UNIT 2 - LESSON 3

Name Period Date

READY

Topic: Solving exponential equations.

Solve for the value of *x*.

1. $5^{x+1} = 5^{2x-3}$

$x+1=2x-3$
$4=x$

2. $7^{3x-2} = 7^{-2x+8}$

$3x-2=-2x+8$
$5x=10$
$x=2$

3. $4^{3x} = 2^{2x-8}$

$2^{6x}=2^{2x-8}$
$6x=2x-8$
$4x=-8$
$x=-2$

4. $3^{5x-4} = 9^{2x-3}$

$3^{5x-4}=3^{4x-6}$
$5x-4=4x-6$
$x=-2$

5. $8^{x+1} = 2^{2x+3}$

$2^{3x+3}=2^{2x+3}$
$3x+3=2x+3$
$x=0$

6. $3^{x+1} = \frac{1}{81}$

$3^{x+1}=3^{-4}$
$x+1=-4$
$x=-5$

SET

Topic: Exploring the inverse of an exponential function

In the fairy tale *Jack and the Beanstalk*, Jack plants a magic bean before he goes to bed. In the morning Jack discovers a giant beanstalk that has grown so large, it disappears into the clouds.

But here is the part of the story you never heard. Written on the bag containing the magic beans was this note.

Plant a magic bean in rich soil just as the sun is setting. Do not look at the plant site for 10 hours. (This is part of the magic.) After the bean has been in the ground for 1 hour, the growth of the sprout can be modeled by the function $b(t) = 3^t$. (b in feet and t in hours)

Jack was a good math student, so although he never looked at his beanstalk during the night, he used the function to calculate how tall it should be as it grew. The table on the right shows the calculations he made every half hour.

Hence, Jack was not surprised when, in the morning, he saw that the top of the beanstalk had disappeared into the clouds.

Time (hours)	Height (feet)
1	3
1.5	5.2
2	9
2.5	15.6
3	27
3.5	46.8
4	81
4.5	140.3
5	243
5.5	420.9
6	729
6.5	1,262.7
7	2,187
7.5	3,788
8	6,561
8.5	11,364
9	19,683
9.5	34,092
10	59,049

Need help? Visit **www.rsgsupport.org**

mathematics vision project

7. Demonstrate how Jack used the model $b(t) = 3^t$ to calculate how high the beanstalk would be after 6 hours had passed. (You may use the table but write down where you would put the numbers in the function if you didn't have the table.)

$b(6) = 3^6 = 729$ feet ✓

8. During that same night, a neighbor was playing with his drone. It was programmed to hover at 243 ft. How many hours had the beanstalk been growing when it was as high as the drone?

$243 = 3^t$ $t = 5$ hrs. ✓table

9. Did you use the table in the same way to answer #8 as you did to answer #7? No Explain.

In #7, I knew the time so I found the height for that time.
In #8, I knew the height so I found the time for that height

10. While Jack was making his table, he was wondering how tall the beanstalk would be after the magical 10 hours had passed. He quickly typed the function into his calculator to find out. Write the equation Jack would have typed into his calculator.

$b(10) = 3^{10}$

11. Commercial jets fly between 30,000 ft. and 36,000 ft. About how many hours of growing could pass before the beanstalk might interfere with commercial aircraft? Explain how you got your answer.

- If look at table, between 9 and 10 hours
- If use technology to get graphs, then beanstalk reaches height of 30,000 ft after 9.3836 hours

12. Use the table to find $f(7)$ and $f^{-1}(11{,}364)$.

$b(7) = 2187$ $b^{-1}(11{,}364) = 8.5$

13. Use the table to find $f(9)$ and $f^{-1}(9)$.

$b(9) = 19{,}683$ $b^{-1}(9) = 2$

13. Explain why it's possible to answer some of the questions about the height of the beanstalk by just plugging the numbers into the function rule and why sometimes you can only use the table.

When the time is given, I can always plug that value into the function rule.
When height is given, I can plug the value into the function rule if the height is an exact power of 3. Otherwise, I need to use the table or technology until I learn more about logs.

GO

Topic: Evaluating functions

The functions $f(x), g(x), and\ h(x)$ are defined below.

$f(x) = -2x$ $\quad g(x) = 2x + 5$ $\quad h(x) = x^2 + 3x - 10$

Calculate the indicated function values. Simplify your answers.

14. $f(a) = -2a$

15. $f(b^2) = -2b^2$

16. $f(a + b) = -2a - 2b$

17. $h(a^2) = a^4 + 3a^2 - 10$

18. $g(a) = 2a + 5$

19. $g(b^2) = 2b^2 + 5$

20. $g(a + b) = 2a + 2b + 5$

21. $h(a - b) = (a-b)^2 + 3(a-b) - 10$
$= a^2 - 2ab + b^2 + 3a - 3b - 10$

22. $h(a) = a^2 + 3a - 10$

23. $h(b^2) = b^4 + 3b^2 - 10$

24. $h(a + b) = a^2 + 2ab + b^2 + 3a + 3b - 10$

25. $g(b - a) = 2b - 2a + 5$