

Negative Exponents and Negative Bases

Name: _____

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Score: _____ / 18

Quick Review and Helpful Hints

A negative *exponent* means take the reciprocal: $x^{-n} = \frac{1}{x^n}$. A negative *base* needs care: an *even* exponent gives a positive result, an *odd* exponent gives a negative result. Watch the parentheses: $(-2)^4$ has base -2 , but -2^4 means $-(2^4)$.

▷ **Example:** Evaluate $(-2)^{-3}$. **Work:** First handle the negative exponent: $(-2)^{-3} = \frac{1}{(-2)^3}$. Now $(-2)^3 = -8$ (odd power of a negative base is negative). So the value is $\frac{1}{-8} = -\frac{1}{8}$. ★ **Answer:** $-\frac{1}{8}$

◆ Practice Problems

Evaluate each expression. Watch the parentheses carefully.

1. $(-3)^2$

8. $(-4)^2$

2. $(-3)^3$

9. -3^2

3. -2^4

10. $(-10)^{-2}$

4. $(-2)^4$

11. $(-1)^{10}$

5. $(-5)^{-2}$

12. $(-2)^5$

6. $(-2)^{-3}$

13. $(-6)^{-1}$

7. $(-1)^7$

14. $(-3)^{-2}$

◆ Word Problems

15. A temperature change is modeled by $(-2)^3$ degrees. What is its value?

16. In a repeating pattern, a term equals $(-1)^{20}$. What is its value?

17. A value in a formula is $(-5)^{-2}$. Write it as a fraction.

18. A spreadsheet compares two formulas, -4^2 and $(-4)^2$, for a sign-error check. Find both values and explain why they differ.



Answer Keys

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| 1. <input type="text" value="9"/> | 7. <input type="text" value="-1"/> | 13. <input type="text" value="-1/6"/> |
| 2. <input type="text" value="-27"/> | 8. <input type="text" value="16"/> | 14. <input type="text" value="1/9"/> |
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| 4. <input type="text" value="16"/> | 10. <input type="text" value="1/100"/> | 16. <input type="text" value="1"/> |
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| 6. <input type="text" value="-1/8"/> | 12. <input type="text" value="-32"/> | 18. <input type="text" value="-16 and 16"/> |

Step-by-Step Explanations

1. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is An even power makes a negative base positive: $(-3)^2 = (-3)(-3) = 9$. So the final answer is 9.

2. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is An odd power keeps the result negative: $(-3)^3 = -27$. So the final answer is -27 .

3. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is No parentheses, so the power touches only the 2: $-2^4 = -(16) = -16$. So the final answer is -16 .

4. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is The parentheses include the sign, and an even power is positive: $(-2)^4 = 16$. Notice how this differs from -2^4 ! So the final answer is 16.

5. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Flip for the negative exponent, then square (even power stays positive): $(-5)^{-2} = \frac{1}{(-5)^2} = \frac{1}{25}$. So the final answer is $\frac{1}{25}$.

6. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Flip, then cube (odd power stays negative): $(-2)^{-3} = \frac{1}{(-2)^3} = \frac{1}{-8} = -\frac{1}{8}$. So the final answer is $-\frac{1}{8}$.

7. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is An odd power of -1 stays -1 . So the final answer is -1 .

8. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is An even power of a negative base is positive, so $(-4)^2 = 16$. So the final answer is 16.

9. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Without parentheses this means $-(3^2) = -9$ - the sign is not squared. So the final answer is -9 .

10. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Flip and square: $(-10)^{-2} = \frac{1}{(-10)^2} = \frac{1}{100}$. So the final answer is $\frac{1}{100}$.

11. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is An even power of -1 is 1. So the final answer is 1.

12. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is An odd power of a negative base is negative: $(-2)^5 = -32$. So the final answer is -32 .

13. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is The reciprocal of -6 is $-\frac{1}{6}$, so $(-6)^{-1} = -\frac{1}{6}$. So the final answer is $-\frac{1}{6}$.

14. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Flip and square (even power, positive): $(-3)^{-2} = \frac{1}{(-3)^2} = \frac{1}{9}$. So the final answer is $\frac{1}{9}$.

15. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is An odd power of a negative base is negative, so $(-2)^3 = -8$ degrees. So the final answer is -8 .

16. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is An even power of -1 is 1, so this pattern term equals 1. So the final answer is 1.

17. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Flip, then square: $(-5)^{-2} = \frac{1}{(-5)^2} = \frac{1}{25}$. So the final answer is $\frac{1}{25}$.

18. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Without parentheses, $-4^2 = -(16) = -16$; with them, $(-4)^2 = 16$. The parentheses decide whether the sign is squared. So the final answer is -16 and 16.



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