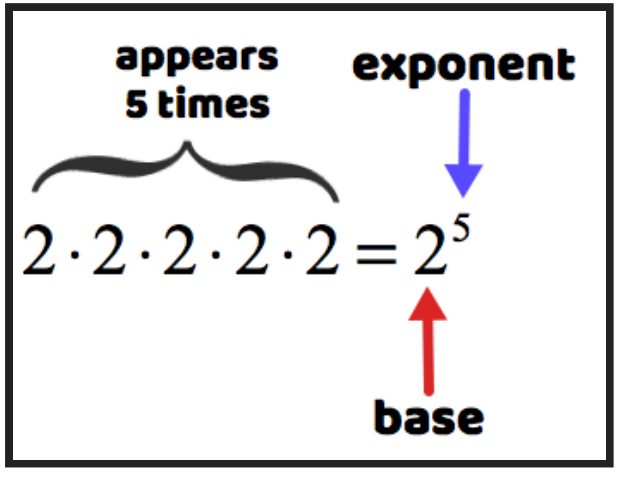
# EXPONENTS: THE PRODUCT RULE

## LEARNING GOAL

1. I can identify the **base** and the **exponent** in an exponential expression.
2. I can multiply exponential expressions using the **product rule.**




Write each expression in expanded form:

1. $7^5 =$
2. $x^4 =$

Write each expression using a single base and a power:

1. $2 \cdot 2 \cdot 2 =$
2. $3x \cdot 3x \cdot 3x \cdot 3x =$

# Exponential Rules

## Product Rule

$$a^x \times a^y = a^{x+y}$$

$$a^2 \times a^3 = a^5$$

## Quotient Rule

$$a^x \div a^y = a^{x-y}$$

$$a^7 \div a^3 = a^4$$

## Power Rule

$$\left(a^x\right)^y = a^{xy}$$

$$\left(a^7\right)^2 = a^{14}$$

## Negative Rule

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

$$a^{-4} = \frac{1}{a^4}$$

## Zero Rule

$$a^0 = 1$$

Name:_____

Exponents
Worksheet 1

| | Exponent Form | Base | Exponent | Expanded Form | Standard Form |
|---|---|---|---|---|---|
| 1. | $10^2$ | 10 | 2 | 10·10 | 100 |
| 2. | $2^3$ | 2 | 3 | 2 • 2 • 2 | 8 |
| 3. | $\left(\frac{1}{4}\right)^2$ | $\frac{1}{4}$ | 2 | $\frac{1}{4}\cdot\frac{1}{4}$ | $\frac{1}{16}$ |
| 4. | $15^1$ | 15 | 1 | 15 | 15 |
| 5. | $1^4$ | 1 | 4 | 1 ·1 ·1 ·1 | 1 |
| 6. | $x^2$ | x | 2 | x·x | |
| 7. | $b^3$ | $b$ | 3 | b·b·b | |
| 8. | $y^7$ | y | 7 | $y{\cdot}y{\cdot}y{\cdot}y{\cdot}y{\cdot}y{\cdot}y$ | |
| 9. | $(2x)^4$ | $2x$ | 4 | 2x·2x·2x·2x | |
| 10. | $(5n)^3$ | 5n | 3 | $5n \cdot 5n \cdot 5n$ | |
| 11. | $4(xy)^2$ | xy | 2 | 4·xy·xy | |
| 12. | $3y^4$ | y | 4 | $3{\cdot}y{\cdot}y{\cdot}y{\cdot}y$ | |
| 13. | $(2xyz)^3$ | 2xyz | 3 | 2xyz·2xyz·2xyz | |
| 14. | $-2x^6$ | x | 6 | -2·x·x·x·x·x·x | |
| 15. | $(-4y)^2$ | -4y | 2 | -4y·-4y | |

Name:_____

Exponents
Worksheet 1

**Directions:** Complete the table below.

**Directions:** Complete the chart below.

| | 2nd | Expanded Form | 4th |
|---|---|---|---|
| 1. | $2^{10} \cdot 2^2$ | $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$ (10 times; 2 times) | $2^{12}$ |
| 2. | $3^2 \cdot 3^4$ | $3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$ (2 times; 4 times) | $3^6$ |
| 3. | $5^3 \cdot 5^6$ | $5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5$ (3 times; 6 times) | $5^9$ |
| 4. | $x^5 \cdot x^1$ | $x \cdot x \cdot x \cdot x \cdot x \cdot x$ (5 times; 1 time) | $x^6$ |
| 5. | $y^3 \cdot y^5$ | $y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y$ (3 times; 5 times) | $y^8$ |
| 7. | $a^3 \cdot a^4$ | $a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a$ (3; 4) | $a^7$ |
| 8. | $m^2 \cdot m$ | $m^2 \cdot m$ | $m^3$ |
| 9. | $x^3 \cdot x^6 \cdot x^3 \cdot x^2$ | $x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$ (3 times; 6 times; 3 times; 2 times) | $x^9 \cdot x^5 = x^{14}$ |
| 10. | $5y^3 \cdot y \cdot y^5$ | $5 \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y$ | $5y^9$ |
| 11. | $2b^3 \cdot 3b^{10}$ | $2 \cdot b \cdot b \cdot b \cdot 3 \cdot b \cdot b \cdot b \cdot b \cdot b \cdot b \cdot b \cdot b \cdot b \cdot b \cdot b$ | $6b^{13}$ |

12. Compare the 2nd and 4th columns in the table above. Describe, in words, what you notice about the relationship you see between them.

The exponent in column 4 is the sum of the exponents in column 2.