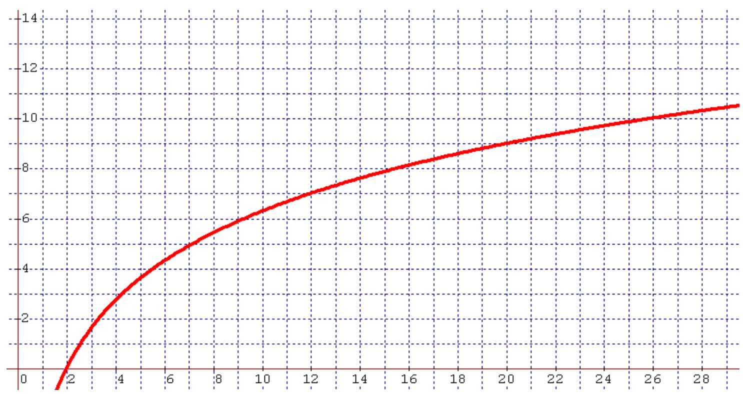
Example #5: Write the equations that correspond to the following transformations of $y = \log_5 x$

a) Reflected in the x axis and translated 1 unit down and 4 units left

b) vertically stretched by a factor of 3, stretched horizontally by a factor of 2 and translated 2 units right

Example #6:

There is a logarithmic relationship between butterflies and flowers. In one study, scientists found that the relationship between the number, *F*, of flower species that a butterfly feeds on and the number of butterflies observed, *B*, can be modelled by the function $F = -2.641 + 8.958 \log B$.



a) How many flower species would you expect to find if you observed 100 butterflies?

b) Predict the number of butterfly observations in a region with 25 flowers.

8.2 ASSIGNMENT

8.2 FA: P389 #1, 2, 3, 4, 6, 7
8.2 MLA: P289 #8, 9, 10, 11, 13, 14
8.2 ULA: P289 #15, 16, 17, C1, C2

8.3 DAY 1 Laws of Logarithms

To use transformations to determine equivalent expressions for given logarithmic statements

INVESTIGATION:

1. a) Show that log (1000 × 100) ≠ (log 1000)(log 100).

b) Use a calculator to find the approximate value of each expression, to four decimal places.

i) log 6 + log 5 **ii)** log 21 **iii)** log 11 + log 9

iv) log 99 **v)** log 7 + log 3 **vi)** log 30

c) Based on the results in part b), suggest a possible law for log *M* + log *N*, where *M* and *N* are positive real numbers.

PRODUCT LAW OF LOGS: $\log_c MN =$

d) Use your conjecture from part c) to express log 1000 + log 100 as a single logarithm.

2. a) Show that $\log \frac{1000}{10} \neq \frac{\log 1000}{\log 10}$

b) Use a calculator to find the approximate value of each expression, to four decimal places.

i) log 12 **ii)** log 35 - log 5 **iii)** log 36

iv) log 72 - log 2 **v)** log 48 - log 4 **vi)** log 7

c) Based on the results in part b), suggest a possible law for log *M* - log *N*, where *M* and *N* are positive real numbers.

QUOTIENT LAW OF LOGS: $\log_c \frac{M}{N} =$

d) Use your conjecture from part c) to express log 1000 - log 100 as a single logarithm.

3. a) Show that $\log 1000^2 \neq (\log 1000)^2$.

b) Use a calculator to find the approximate value of each expression, to four decimal places.

