

Teacher's Guide

FiCycle LOGs and the accompanying activities represent a “constructivist” approach to instruction on logarithms. With the FiCycle “LOGs” students can explore the properties of LOGs in the physical world first before explicitly linking to exponents.

What are FiCycle LOGs?

FiCycle LOGs are a manipulative designed to help with instruction on exponents and logarithms. Each piece is labeled with a number and the length of the piece is proportional to the logarithm of the number. Thus, FiCycle LOGs exhibit all of the properties of logarithms. With FiCycle LOGs, students can experience the power of logarithms through experimentation. The LOGs range from 2 to 100 as set of LOGs contains multiples of 2 and 5.



What makes FiCycle Logs different?

FiCycle Logs allow student to explore and discover the properties of logarithms in a student-centered discovery-based way. Unlike typical instruction in logarithms, students are not told about logarithms and their relationship to exponents, they discover it. By working through these activities students learn how to:

- Add logarithmic functions with the same base
- Subtract logarithmic functions with the same base
- Multiply logarithmic functions by a constant
- Evaluate a logarithmic function
- Change of base formula
- Solve equation using logarithms
- Express logarithms using exponents and express exponential expressions using logarithms
- Use a calculator to evaluate logarithms with any base

Notes and Tips for Included Lessons

- Give the students the predetermined set of LOGS, specified at the top of the activity and get them started on the subject of the lesson.
- Let the students work with and play with the LOGS for a while first, working through activities designed to help them discover or realize properties of LOGS.
- Have the students discuss their observations in a small group or with the class.
- Let the students see if they can extend the relationship to a larger set of LOG problems.
- At the end of the session have the students discuss generalizations of the rules they have discovered either in groups or with the whole class.
- Once the concept has been developed have the students perform the exercises. Tasks typically follow the following progression:
 - Early problems are meant to be worked out using the FiCycle LOGS.
 - Later problems use the same concepts but there are not matching the FiCycle LOGS students have been given, forcing students to generalize/extend their understandings.
 - Students work out the general rule for that lesson using notation with variables.

Pacing and Completion

It's important to note that most problem sets are not intended to be completed by the entire class in their entirety; rather they are designed with differentiation in mind, such that *most* students will complete *almost* all problems.

- Most problem sets contain more problems and exercises than is necessary for everyone to complete.
- The final section in each lesson contains problems which, while able to be completed by applying the rule that was discovered, also serve to challenge students or hint at future topics. These problems might not be appropriate for all students and not all students are expected to complete them.
- Teachers should move on once most of the class has successfully generalized and engaged in some application. (For example, in lesson one, the teacher could move on once most of the class has completed Part III. It is not necessary or appropriate for all students to complete part IV)
- In this way, the whole class will be working on the same concept, but they can engage with it at different levels of understanding and depth.
- It is important to focus on cultivating a classroom culture that values “being engaged and working the whole time”, as opposed to “finishing the sheet/task” so that students for whom the challenge is appropriate don't feel like they are being asked to do “extra work” and so that students who discover the rule but never get to latter problems don't feel like they are not successful.

Prerequisite Knowledge

At times lessons rely heavily on prerequisite knowledge around exponents and key definitions. To this end, we have provided suggested Do-Nows for some activities. These small Do-Nows are meant to take 1-5 minutes and serve to highlight requisite mathematical knowledge. If your students do not need this review it can be ignored.

General Outline of Lessons

1. Adding Logs – Multiplication
2. Subtracting Logs -- Division
3. Multiple Logs -- Powers
4. Fractional Logs – Fractional Powers
5. Log 1
6. Pre-Assessment Review
7. Check for Understanding
8. LOGs & Scale
9. LOGs & Calculators
10. Changing the Base
11. Solving Equations Using Logs
12. Graphs and LOGs (*Coming Soon*)
13. Making Sense of LOG Scale (*Coming Soon*)

Frequently Asked Questions

What are FiCycle LOGs?

These educational manipulatives have been designed to aid in the instruction of logarithms. They are interesting and fun, and they are intended to be used prior to formal instruction in logarithms.

Who are FiCycle LOGs for?

FiCycle LOGs are meant for algebra level mathematics students in the beginning of their exploration of logarithms. Teachers, parents, afterschool instructors, tutors, and educators of all kinds can use FiCycle LOGs as supplementary instructional aids in the introduction of logarithms with individual students, small groups, or entire classes.

Why don't FiCycle LOGs have a base? What base are they?

We made the pedagogical choice to delay teaching students about the base initially since it distracts from discovering the properties and encourages students to only think about logarithms in terms of exponents. By starting in a “baseless” environment we allow students to focus on developing a deep understanding of the various properties of the function.

How many FiCycle LOGs are included in each set?

Each set contains 22 FiCycle Logs:

LOG Piece	Number Included
LOG 2	6
LOG 4	3
LOG 5	2
LOG 8	2
LOG 10	2
LOG 16	1
LOG 20	1
LOG 25	1
LOG 32	1
LOG 40	1
LOG 50	1
LOG 64	1
LOG 100	1
Total # of Pieces	23

What topics can be taught using FiCycle LOGs?

Using FiCycle LOGs and the included lessons you can teach your students all about the various properties of logarithms, change of base formula, solving equations involving logarithms or requiring and LOG scale.

How can I incorporate FiCycle LOGs into my already established mathematics curriculum?

FiCycle LOGs and the included activities are self-contained and can slot into any study of Algebra. They work best when used before introducing your students to logarithms.

Are FiCycle LOGs meant to be used as an individual learning aid or in a collaborative setting?

While FiCycle LOGs are great for individuals, parents or tutors working one-on-one with students they were designed with collaborative learning in mind and can be employed in any classroom setting.

Where can I find out more about FiCycle Logs, download materials and check for updates?**Are there additional resources available to aid in the use of FiCycle LOGs?**

Check our webpage for more information, to download materials, or check or updates:

<http://ficycle.org/logs/>