Name:
Date:

Subtracting LOGs

Required Materials: LOG 2, 2 x LOG 4, LOG 5, LOG 8, LOG 10, LOG 16, LOG 20, LOG 25, LOG 40, LOG 50, LOG 100

Directions: *Using your Ficycle LOGS, explore what happens when you subtract LOGS by comparing the relative heights of two LOGS and finding the LOG that makes up the difference.*

Part I: Discovering Log Properties

1. What is the difference between a LOG 20 and a LOG 4?
   Another way of asking this: What do you add to LOG 4 to make it the same height as LOG 20?

   This can be written this using the following notation: LOG 20 – LOG 4 = LOG __5__

   Check your answer: LOG __5__ + LOG 4 = LOG 20

2. What is the difference between a LOG 16 and a LOG 4?
   This can be written this using the following notation: LOG 16 – LOG 4 = LOG __4__

3. What is the difference between a LOG 10 and a LOG 2?
   This can be written this using the following notation: LOG 10 – LOG 2 = LOG __5__

4. What is the difference between a LOG 100 and a LOG 4?
   This can be written this using the following notation: LOG 100 – LOG 4 = LOG __25__

5. Someone in class is confused and doesn't understand how LOG 8 – LOG 2 = LOG 4. Describe how you could show that it is true using LOGS.

   Take LOG 8 and LOG 2 and put them next to each other. In order to make their heights congruent, LOG 4 must be added on top of LOG 2. Therefore, LOG 8 – LOG 2 = LOG 4.

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

Part II: Applying knowledge

6. LOG 40 – LOG 10 = LOG __4__
7. LOG 40 – LOG 5 = LOG __8__
8. LOG 40 – LOG 4 = LOG __10__
9. LOG 20 – LOG 5 = LOG __4__
10. LOG 20 – LOG 2 = LOG __10__
11. LOG 40 – LOG 20 = LOG __2__
12. LOG 100 – LOG 50 = LOG __2__

13. Barney incorrectly thinks that LOG 25 – LOG 5 = LOG 20. What is his mistake? How could you show him that he has made an error using LOGS?

Take LOG 25 and LOG 5 and put them next to each other. In order to make their heights congruent, a second LOG 5 must be added on top of LOG 5. Therefore, LOG 25 – LOG 5 = LOG 5.

Part III: Generalizing

14. Look back at your answers to Part I & Part II. What's the pattern? Is it possible to subtract LOGS even if you don't have them in front of you? In your own words, what is the rule or pattern for subtracting LOGS?

Yes, it is possible. In order to subtract two LOGs, take the argument of the first LOG and divide it by the argument of the second LOG. This gives you the argument of your final LOG.

15. Use your rule to determine: LOG 50 – LOG 5 = LOG *10*

16. Describe the pattern using variables: **LOG A – LOG B =** *LOG (A/B)*

17. *Vocabulary*: The number that comes after the word LOG is referred to as *the argument*.

a. What's the argument in "LOG 50"? *50*
b. What's the argument in "LOG 356"? *356*

18. *Last time we learned that:* To add LOGS we multiply their arguments.

Today we learned that: To subtract LOGS we *divide* their arguments.

Before moving on to Part IV make sure everyone in your group understands Part III.

Part IV: Practice & Application

19. LOG 50 – LOG 10 = LOG *5*

20. LOG 100 – LOG 2 = LOG *50*

21. LOG 200 – LOG 50 = LOG *4*

22. LOG 144 – LOG 12 = LOG *12*

23. LOG 35 – LOG7 = LOG *5*

24. LOG 56 – LOG 8 = LOG *7*

25. LOG 33 – LOG 3 = LOG *11*

26. LOG 45 – LOG 9 = LOG *5*

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

Use the pattern you discovered to work backwards and express each LOG *as the difference of two other* LOGS*:*

For example: LOG 5 = LOG $\frac{20}{4}$ = LOG 20 – LOG 4

27. LOG $\frac{20}{10}$ = LOG _20_ – LOG _10_

28. LOG $\frac{16}{4}$ = LOG _16_ – LOG _4_

For numbers 29 to 30:
Express LOG *10 in two different ways:*

29. LOG 10 = LOG _20_ – LOG _2_

30. LOG 10 = LOG _50_ – LOG _5_

Multiple Possible Responses

31. LOG $\frac{x}{10}$ = LOG _x_ – LOG _10_

32. LOG $\frac{x}{4}$ = LOG _x_ – LOG _4_

33. LOG $\frac{x}{y}$ = LOG _x_ – LOG _y_

34. LOG $\frac{2x}{5}$ = LOG _2x_ – LOG _5_

35. LOG $\frac{2x}{4y}$ = LOG _2x_ – LOG _4y_

36. *Generalize*: Describe the pattern using variables: **LOG A/B = LOG** _A_ **– LOG** _B_

Part VI: More Challenging Questions

37. LOG 1 – LOG 10 = LOG _1/10_

38. LOG ½ – LOG ¼ = LOG _2_

39. LOG ¼ – LOG ½ = LOG _1/2_

40. LOG 5 – LOG 2 = LOG _5/2 = 2 ½_

41. LOG 3^{12} – LOG 3^7 = LOG _3^5 = 243_

42. LOG x^6 – LOG x^4 = LOG _x^2_