Zero and Negative Exponents

Name: _____	Date: _____	Score: _____ / 18

Quick Review and Helpful Hints

Any *nonzero* base raised to the 0 power equals 1: $x^0 = 1$. A *negative* exponent means take the reciprocal: $x^{-n} = \frac{1}{x^n}$, and $\frac{1}{x^{-n}} = x^n$. To finish a problem, rewrite everything with positive exponents and then simplify.

▷ **Example:** Rewrite 2^{-3} with a positive exponent and evaluate it. **Work:** A negative exponent means take the reciprocal: $2^{-3} = \frac{1}{2^3}$. Then $2^3 = 8$, so the value is $\frac{1}{8}$.

★ **Answer:** $\frac{1}{8}$

Practice Problems

Evaluate or rewrite each expression with positive exponents.

1. Evaluate 7^0 _____

2. Evaluate 3^{-2} _____

3. Evaluate 5^{-1} _____

4. Evaluate $(-4)^0$ _____

5. Evaluate 2^{-4} _____

6. Rewrite x^{-5} with a positive exponent _____

7. Evaluate 10^{-3} _____

8. Simplify $\frac{1}{x^{-2}}$ _____

9. Evaluate $4^0 + 3^0$ _____

10. Evaluate 6^{-2} _____

11. Rewrite $3x^{-2}$ with positive exponents _____

12. Evaluate 2^{-3} _____

13. Evaluate $\left(\frac{1}{2}\right)^{-2}$ _____

14. Evaluate 9^{-1} _____

Word Problems

15. A scientist writes a measurement as 10^{-2} meters. Express this as a fraction. _____

16. A calculator displays 5^0 as a result. What number is this? _____

17. The thickness of a sheet is 2^{-4} inch. Write this thickness as a fraction. _____

18. A science formula has the denominator 4^{-1} in the expression $\frac{1}{4^{-1}}$. What is the simplified value? _____

Answer Keys

1. $\boxed{1}$	**7.** $\boxed{\frac{1}{1000}}$	**13.** $\boxed{4}$
2. $\boxed{\frac{1}{9}}$	**8.** $\boxed{x^2}$	**14.** $\boxed{\frac{1}{9}}$
3. $\boxed{\frac{1}{5}}$	**9.** $\boxed{2}$	**15.** $\boxed{\frac{1}{100}}$
4. $\boxed{1}$	**10.** $\boxed{\frac{1}{36}}$	**16.** $\boxed{1}$
5. $\boxed{\frac{1}{16}}$	**11.** $\boxed{\frac{3}{x^2}}$	**17.** $\boxed{\frac{1}{16}}$
6. $\boxed{\frac{1}{x^5}}$	**12.** $\boxed{\frac{1}{8}}$	**18.** $\boxed{4}$

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 Any nonzero number raised to the zero power equals 1 – a handy rule to memorize, so $7^0 = 1$. So the final answer is 1.

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 A negative exponent means take the reciprocal: $3^{-2} = \frac{1}{3^2} = \frac{1}{9}$. So the final answer is $\frac{1}{9}$.

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 5^{-1} is simply the reciprocal of 5, namely $\frac{1}{5}$. So the final answer is $\frac{1}{5}$.

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 zero power gives 1 even with a negative base, so $(-4)^0 = 1$. So the final answer is 1.

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 and raise: $2^{-4} = \frac{1}{2^4} = \frac{1}{16}$. So the final answer is $\frac{1}{16}$.

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 Move the factor to the denominator to make the exponent positive: $x^{-5} = \frac{1}{x^5}$. So the final answer is $\frac{1}{x^5}$.

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 $10^{-3} = \frac{1}{10^3} = \frac{1}{1000}$ – powers of ten make this quick. So the final answer is $\frac{1}{1000}$.

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 A negative exponent in the denominator jumps up top: $\frac{1}{x^{-2}} = x^2$. So the final answer is x^2.

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 Each term is 1 because of the zero power, so $1 + 1 = 2$. So the final answer is 2.

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: $6^{-2} = \frac{1}{6^2} = \frac{1}{36}$. So the final answer is $\frac{1}{36}$.

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 Only the x has the negative exponent, so it moves down while the 3 stays: $3x^{-2} = \frac{3}{x^2}$. So the final answer is $\frac{3}{x^2}$.

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 $2^{-3} = \frac{1}{2^3} = \frac{1}{8}$. So the final answer is $\frac{1}{8}$.

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 A negative exponent flips the fraction first: $\left(\frac{1}{2}\right)^{-2} = \left(\frac{2}{1}\right)^2 = 4$. So the final answer is 4.

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 9^{-1} is the reciprocal of 9, namely $\frac{1}{9}$. 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 $10^{-2} = \frac{1}{10^2} = \frac{1}{100}$ meter. So the final answer is $\frac{1}{100}$.

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 Any nonzero base to the zero power is 1, so the display reads 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 $2^{-4} = \frac{1}{2^4} = \frac{1}{16}$ inch. So the final answer is $\frac{1}{16}$.

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 The negative exponent in the denominator moves up top: $\frac{1}{4^{-1}} = 4$. So the final answer is 4.

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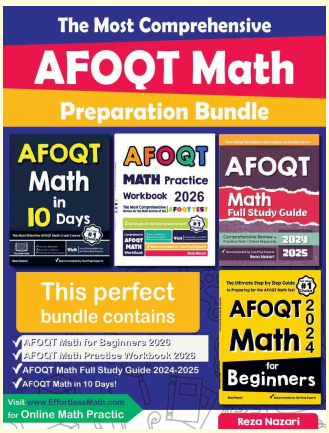

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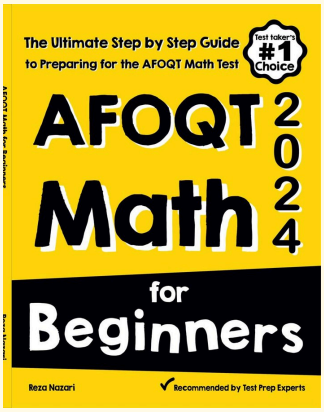

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