i) 3 log 5 | **ii)** log 49

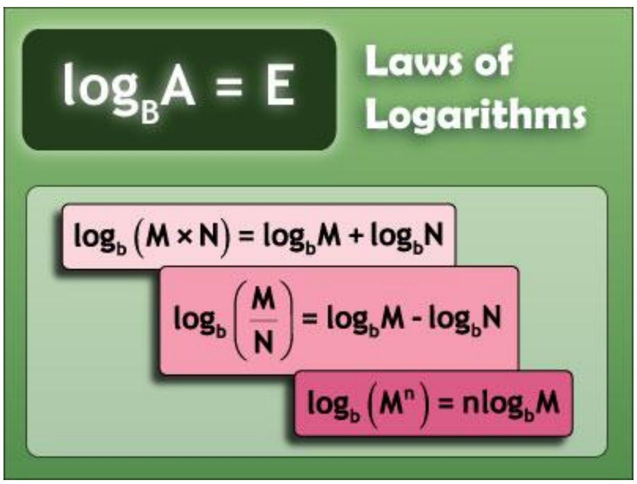
iii) log 125 | **iv)** log 16

v) 4 log 2 | **vi)** 2 log 7

c) Based on the results in part b), suggest a possible law for *P* log *M*, where *M* is a positive real number and *P* is any real number.

POWER LAW OF LOGS: $\log_c M^P =$

d) Use your conjecture from part c) to express 2 log 1000 as a logarithm without a coefficient.



Example #1: The laws of common logarithms are also true for any logarithm with a base that is a positive real number other than 1. Without using technology, evaluate each of the following.

a) $\log_6 18 + \log_6 2$

b) $\log_2 40 - \log_2 5$

c) $4 \log_9 3$

Example #2: Rewrite as a single log.

a) $5\log_3 2$

b) $\log_8 35 - \log_8 5$

c) $\log_9 6 + \log_9 7$

d) $\log_7 24 + \log_7 4 - \log_7 3$

e) $-\log_7 24 - \log_7 4 - \log_7 3$

f) $6\log_5 2 - 2\log_5 4$

Example #3: Rewrite as a single log and evaluate.

a) $4\log_4 2 - 2\log_4 8$

b) $\log_6 8 + \log_6 9 - \log_6 2$

c) $3\log_{\frac{2}{3}} 2 - 3\log_{\frac{2}{3}} 3$

d) $\log_7 7\sqrt{7}$

e) $2\log_2 12 - \left(\log_2 6 + \frac{1}{3}\log_2 27\right)$

Turn to page 392 in your textbook!

- How do slide rules work: https://goo.gl/YtBU2m
- Slide Rule Scene in Apollo 13: https://vimeo.com/34664087

8.3 Day 1 ASSIGNMENT

Use your properties of logarithms to rewrite each logarithmic statement as the logarithm of a single number or expression. Assume that all logarithms are defined.

1. $\log_8 3 + \log_8 11$
2. $\log_2 3 + \log_2 5 + \log_2 6$
3. $\log_a x + \log_a y + \log_a z$
4. $\log_b(x-1) + \log_b(x+3)$
5. $\log_4 20 - \log_4 10$
6. $\log_5 160 - \log_5 16$
7. $\log_v(h+1) - \log_v(h-1)$
8. $3\log_6 4$
9. $2\log_7 11$
10. $\frac{1}{3}\log_3 25$
11. $-1\log_6 4$
12. $5\log_8 3$
13. $p\log q$
14. $(a+8)\log_2 w$
15. $\log 20 + \log 5 - \log 25$
16. $\log 6 + \log 8 - \log 2 - \log 12$
17. $\log 60 - \log 2 - \log 3 - \log 5$
18. $2\log_3 2 + 3\log_3 3$
19. $4\log_7 2 - 2\log_7 8$
20. $\log x + \log y - \log z$
21. $\log x - \log y - \log z$
22. $-\log x - \log y - \log z$
23. $2\log_{11} x + 3\log_{11} y + 4\log_{11} z$
24. $\frac{1}{2}\log_3 x + \frac{2}{3}\log_3 y$
25. $\log_k\left(x^2 - y^2\right) - \log_k(x+y)$
26. $-2\log a - 3\log b + 4\log c$
27. $\log a + \log(a+1) - \log\left(a^3 - a\right)$

Use your properties of logarithms to rewrite each logarithmic statement as the logarithm of a single number. Then evaluate that logarithm without the use of a calculator.

