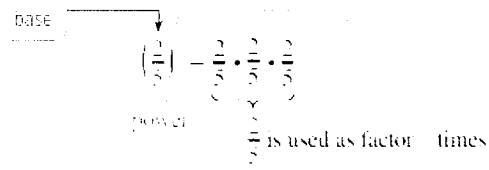
Algebra 1 Name:

6.1 Explain – Properties of Exponents Day 1 - Notes

Essential Question: How can you write general rules involving properties of exponents?

Main Ideas/ Questions	Notes/Examples
What You Will Learn	• Use zero and negative exponents. • Use the product of powers and quotient of powers properties of exponents. • Solve real-life problems involving exponents.
Exponent Review	• A **power** is a product of repeated factors. • The **base** of a power is the common factor. • The **exponent** of a power indicates the number of times the base is used as a factor.



Zero Exponents

Use your calculator to evaluate the following:

1. $3^0 = 1$ 2. $5^0 = 1$ 3. $(-10)^0 = 1$

Write a conjecture based on the previous three problems:

Anything to the zero power equals 1

Negative Exponents

$a^{-n} = \frac{1}{a^n}$

No neg exp stays.

$3x^{-2} = \frac{3}{x^2}$ ← move & change sign.

Simplified polynomials may NOT have negative exponents.

Using Zero and Negative Exponents

Practice: Evaluate the expression.

1. $3^0 = 1$
2. $(-2)^0 = 1$
3. $3^{-4} = \frac{1}{3^4} = \frac{1}{81}$
4. $(-4)^{-3} = \frac{1}{(-4)^3} = \frac{1}{-64}$
5. $\frac{2^{-3}}{5^0} = \frac{1}{2^3} = \frac{1}{8}$ (put 1 (don't leave blank!))
6. $\frac{-3^{-2}}{2^{-3}} = \frac{2^3}{-3^2} = \frac{8}{-9}$ (neg is not squared)
7. $\frac{4^{-1}}{-7^0} = \frac{1}{4}$
8. $\frac{3^{-1}}{(-5)^0} = \frac{1}{3}$

Practice: Simplify the expression. Write your answer using only positive exponents.

9. $z^0 = 1$
10. $a^{-8} = \frac{1}{a^8}$
11. $6a^0b^{-2} = \frac{6}{b^2}$
12. $14m^{-4}n^0 = \frac{14}{m^4}$
13. $\frac{3^{-2}r^{-3}}{s^0} = \frac{1}{3^2r^3} = \frac{1}{9r^3}$
14. $\frac{2^3a^{-3}}{8^{-1}b^{-5}c^0} = \frac{2^3 \cdot 8 \cdot b^5}{a^3} = \frac{64b^5}{a^3}$

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Product of Powers Property

To multiply powers with the same base....

- Multiply coefficients, ADD exponents.

What it looks like: $3x^3(4x^6)$

What it means: $(3 \cdot 4)(x^{3+6})$

What it is: $12x^9$

$3 \cdot xxx \cdot 4 \cdot xxxxxx$

$12x^9$

Practice: Simplify the expression. Write your answer using only positive exponents.

15. $x^4 \cdot x^7$ $= x^{11}$

16. $(m^3)(m^3)$ m^6

17. $r^2 \cdot r^1$ r^3

18. $(-5)^3 \cdot (-5)^3$ $(-5)^6$

19. $x^1 \cdot x^7 \cdot x^1$ x^9

20. $(ab^4)(ab^2c)$ a^2b^6c

21. $(4x^2y^3)(6x^{12}y)^1$ $24x^{14}y^4$

22. $a^m \cdot a^n$ a^{m+n}

Quotient of Powers Property

To divide powers with the same base....

- Divide coefficients, SUBTRACT exponents.

What it looks like: $\frac{12x^3}{2x^2}$

What it means: $\frac{12}{2} x^{3-2}$

What it is: $6x$

$\frac{12xxx}{2xx} = 6x$

Practice: Simplify the expression. Write your answer using only positive exponents.

23. $\frac{x^7}{x^2}$ x^5

24. $\frac{m^3}{m^5}$ $m^{-2} = \frac{1}{m^2}$

25. $\frac{2\cancel{6}x^3}{3\cancel{9}x^5}$ $\frac{2x^2}{3} = \frac{2}{3x^2}$

26. $\frac{6\cancel{18}x^5\cancel{y}}{\cancel{3}x^4\cancel{y}}$ $6x$

27. $\frac{-\cancel{20}x^2}{\cancel{4}x^4}$ $\frac{-5}{x^2}$

28. $\frac{a^m}{a^n}$ a^{m-n}

29. $\frac{4^7}{4^3} = 4^4$

30. A rectangular prism has length x, width $\frac{x}{2}$, and height $\frac{x}{3}$. Which of the expressions represent the volume of the prism? Select all that apply.

(A.) $6^{-1}x^3$ ~~B.~~ $6^{-1}x^{(-3)}$ (C.) $\frac{2x^{10}x^3}{6\ 12x^7}$ (D.) $2^{-1} \cdot 3^{-1} \cdot x^3$ $\frac{x^3}{2 \cdot 3} = \frac{x^3}{6}$

$V = (x)\left(\frac{x}{2}\right)\left(\frac{x}{3}\right) = \frac{x^3}{6} = 6^{-1}x^3$

Name _____ Date _____

6.1 Properties of Exponents - Day 1

STAAR Algebra 1 Reference Materials

PROPERTIES OF EXPONENTS

Product of powers	$a^m a^n = a^{(m+n)}$
Quotient of powers	$\frac{a^m}{a^n} = a^{(m-n)}$
Power of a power	$(a^m)^n = a^{mn}$
Rational exponent	$a^{\frac{m}{n}} = \sqrt[n]{a^m}$
Negative exponent	$a^{-n} = \frac{1}{a^n}$

In Exercises 1–6, evaluate the expression.

1. $(-3)^0$
2. 7^0
3. 3^{-5}
4. $(-5)^{-3}$
5. $\frac{3^{-2}}{9^0}$
6. $\frac{6^{-1}}{-5^0}$

In Exercises 7–18, simplify the expression. Write your answer using only positive exponents.

7. x^{-6}
8. z^0
9. $7x^{-4}y^0$
10. $12f^0g^{-9}$
11. $\frac{3^{-2}a^0}{b^{-2}}$
12. $\frac{6^0tu^{-5}}{2^5}$

(Simplify the expression. Write your answer using only positive exponents.)

13. $\frac{4^7}{4^4}$

14. $\frac{(-3)^6}{(-3)^3}$

15. $(-8)^3 \bullet (-8)^3$

16. $7^{-4} \bullet 7^4$

17. $\frac{17x^0y^{-8}}{4^{-2}z^{-6}}$

18. $\frac{3^{-2}a^{-1}}{9^{-1}b^{-2}c^0}$

In Exercises 19 and 20, evaluate the expression. Write your answer in scientific notation form.

19. $(1.2 \times 10^7)(4 \times 10^{-2})$

20. $\frac{3.9 \times 10^8}{1.3 \times 10^3}$

21. Which expression is equivalent to the area of a parallelogram with a height of $2x^2y^4z$ units and a base with a length of $5xy^4z^3$ units? $A = bh$

A $10x^{32}y^8z^3$ B $10x^2y^{16}z^3$ C $10x^3y^8z^4$ D $7x^2y^{16}z^3$

22. Find the area of the following figure. $A = \frac{bh}{2}$