Properties of Logarithms

Time required
00 minutes

Activity Overview

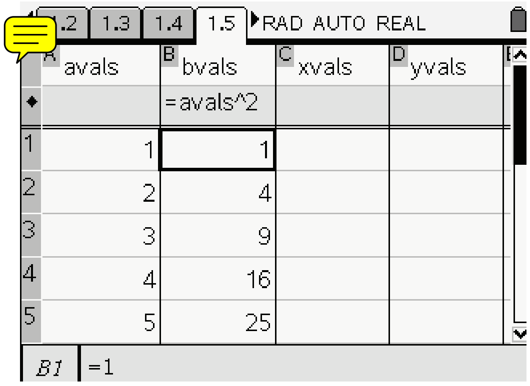
Logarithms are just another way of writing exponents. Just like exponents, logarithms have properties that allow you to simplify expressions and solve equations. In this activity, you will discover some of these properties by graphing and confirm them with algebra.

Materials

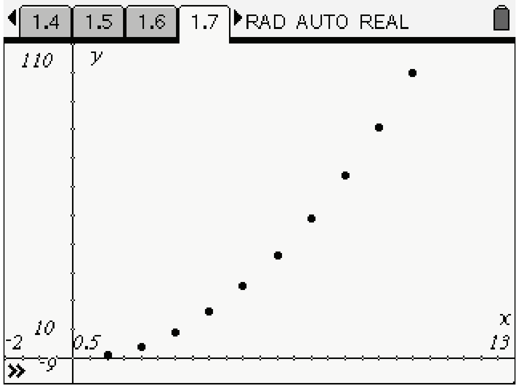
- *Technology*: TI-Nspire handheld, TI-Nspire CAS handheld, or TI-Nspire computer software
- *Documents*: Properties_Of_Logs.tns, Properties_Of_Logs_Student.doc

~~Properties of Logarithms—~~Student Solutions

1. a.



b. The graph is curved as it should be, since it is a quadratic plot.



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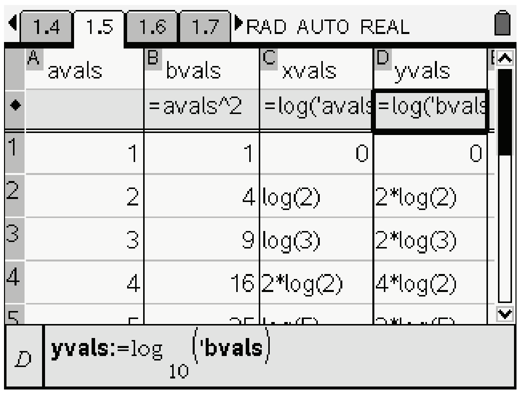
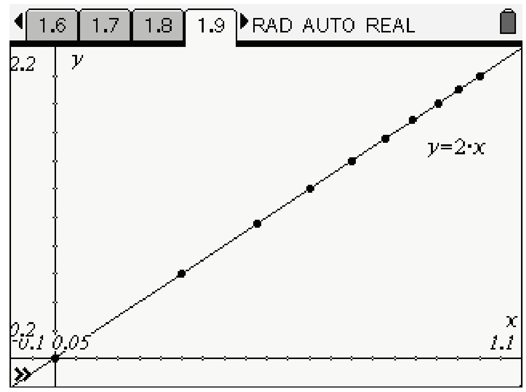
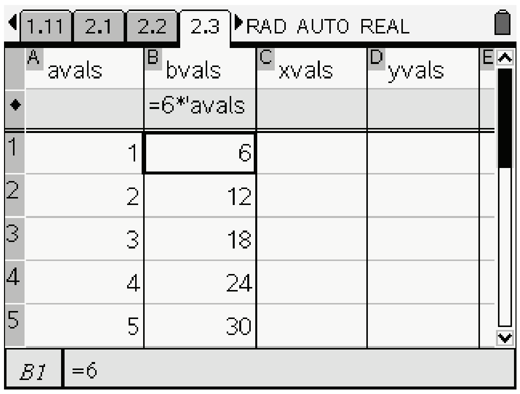
c. 

