

Fast Growing Plant?

Name _____

I recently purchased a new plant. When I bought the plant it was exactly one foot tall. I noticed the plant was growing at a pretty fast rate, so after one month I decided to measure its height. After one month my plant was two feet tall. I decided that I would measure the height of my plant at the end of each month. As I give you the measurements please fill in the data in the table below. After two months my plant was four feet tall. After three months my plant was eight feet tall. We had to move the plant out of my house at this point. We relocated it to a nearby office building. After four months the plant was 16 feet tall and after five months the plant was 32 feet tall.

Months owned	0	1	2	3	4	5		
Height in feet								

1. If my plant keeps growing at this rate, how can you find the height of my plant after eight months? Add this height to the table.

2. If my plant keeps growing at this rate, how can you find the height of my plant for any number of months? Think of a couple of different ways that the height could be found for any number of months.

3. Write an equation that gives the height of plant in feet for any number of months. Explain what your variables represent in the context of this story.

4. I recently went back to the store where I bought my plant and I found out that the plant was alive for a long time before I bought it and that the store owner believes it was growing at the same rate, even before it was one foot tall. Assuming this is the case, and that my plant was doubling in height each month, how tall was plant (in feet) one month before I purchased it?

5. How tall was my plant (in feet) two and three months before I purchased it? What math are you doing to find the height a year earlier?

6. You should have noticed that in your equation in problem three the exponent represents the number of months that you owned the plant. What exponent value would it make sense to use in your equation to model when I bought the plant? How about 1, 2 and 3 months before I owned the plant?

7. Fill in the table below to include the plant's height for months before and after I purchased the plant.

Months owned	-4	-3	-2	-1	0	1	2	3	4
Height in feet									

8. Based on questions 4 – 7, describe in words what happens when we take a positive number and raise it to a negative power.

9. Describe any patterns or anything you notice in the table in problem number seven.

10. Based on what you learned think about the value of the following powers of two. If it helps think about them in the context of my plant:

$2^{-6} =$

$2^{-7} =$

$2^6 =$

$2^7 =$

Beanstalk?

After the world learned about my fast growing plant, news broke about a giant beanstalk in a far away land. A man named Jack had been recording the height of his fast-growing beanstalk for sometime. Jack kept a record of the beanstalk's height in meters.

Years Owned	Height in Meters
0	1
1	10
2	100
3	1000
4	
5	
9	

11. If my beanstalk keeps growing at this rate, how can you find the height of the beanstalk after 4, 5 and 9 years?

12. Write an equation that gives the height of the beanstalk for any number of years. Explain what your variables represent in the context of this story.

13. The beanstalk was growing at the same rate for several years before Jack found it. How tall was the beanstalk 1, 2, 3, 4 and 5 years before Jack found it. Just like we can model the height of the beanstalk three years after Jack found it with 10^3 we can model how tall the plant was three years before Jack found it with 10^{-3} . If possible try to write the heights in fractions and decimals:

Years since Jack found beanstalk	Height in meters of beanstalk
-5	
-4	
-3	
-2	
-1	
0	
1	
2	
3	
4	
5	

14. Let's now make some observations from the table in problem 13. What operation do you do to move to a greater power of ten? What operation do you do to move to a lesser power of ten? What patterns or other observations do you notice in the table?

15. When we raise 10 or any other positive whole number to a negative power what is the result?

16. Rewrite each expression in its standard numeral form.

$10^{-6} =$

$10^6 =$

$10^{-8} =$

$10^8 =$

17. Determine the value of these expressions. You might consider thinking of each expression in the context of the plant or beanstalk or you might think of terms in symmetry.

$4^{-2} =$

$3^{-1} =$

$5^{-3} =$

$6^{-2} =$

18. Make up your own story to help you (or your class) understand negative exponents. Make up a story about a one ton blob. At what rate was it growing before and after you got him at the pet store?

To learn even more about negative exponents try going to www.geogebra.org/ or <http://www.meta-calculator.com/online/> to see a graph of the exponential patterns that you have been studying. Make sure that you can view the negative x values in quadrant two so that you can see the values of the negative exponents.

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