28. $\log_2 80 - \log_2 5$
29. $\log_5 50 + \log_5 5 - \log_5 2$
30. $\log_{10} 2 + \log_{10} 50$
31. $\log_4 32 + \log_4 2$
32. $\log_3 9^{10}$
33. $\log_5 125^{-13}$
34. $\log_3\left(3\sqrt[3]{3}\right)$
35. $\log_{12} 8 + \log_{12} 9 + \log_{12} 2$
36. $\log_{15} 450 - \log_{15} 2$
37. $3\log_7 4 - 2\log_7 8$
38. $\log_4 48 + \log_4 8 + \log_4\left(\frac{2}{3}\right)$
39. $\log_2 24 + \log_2 4 - \log_2 3$
40. $\log_3 36 + \log_3 18 - \log_3 24$
41. $\log_2 20 - \log_2 5 + \log_2 8$
42. $\log_5 \sqrt{10} + \log_5 \sqrt{\frac{25}{2}}$

SOLUTIONS TO 8.3 DAY 1

1. $\log_8 33$
2. $\log_2 90$
3. $\log_a(xyz)$
4. $\log_b(x^2+2x-3)$
5. $\log_4 2$
6. $\log_5 10$
7. $\log_v\left(\frac{h+1}{h-1}\right)$
8. $\log_6 64$
9. $\log_7 121$
10. $\log_3 \sqrt[3]{25}$
11. $\log_6 \frac{1}{4}$
12. $\log_8 243$
13. $\log q^p$
14. $\log_2 w^{a+8}$
15. $\log 4$
16. $\log 2$
17. $\log 2$
18. $\log_3 108$
19. $\log_7 \frac{1}{4}$
20. $\log\left(\frac{xy}{z}\right)$
21. $\log\left(\frac{x}{yz}\right)$
22. $\log\left(\frac{1}{xyz}\right)$
23. $\log_{11}(x^2y^3z^4)$
24. $\log_3\left(x^{\frac{1}{2}}y^{\frac{2}{3}}\right)$
25. $\log_k(x-y)$
26. $\log\left(\frac{c^4}{a^2b^3}\right)$
27. $\log\left(\frac{1}{a-1}\right)$
28. 4
29. 3
30. 2
31. 3
32. 20
33. -39
34. $\frac{4}{3}$
35. 2
36. 2
37. 0
38. 4
39. 5
40. 3
41. 5
42. $\frac{3}{2}$
43. $\log_5 4-\log_5 7$
44. $\log_3 8+\log_3 a$
45. $\log_2 9+\log_2 x+\log_2 y$
46. $\log_6 5+\log_6 h-\log_6 3-\log_6 t$
47. $3\log_7 t$
48. $\log_8 4+6\log_8 s+7\log_8 h$
49. $\log_w 12+3\log_w a-2\log_w b$
50. $\log_3 6+\frac{1}{2}\log_3 3-\log_3 11$
51. $\log_a(x-4)+\log_a(x+3)$
52. $-3\log_t a-2\log_t b$
53. $2\log_4(x+5)$
54. $\log_s(m-6)+\log_s(m+3)-\log_s(m+7)-\log_s(m-2)$
55. 1.38685
56. 2.66096
57. 0.52068
58. -2.44566
59. -28.43316
60. -0.73912
61. 1.31396
62. -1.23599

63. (a)
$\log(12+4)=1.204119983$
$\log 12+\log 4=1.681241237$

63. (b)
$\log\left(\frac{12}{4}\right)=0.4771212547$
$\frac{\log 12}{\log 4}=1.79248125$

63. (c)
$\log(12^2)=2.1585362492$
$(\log 12)^2=1.164632162$

64. There are several possibilities. One suggestion is to write $\log 11$ as $\log\left(\frac{22}{2}\right)$. Then you can use your log properties to obtain $\log\left(\frac{22}{2}\right)=\log 22-\log 2$.

