**Activity 1.7.1 Review of Exponents**

In order to understand certain kinds of functions, it is important to remember some properties of exponents. Following are some important properties:

* am × an = am+n  
  Remember that am = a × a × … × a, where there are m a’s on the right hand side of the equation. In order to see why am × an = am+n, let’s write am in red and an in blue:  
  am × an = (a × a × … × a) × (a × a × … × a) [with m a’s in red and n a’s in blue]  
   = (a × a × … × a × a × a × … × a) [with m a’s in red and n a’s in blue]  
  Now, how many a’s are there in the last expression? m + n of them. Therefore,  
  am × an = am+n.
* am ÷ an = am-n  
  We can see this in a similar way:  
  am ÷ an = (a × a × … × a) ÷ (a × a × … × a) [with m a’s in red and n a’s in blue]  
   = [with m a’s in red and n a’s in blue]  
  Now if m > n, we can “cancel” n of the a’s in the numerator and the denominator of the fraction. If we do that, how many a’s are left in the numerator? m – n of them. Therefore,  
  am ÷ an = am-n.
* = [with n terms of ]  
  Now each term has m a’s, and there are n such terms. How many a’s do we have in all? mn of them. Therefore, .
* For any value of a, a1 = a. For any value of a except for a = 0, a0 = 1. 00 is undefined.
* Note that (since a0 = 1). But = a0-m = a-m, so = a-m.  
  Another way to see this makes sense is to think of it as follows:  
  We know that 23 = 8, 22 = 4, 21 = 2, 20 = 1. 4 is half of 8, 2 is half of 4, and 1 is half of 2.  
  This shows that when the exponent decreases by 1, we take half of the preceding value.  
  If this is true, then what should 2-1 be? It should be half of 1, or , so 2-1 = .  
  Similarly, 2-2 = , 2-3 = , etc.

Here are a few problems to try:

1. *x*4 × *x*3 =

2. =

3. *z*6 ÷ *z*4 =

4. =

5. =

6. =

7. =

8. =

9. =

10. =

One more property of exponents involves . Suppose we raise to the nth power.

Then [with n terms of ].

It is also true that .

This shows if we multiply by itself n times, we get a.

This means that must be the nth root of a: .

Similarly, and .

Answer the following questions:

11. Write in the form .

12. Write in the form.

13. Simplify the following:

a.   
  
b.