## Lesson 4: Positive Rational Exponents

* Let’s use roots to write exponents that are fractions.

### 4.1: Math Talk: Regrouping Fractions

Find the value of each expression mentally.

### 4.2: You Can Use Any Fraction As an Exponent

1. Use exponent rules to explain why these expressions are equal to each other:

|  |  |
| --- | --- |
|  |  |

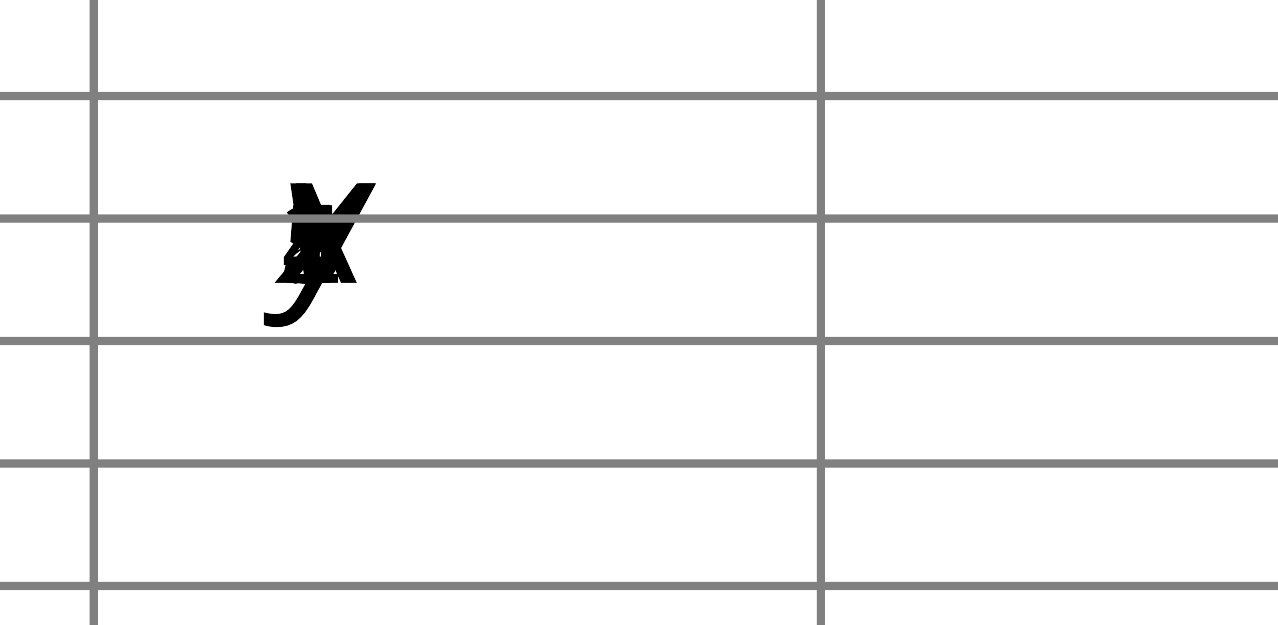


1. Write using radicals.
2. Write using radicals. Show your reasoning using exponent rules.

### 4.3: Fractional Powers Are Just Numbers

1. Complete the table as much as you can without using a calculator. (You should be able to fill in three spaces.)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | * 0 |  |  | * 1 |  |  | * 2 |
| * (using exponents) |  |  |  |  |  |  |  |
| * (decimal approximation) |  |  |  |  |  |  |  |

* 1. Plot the points that you filled in.
  + 
  1. Connect the points as smoothly as you can.
  2. Use this graph of to estimate the value of the other powers in the table, and write your estimates in the table.

1. Let’s investigate :
   1. Write using radical notation.
   2. What is ?
   3. Raise your estimate from the table of to the third power. What should it be? How close did you get?
2. Let’s investigate :
   1. Write using radical notation.
   2. What is the value of ?
   3. Raise your estimate from the table of to the third power. What should it be? How close did you get?

#### Are you ready for more?

Answer these questions using the fact that .

1. Explain why is very close to . Is it larger or smaller than ?
2. Is it possible to write exactly with a finite decimal expansion? Explain how you know.

### Lesson 4 Summary

Using exponent rules, we know is the same as because . But what about ?

Using exponent rules,

which means that

Since , we could just write .

Alternatively, we could express the fraction as  instead. Using exponent rules, we get

Here are more examples of exponents that are fractions and their equivalents:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 |  |  | 1 |  |  | 2 |
| (using exponents) |  |  |  |  |  |  |  |
| (equivalent expression) | 1 |  | or | 5 | or | or | 25 |



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