65. to be discussed

66. (a)
$\log_a b=\frac{\log_b b}{\log_b a}=\frac{1}{\log_b a}$

66. (b)
$(\log_c b)(\log_a c)$
$=\left(\frac{\log_a b}{\log_a c}\right)(\log_a c)$
$=\log_a c$

67.
$\log_b b^x=x\log_b b=x(1)=x$

68. 0

69.
(a) $r+s$
(b) $4s$
(c) $s-r$
(d)
$\log 30=\log(3\cdot 10)$
$=\log 3+\log 10=s+1$
(e) $2r+2s$
(f) $-5r$
(g) $1-r$

8.3 DAY 2 Laws of Logarithms

To use transformations to determine equivalent expressions for given logarithmic statements

Example #1: Expand each log as far as possible:

a) $\log_5\left(\frac{4}{7}\right)$

b) $\log_{23}(7 \bullet 9 \bullet 25)$

c) $\log_5\left(\frac{3^8 x 3^{11}}{7^4}\right)$

d) $\log_7 \sqrt[3]{x}$

e) $\log_5 \frac{xy}{z}$

f) $\log_6 \frac{1}{x^2}$

g) $\log_4 \frac{x^3 y}{4z}$

h) $\log \frac{x^3}{y\sqrt{z}}$

Example #2: Write each expression as a single logarithm in simplest form. State the restrictions on the variable.

a) $\log_7 x^2 + \log_7 x - \frac{5\log_7 x}{2}$

b) $\log_5(2x-2)-\log_5(x^2+2x-3)$

Example #3: Write each expression as a single logarithm in simplest form.

a) $\log_6 2x^7+\log_6 3x^2+\log_6 9$

b) $\log 4x\sqrt{y}-\log x^2\sqrt{y}$

c) $\log_7 x^4+\frac{1}{3}\left(\log_7 x^2-\log_7 \sqrt{5x}\right)$

8.3 Day 2 ASSIGNMENT

8.3 Day 2 FA: P400 #1, 3, 7, 8

8.3 Day 2 MLA: P400 #6, 10, 11, 12

8.3 Day 2 MLA: P400 #9, 13, 16, 18, 19, 20, C2

PC 30

8.4 Day 1: Logarithmic and Exponential Equations

To solve logarithmic and exponential equations.

Note: A logarithmic equation is an equation containing the logarithm of a variable.

SOLVING LOGARITHMIC EQUATION: START BY STATING RESTRICTIONS
Remember these basic statements of equality:

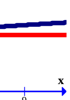
- If $\log_c L = \log_c R$, then $L = R$
- If $L = R$, then $\log_c L = \log_c R$
- $\log_c L = R$ can be written as $L = c^R$

!! Given that *c, L, R* > 0 and c ≠1

1. **Method 1** – Solve Graphically
   - Graph each side of the original equation as its own function. The intersection point(s) represent the solutions
2. **Method 2** – If both sides have the same base, solve algebraically
   - If you have $\log_c(\text{Polynomial 1}) = \log_c(\text{Polynomial 2})$, let Polynomial 1 = Polynomial 2 and solve
3. **Method 3** – Convert to exponential form and solve the resulting exponential equation
4. **Method 4** – Use the laws of logs to change both sides of the equation to single logarithms that each have same base and use method 2 to solve

Example #1: Solve $\log_6(2x-1) = \log_6 11$ graphically.

- Graph $y = \log_6(2x-1)$ and $y = \log_6 11$ on the same set of axes and find the *x*-coordinate of the point of intersection. (See graph below)



Our focus is to solve algebraically!