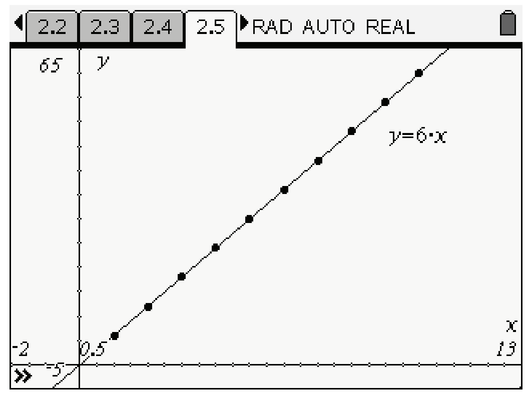


d. Students may be surprised to see a line instead of a curve. Answers will vary. The point here is to get the students discussing their thoughts on why this line occurred.

e. Since $y = \log(b)$ and $x = \log(a)$, we get $\log(b) = 2\log(a)$. But since $b = a^2$, we can write this as $\log(a^2) = 2\log(a)$. Students might then extend this pattern to the more general relationship of $\log(a^n) = n\log(a)$.

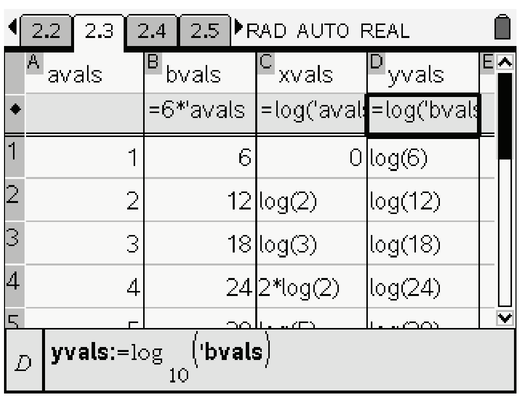
2. a.

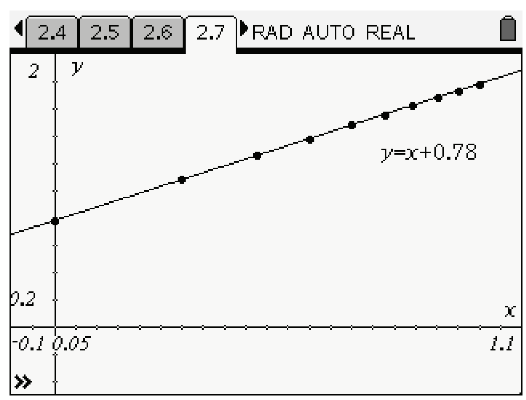




b. Students should note the expectation of a linear pattern, since the *a* values were simply ~~multiply~~ by 6.

c.





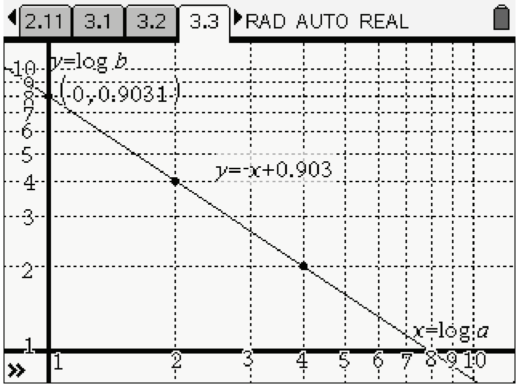
d. Students may not be sure what to expect at first. Once they calculate $10^{0.778151}$, they should realize that 0.778151 is the exponent that gives 6 when you raise 10 to it. Since the 6 is the coefficient of the *a* values from earlier, this is somehow related to the *y*-intercept of the new linear graph.

e. Here the equation becomes $\log(6a) = \log(a) + \log(6)$.

3. a. Since we are transforming the axes via a logarithm and the $\log(1) = 0$, the normal 0 points on the axes become 1 under the transformation.

b. Convenient points to use are $\frac{8}{1} = 8$, $\frac{8}{2} = 4$, and $\frac{8}{4} = 2$. Once these are plotted at the appropriate intersection points of the grid, we get a line.

c. Student responses will vary, but may state that the graph seems to be a line that involves the difference between a decimal number and the denominator of the original function $y = \frac{8}{x}$.



d. Students may try the approach used earlier to see what they get with $10^{0.90309}$. Here they will obtain a result of 8, yielding the numerator of the original rational function.

e. $\log\left(\frac{b}{a}\right) = \log(b) - \log(a)$