Name:
Date:
Revisiting Prerequisite Knowledge for fractions of LOGS

1. List the first 8 square numbers:

   1, 4, 9, 16, 25, 36, 49, 64

2. List the square root of the first 8 square numbers:

   1, 2, 3, 4, 5, 6, 7, 8

3. What makes a number a square number?

   A square number is the product of some integer and itself.

4. List the first 5 cubic numbers:

   1, 6, 27, 64, 125

5. List the cubed root of the first 5 cubic numbers:

   1, 2, 3, 4, 5

6. What makes a number a cubic number?

   A cubic number is the product of three identical integers.

7. List the first 3 biquadratic numbers (Numbers that can be represented as a whole number to the fourth power, n^4):

   1, 16, 81

8. List the fourth root of the first 3 biquadratic numbers:

   1, 2, 3

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Fractions of LOGS

Required Materials: 3 x LOG 2, 2 x LOG 5, 2 x LOG 4, 2 x LOG 8, LOG 10, LOG 16, LOG 25, LOG 64, and LOG 100

Part I: Discovering Log Properties

1. What LOG is half the height of a LOG 25? *LOG 5*

   This can be written this using the following notation: $\frac{1}{2} \bullet$ LOG 25 = LOG__*5*__

2. What LOG is half the height of a LOG 100?

   This can be written this using the following notation: $\frac{1}{2} \bullet$ LOG 100 = LOG_*10*__

3. What LOG is half the height of a LOG 4? $\frac{1}{2} \bullet$ LOG 4 = LOG__*2*__

4. What LOG is half the height of a LOG 64? $\frac{1}{2} \bullet$ LOG 64 = LOG__*8*__

5. Describe (in symbols, works or both) how you can determine the argument:

   $\frac{1}{2} \bullet \log A = \log$ _*$A^{½}$* = *LOG $\sqrt[2]{A}$*

Part II: Applying knowledge

We have multiple ways to think about and explain this result.

1) An example of multiple LOGS where the multiple happens to be a fraction:

   We know that: **B • LOG A = LOG A^B,**

   Applying this we get: $\frac{1}{2} \bullet \text{LOG } 25 = \text{LOG } 25^{\frac{1}{2}}$

2) We also know from lining up and looking at our logs that:
   Two LOG 5s are the same height as a LOG 25.
   (Or that a LOG 5 is half the height of a LOG 25.)

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Putting these two ways of thinking about $\frac{1}{2} \bullet$ LOG 25 together we can see that:

$$\frac{1}{2} \bullet \text{LOG } 25 = \text{LOG } 25^{\frac{1}{2}} = \text{LOG } 5 \text{ and by extension } 25^{\frac{1}{2}} = \sqrt{25} = 5$$

Raising a quantity, a, to the $\frac{1}{2}$ power is the same as taking the square root of the quantity: $a^{\frac{1}{2}} = \sqrt{a}$

Examples: $25^{\frac{1}{2}} = \sqrt{25} = 5$ $\quad 100^{\frac{1}{2}} = \sqrt{100} = 10$ $\quad 9^{\frac{1}{2}} = \sqrt{9} = 3$

Part III: Generalizing

6. What LOG is half the height of a LOG 16?

   This can be written this using the following notation: $\frac{1}{2} \bullet \text{LOG } 16 = \text{LOG } 16^{\frac{1}{2}} = \text{LOG }$ _4_

7. What LOG is one fourth the height of a LOG 16?

   This can be written this using the following notation: $\frac{1}{4} \bullet \text{LOG } 16 = \text{LOG } 16^{?\ 1/4} = \text{LOG }$ _4_

8. What LOG is one third the height of a LOG 8? $\frac{1}{3} \bullet$ LOG 8 = LOG _$8^{1/3}$_ = LOG _2_

9. What LOG is one third the height of a LOG 64? $\frac{1}{3} \bullet$ LOG 64 = LOG _$64^{1/3}$_ = LOG _4_

10. What LOG is $\frac{1}{3}$ the height of a LOG A? $\frac{1}{3} \bullet \text{LOG } A = \text{LOG } A^{\frac{1}{3}} = \text{LOG }$ _$\sqrt[3]{A}$_

    How large is log $A^{\frac{1}{3}}$? → *It is $\frac{1}{3}$ the size of log A.*

    How large is log $\sqrt[3]{A}$? → *It is $\frac{1}{3}$ the size of log A.*

11. What LOG is $\frac{1}{n}$ the height of a LOG A? $\frac{1}{n} \bullet \text{LOG } A = \text{LOG } A^{\frac{1}{n}} = \text{LOG }$ _$\sqrt[n]{A}$_

    How large is log $A^{\frac{1}{n}}$? → *It is $\frac{1}{n}$ the size of log A.*

    How large is log $\sqrt[n]{A}$? → *It is $\frac{1}{n}$ the size of log A.*

Part IV: Practice & Application

12. What LOG is $\frac{1}{3}$ the height of a LOG 125? $\frac{1}{3} \bullet$ LOG 125 = LOG _$\sqrt[3]{125}$_ $= LOG\ 5$

13. What LOG is $\frac{1}{5}$ the height of a LOG 32? $\frac{1}{5} \bullet$ LOG 32= LOG _$\sqrt[5]{32}$_ $= LOG\ 2$

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14. What LOG is $\frac{1}{5}$ the height of a LOG 1024? $\frac{1}{5}$ • LOG 1024= LOG $\sqrt[5]{1024}$ = LOG 4

15. What LOG is $\frac{1}{10}$ the height of a LOG 1024? $\frac{1}{10}$ • LOG 1024= LOG $\sqrt[10]{1024}$ = LOG 2

16. What LOG is $\frac{1}{2}$ the height of a LOG 81? $\frac{1}{2}$ • LOG 81= LOG $\sqrt[2]{81}$ = LOG 9

17. What LOG is $\frac{1}{4}$ the height of a LOG 81? $\frac{1}{4}$ • LOG 81= LOG $\sqrt[4]{81}$ = LOG 3

18. What LOG is $\frac{1}{4}$ the height of a LOG 625? $\frac{1}{4}$ • LOG 625 = LOG $\sqrt[4]{625}$ = LOG 5

19. What LOG is 20% the height of a LOG 625? .2 • LOG 625 = LOG $\sqrt[.2]{625}$

20. What LOG is $\frac{1}{\pi}$ the height of a LOG 9? $\frac{1}{\pi}$ • LOG 9= LOG $\sqrt[\pi]{9}$

21. What LOG is $\frac{1}{☺}$ the height of a LOG ☹? $\frac{1}{☺}$ • LOG ☹= LOG $\sqrt[☺]{☹}$

Make up your own! Make up three that work out to a with a LOG whole number argument:

22. What LOG is __1/8__ the height of a LOG _2_? _1/8_ • LOG _2_ = LOG $\sqrt[8]{2}$

23. What LOG is __1/27__ the height of a LOG _5_? _1/27_ • LOG _5_ = LOG $\sqrt[27]{5}$

24. What LOG is __1/3__ the height of a LOG _73_? _1/3_ • LOG _73_ = LOG $\sqrt[3]{73}$

(Example answers. Students can make up any three as long as they work out.)

Evaluate

25. $8^{\frac{1}{3}}$ 2

27. $125^{\frac{1}{3}}$ 5

26. $10000000^{\frac{1}{7}}$ 10

28. $3^{\frac{1}{4}}$ $\sqrt[4]{3}$