Example #2: Solve the following

a) $\log_3(x - 4) = 5$

b) $\log_4(x - 3) + \log_4(x + 3) = 2$

c) $\log_2(2x - 1) - \log_2(x + 7) = -3$

d) $\log(x + 3) - \log 2 = 2\log x$

e) $\log_7 4 - \log_7 x = \log_7 5 - \log_7(x + 3)$

d) $\log_3(x^2 - 8x)^5 = 10$

SOLVING EXPONENTIAL EQUATIONS WITH DIFFERENT BASES:

- Remember that you can do whatever you want to one side of an equation as long as you do it to another (besides dividing by zero!).
- In order to solve an exponential equation with different bases, follow these steps:
  1. Take the log of both sides (remember that this really means $\log_{10}$)
  2. Use the laws of logs to isolate your variable
  3. Solve for the variable

Example #2: Solve the following:

a) $13^x = 26$

b) $11^{-4x} = 104$

c) $4^{2x} = 3^{x-1}$

d) EXTRA CHALLENGE

$$3\left(5^{2x-6}\right) = \frac{2^{x+7}}{7^x}$$

8.4 Day 1 ASSIGNMENT

Solve each of the following logarithmic equations. Be careful to reject those values of x that would cause the logarithm to be undefined.

1. $\log x + \log 5 = 1$
2. $\log_3 x - \log_3 4 = 2$

10. $\log_3(2x-5) - \log_3\left(x^2+4x+4\right) = -2$
11. $\log_4 72 - \log_4 9 = x$

3. $\log_5 x^3 = 2 + \log_5 x$

4. $\log 9x + \log x = 4$

5. $\log_6 x - \log_6(x-1) = \log_6 3$

6. $\log_8(x+1) - \log_8 x = \log_8 4$

7. $\log_7(x+1) + \log_7(x-5) = 1$

8. $\log_6(x-3) + \log_6(x+2) = 1$

9. $\log_2(9x+5) - \log_2\left(x^2-1\right) = 2$

12. $\log_5 6 = \log_5 x - \log_5 7$

13. $\log_7 98 + \log_7 3.5 = x$

14. $\log_3 63 - \log_3 7x = \log_3 2$

15. $\log_8 \sqrt{0.125} = x$

16. $\log_5 4 + \log_5(2x-3) = 20$

17. $\log_2 2 + \log_2(x+2) - \log_2(3x-5) = 3$

18. $\log_5(2x+1) + \log_5(3x-1) = 2$

Solve each of the following exponential equations. Give your answers to 5 decimal places.

19. $3^x = 18$

20. $8^x = 25$

21. $4^{2x} = 90$

22. $5^{3x} = 63$

23. $29^{\frac{1}{2}x} = 76$

24. $16^{\frac{3}{5}x} = 73$

25. $4^{2x} = 3^{x-1}$

26. $6^{3x} = 2^{2x-3}$

27. $\left(2^{2x}\right)^3 = 4^{x+3}$

28. $\left(3^{x+1}\right)^3 = 2^{4-x}$

29. $(1.4)^x = (2.6)^{x+5}$

30. $(1.93)^{2x} = 3(4.1)^x$

31. $4\left(2^x\right) = 3^{x+1}$

32. $(2.1)^{x+1} = 5(3.6)^{2x}$

Digging Deeper

33. To try and simplify $\dfrac{\log a}{\log b}$, a careless student just "crossed out" the "log" getting $\dfrac{a}{b}$ which he then reduced to $\dfrac{2}{3}$. Amazingly, and coincidentally, that was the correct answer. What were the values of a and b?

SOLUTIONS:

1. {2}
2. {36}
3. {5}
4. $\left\{\dfrac{100}{3}\right\}$
5. $\left\{\dfrac{3}{2}\right\}$
6. $\left\{\dfrac{1}{3}\right\}$
7. {6}
8. {4}
9. {3}
10. {7}
11. $\left\{\dfrac{3}{2}\right\}$
12. {42}
13. {3}
14. $\left\{\dfrac{9}{2}\right\}$
15. $\left\{-\dfrac{1}{2}\right\}$
16. $\left\{\dfrac{5^{20}+12}{8}\right\}$
17. {2}
18. {2}
19. {2.63093}
20. {1.54795}
21. {1.62296}
22. {0.85809}
23. {2.57223}
24. {2.57909}
25. {−0.65629}
26. {−0.52130}
27. {1.50000}
28. {−0.13117}
29. {−7.71770}
30. {−11.45020}
31. {0.70951}
32. {−0.47667}
33. $a = \dfrac{9}{4}$; $b = \dfrac{27}{8}$

