Name: 
Date: 
Do Now

1. Find a number that equals the same quantity when added to itself as it does when multiplied by itself.

   \[ 0 \text{ or } 2 \]

2. Find all such numbers that exist and, if possible, provide some justification as to why you believe you have listed them all.

   \[ 0, 2 \]

   After 2, the difference between adding a number to itself and squaring it will continually get larger.
Adding LOGs

Required Materials: 3 x LOG 2, 2 x LOG 4, LOG 8, LOG 5, LOG 10, LOG 16 and LOG 20

Directions: Using your FiCycle LOGS, explore what happens when you add LOGS by linking them end to end and seeing what LOGS have the same height. You can compare a sum of LOGS to another by placing two stacks of linked LOGS side by side.

Part I: Discovering LOG Properties
1. What LOG has the same height as linking one LOG 2 with another LOG 2?
   "This can be written this using the following notation:" LOG 2 + LOG 2 = LOG 4

2. What LOG has the same height as linking one LOG 4 and one LOG 4?
   "This can be written this using the following notation:" LOG 4 + LOG 4 = LOG 16

3. What LOG has the same height as linking one LOG 5 and one LOG 2?
   "This can be written this using the following notation:" LOG 5 + LOG 2 = LOG 10

4. Someone in class is confused and doesn’t understand how LOG 2 + LOG 2 + LOG 2 = LOG 8. Describe how you could show that it is true using LOGS.
   Stack 3 LOG 2's on top of each other. Compare the height of that to the height of the LOG 8. They are congruent, therefore LOG 2 + LOG 2 + LOG 2 = LOG 8.

   Before moving on to Part II make sure everyone in your group has the same answers to the above problems.

Part II: Applying knowledge
5. LOG 5 + LOG 4 = LOG 2 + LOG 10

6. LOG 2 + LOG 8 = LOG 4 + LOG 4

7. LOG 2 + LOG 10 = LOG 2 + LOG 2 + LOG 5

8. LOG (2 x 4) = LOG 2 + LOG 4

9. LOG 10 = LOG 2 + LOG 5

10. Betsy incorrectly thinks that LOG 4 + LOG 2 = LOG 6. What is her mistake? How could you show her that she has made an error using LOGS?
   "Stack a LOG 4 and a LOG 2 on top of each other. The height of this is congruent with the height of LOG 8, not LOG 6. Therefore, LOG 4 + LOG 2 = LOG 8."
Part III: Generalizing
11. Look back at your answers to Part I. What’s the pattern? Is it possible to add \textsc{logs} even if you don’t have them in front of you? In your own words, what is the rule or pattern for adding \textsc{logs}?

\textit{Multiply the arguments of the \textsc{logs} you are adding together to get the argument of the new \textsc{log}.}
\textit{(Not only one right answer for this question)}

12. Use your rule to determine: \( \log 2 + \log 8 = \log \underline{16} \)

13. Describe the pattern using variables: \( \log A + \log B = \underline{\log (A \cdot B)} \)

\textit{Before moving on to Part IV make sure everyone in your group understands Part III.}

Part IV: Practice & Application
14. \( \log 3 + \log 4 = \log \underline{12} \)

15. \( \log 5 + \log 10 = \log \underline{50} \)

16. \( \log 10 + \log 20 = \log \underline{200} \)

17. \( \log 7 + \log 8 = \log \underline{56} \)

18. \( \log 1 + \log 2 + \log 3 + \log 4 = \log \underline{24} \)

19. \( \log 7 + \log 10 = \log \underline{70} \)

Part V: Working Backwards. You can use the same pattern you discovered to work backwards!

\textit{Use the pattern you discovered to work backwards and express each \textsc{log} as the sum of two other \textsc{logs}:}
\textit{For example:} \( \log 16 = \log 4 + \log 4 \) \textit{(for some problems there is more than one correct response)}

20. \( \log (2 \bullet 2) = \log \underline{2} + \log \underline{2} \)

24. \( \log 2x = \log \underline{2} + \log \underline{x} \)

21. \( \log (2 \bullet 4) = \log \underline{2} + \log \underline{4} \)

25. \( \log 5x = \log \underline{5} + \log \underline{x} \)

22. \( \log (5 \bullet 4) = \log \underline{5} + \log \underline{4} \)

26. \( \log (x \bullet x) = \log \underline{x} + \log \underline{x} \)

23. \( \log 20 = \log \underline{5} + \log \underline{4} \)

27. \( \log xy = \log \underline{x} + \log \underline{y} \)

28. \textit{Generalize:} Describe the pattern using variables: \( \log AB = \log \underline{A} + \log \underline{B} \)
Part VI: More Challenging Questions. Express each sum as one LOG.

29. $\log 0.5 + \log 8 = \log 4$

30. $\log \frac{1}{2} + \log \frac{1}{4} = \log \frac{1}{8}$

31. $\log 24 = \log 6 + \log ____$

32. $\log 16 = \log 2 + \log 8$

33. $\log 56 = \log 8 + \log 7$

34. $\log 3^3 + \log 3^5 = \log 3^{3+5} = \log 3^8 = \log 6,561$

35. $\log x^3 + \log x^5 = \log x^8$