If $\dfrac{a}{b} = \dfrac{2}{3}$, then $3a = 2b$. Thus $a = \dfrac{2}{3}b$ (1). But $\dfrac{\log a}{\log b} = \dfrac{2}{3}$. Thus $3\log a = 2\log b$ or $\log a^3 = \log b^2$. This implies $a^3 = b^2$ (2). Substituting (1) into (2) and solving gives our answer. We must reject the solution $b = 0$, since the logarithm of 0 is undefined.

To model and solve situations using exponential and logarithmic functions.

Example #1: Palaeontologists can estimate the size of a dinosaur from incomplete skeletal remains. For a carnivorous dinosaur, the relationship between the length, s, in metres, of the skull and the body mass, m, in kilograms, can be expressed using the logarithmic equation $3.6022 \log s = \log m - 3.4444$. Determine the body mass, to the nearest kilogram, of an Albertosaurus with a skull length of 0.78 m.

Example #2:

General Formula for Half Life Questions: $\boxed{\text{Final Quantity} = \text{Initial Quantity (Factor of Change)}^{\frac{Time(years)}{Half\ Life(years)}}}$

When something living dies, the amount of radioactive carbon-14 (C-14) in its bones decreases. Archaeologists use this fact to determine the age of a fossil based on the amount of C-14 remaining. The half-life of C-14 is 5730 years.

When Ms. C taught at Balfour, she discovered (true story) that the skeleton used in the art department was not only an actual real skeleton, it was a skeleton that was dug up by a long ago science teacher and a group of students. Times were very different back in 1933 but Ms. C was shocked to learn that (according to newspaper clippings) the skeleton was actually taken from First Nation's land. She contacted the archeology department at the U of S and after a rather complicated process (which is another interesting story) the skeleton was picked up and taken to be carbon dated.

If the carbon remaining in the skeleton found at Balfour was 92% of what it originally was, how old was the skeleton that was found at Balfour?

Little bit of history – I went to Balfour myself and the art room was my homeroom throughout my years at high school. The skeleton (we called it Matilda) was hanging in its coffin box and was often taken out to be used in art displays. Here are the articles that I found in the archives room at Balfour – one was written by the Saskatoon Star and one by the Regina Leader. They were quite proud of the ingenuity of this science teacher and the society of the day celebrated his success rather than questioned the cultural appropriateness. Notice that the teacher had to request permission from the RCMP and the department of Indian Affairs to dig up this skeleton, but no permission had to be granted by any First Nation band themselves (the land in question is still held communally various First Nations but is not its own separate reserve community). The photograph of the skeleton was found in the 1933 Balfour yearbook. Unfortunately the skull went missing a week before the coroner picked up the skeleton from Balfour and the mystery of that has never been solved. The carbon dating would have been more accurate if they had been able to use the skull. The skeleton was laid to rest at a funeral ceremony in a cemetery north of Saskatoon.

December 15

The Star

December 5, 1933

What's a high school without a skeleton in the closet? That's just what the Commercial high school students wanted to know. But the situation's been rectified. At least, the school has the makings of a perfectly good skeleton--and it's a "home-grown" product.

From the dry-as-dust report of Principal A. Hodgkins before the vocational committee of the collegiate board, Monday night, it was discovered the Commercial high has a skeleton. Reported Mr. Hodkins:

"For some time the Commercial high school has been endeavoring to secure a human skeleton, for the purpose of instruction in human anatomy. The price of the skeleton, however, has been prohibitive ($150-$190)."

"Humph! Worth more dead than alive, I'd say!" interjected chairman C. E. Little, K.C.

The report continued:

"Some weeks ago Mr. Bird was giving a lesson in anatomy and happened to mention the need for a skeleton. A girl in the class volunteered the information that there was a skeleton out at Regina Beach, which some kiddies had been uncovering. We received the permission of the department of Indian affairs and the R.C.M.P. authorities to get the same. Mr. Bird went out to Regina Beach and got the girl to locate the grave and he and a senior boy dug up the skeleton. Mr. Bird intends to take the bones with him to Queen's University and get the assistance of the college authorities to put it together. The skeleton is in a splendid condition. One of the hospital doctors hazarded the opinion that the man must have died of a tubercular spine. Mr. Bird hopes to let the committee have the pleasure of seeing this skeleton when it is finally completed."

"I wonder if there might be germs in the bones?" hazarded Miss C. E. Sheldon-Williams, noting that "tubercular" part in particular.

"Oh my heavens, no!" exclaimed the principal. "Mr. Bird's been washing the bones in everything. They're quite pure now."

The meeting got on to other skeletons such as the deficit and the power transformers.

Teacher, Boy, Dig Up Skeleton for School

December 5, 1933.

The height of economy . . .

The Commercial High school couldn't afford $150 for a skeleton for instruction purposes . . .

So a member of the staff went out to Regina Beach and dug one up.

And it is a first class skeleton, too!

Alfred Hodgkins, principal of the school, told members of the vocational committee it was in "splendid" condition. A doctor at a Regina hospital hazarded the opinion the man—first inkling of the sex—had died of a tubercular spine.

Invited to See Remains

And members of the committee were invited over to see the remains when they (the remains) get back from Queen's university, where experts will patch the human frame together again.

The exploration and excavation story came out with a report of Mr. Hodgkins.

Some weeks ago A. Bird was giving a lesson in anatomy and happened to mention the need for a skeleton. Mr. Hodgkins reported, but the cost was too high.

A good skeleton brings from $150 to $190, the board was informed.

"We're worth more dead than alive," C. E. Little, K.C., observed.

But a girl in the class volunteered the information there was a skeleton out at Regina Beach which some children had uncovered.

Get Permission

So, armed with permission of the R.C.M.P. and the department of Indian affairs, a shovel and nerve, Mr. Bird, the girl student and a senior boy student journeyed forth to the beach. The girl found the grave, but Mr. Bird and the boy dug up the bones.

Now Mr. Bird intends to take the bones down to Queen's university and have experts patch the human frame together again.

OUR STAFF

TOP ROW—Right to Left: Mr. J. Shaw, B.A., Mr. E. C. Munro, B.A., Miss M. Lee, M. A., Mr. G. M. Wade, M.A., Mr. B. Darnell, Miss S. Mahon, Miss Z. Teed, Mr. D. A. McMaster, B.A. MIDDLE ROW—Miss J. Mooney, B. Com., Mr. F. J. Dixon, M.A., B. Com., Miss M. Sinclair, B. Com., Mr. A. S. Bird, Mr. F. S. Rawlinson, M.A., Miss M. Leverick, Mr. E. W. Larrigan, B.A., Mr. W. N. Hathway. BOTTOM ROW—Miss I. Thomson, Miss V. McAfee, B.A., Mr. P. J. Linden, B.A., Miss J. Griffin, B.A., Mr. H. C. Flegg, B. Com., Miss E. Mitchell (Secretary), Miss K. Foskett, B.A., Miss N. Murdock.

8.4 Day 2 ASSIGNMENT

8.4 Day 2 FA: P412 #6, 11, 13a, 15
8.4 Day 2 ULA: P412 #13bc, 14

LIST OF VIDEOS THAT MAY AIDE IN UNDERSTANDING

Section 8.1

- **https://goo.gl/L2MZxY**
- https://goo.gl/tdG7K4

Section 8.2

- **https://goo.gl/1Ykvyr**
- **https://goo.gl/pSktXV**

Section 8.3

- **https://goo.gl/R5SkBZ**
- **https://goo.gl/zfTLPB**

Section 8.4

- https://goo.gl/vEyKi7
- https://goo.gl/2bxy6W
- https://goo.gl/es7vhg