# Curriculum Outcome

(N1) Demonstrate an understanding of powers with integral bases (excluding base 0) and whole number exponents by: representing repeated multiplication using powers; using patterns to show that a power with an exponent of zero is equal to one; solving problems involving powers.

(N2) Demonstrate an understanding of operations on powers with integral bases (excluding base 0) and whole number exponents.

**Student Friendly:**
**"Learning the laws of Exponents "**
**Simplifying expressions before we try to evaluate them.**

Separate you desk

# Quiz

- All you need is a pencil

***NO CALCULATORS****

# Evaluating Powers of Product and Quotients

$$[(-6) \times 4]^2$$

Method 1

Use the exponent law for a power of a product

$$[(-6) \times 4]^2$$

$=$

$=$

$=$

Method 2

Use the order of operations

$$[(-6) \times 4]^2$$

$=$

$=$

You Decide

Try some more (use which ever method you want)

2) $-(5 \times 2)^3$

3) $\left(\frac{21}{-3}\right)^3$

# Try this

Write as a power

1) $(3^5 \times 4^7)^6$

2) $(4^5 \div 3^4)^7$

3) $(2^6 \div 2^3)^4$

4) $(5^3 \times 5^4)^5$

① $x^0 = 1$ $(-3)^0 = 1$

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② $x^a \cdot x^b = x^{a+b}$ $(2)^3 \times (2)^4 = 2^7$

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③ $\frac{x^a}{x^b} = x^{a-b}$ $\frac{3^4}{3^3} = 3^1$

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④ $(x^a)^b = x^{a \cdot b}$ $(2^5)^6 = 2^{30}$

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⑤ $(x^a y^b)^c = x^{a \cdot c} y^{b \cdot c}$ $(2^6 \times 3^4)^3 = 2^{18} \times 3^{12}$

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⑥ $\left(\frac{x^a}{y^b}\right)^c = \frac{x^{ac}}{y^{bc}}$ $\left(\frac{4^2}{5^3}\right)^6 = \frac{4^{12}}{5^{18}}$

$$[3^2]^4 = 3^8$$

$[3 \cdot 3]$ $[3 \cdot 3]$ $[3 \bullet 3]$ $[3 \bullet 3]$

$3^8$

$$3^2 \times 3^3$$

$3\ 3$ $3\ 3\ 3$ $= 3^5$

# Laws of Exponents

Date

**Simplify.**

1) $(-5)^3 \cdot (-5)^4 = (-5)^7$

2) $8^5 \cdot 8^2$

3) $(-3)^5 \cdot (-3)^2 = (-3)^7$

4) $(-6)^0 \cdot (-6)^4 \cdot (-6)^4$

5) $5^1 \cdot 5^2 = 5^3$

6) $5 \cdot 5^3$

7) $\frac{5^5}{5^2} = 5^3$

8) $\frac{(-4)^3}{(-4)^0}$

9) $\frac{2^{12}}{2^6} = 2^6$

10) $\frac{(-3)^0}{(-3)^0}$

11) $\frac{(-4)^{12}}{(-4)^5} = (-4)^7$

12) $\frac{4^{17}}{4^{12}}$

13) $((-4)^3)^2 = (-4)^6$

14) $(-6)^2$

15) $(2^2)^3$ $2^6$

16) $((-3)^3)^4$

17) $(4^4)^4$ $4^{16}$

18) $(3^4)^2$

.9) $\frac{2^4 \cdot 2^3}{2 \cdot 2^2} = \frac{2^7}{2^3} = 2^4$

20) $\frac{2^{13}}{2 \cdot 2^4}$

21) ~~$\frac{3^2}{9}$~~

22) $\frac{3^{14}}{3^2 \cdot 3^4}$

23) $\frac{7^2 \cdot 7^3}{7^4} = \frac{7^5}{7^4} = 7^1$

24) $\frac{3^2 \cdot 3^2}{3^3}$

25) $\left(\frac{3^8}{3^3}\right)^3 = (3^5)^3 = 3^{15}$

$\frac{3^{24}}{3^9} = 3^{15}$

26) $\frac{(4^4)^4}{4}$

27) $\left(\frac{(-2)^5}{(-2)^4}\right)^2 = [(-2)^1]^2 = (-2)^2$

28) $\frac{((-2)^3)^2}{(-2)^3}$

$\frac{(-2)^{10}}{(-2)^8} = (-2)^2$

29) $\frac{4^2}{4^2} = 4^0 = 1$

30) $\frac{(4^3)^2}{4}$

31) $\frac{3^2 \cdot (3^2)^4}{3^4} = \frac{3^2 \cdot 3^8}{3^4} = \frac{3^{10}}{3^4} = 3^6$

32) $\left(\frac{3^6 \cdot 3^2}{3^4}\right)^4$

33) $\left(\frac{2^2 \cdot 2^4}{2}\right)^3 = \left(\frac{2^6}{2^1}\right)^3 = (2^5)^3 = 2^{15}$

34) $\frac{(-4)^{12} \cdot (-4)^2}{((-4)^4)^2}$

35) $\frac{(2^4)^2}{2^3 \cdot 2^2} = \frac{2^8}{2^5} = 2^3$

36) $\left(\frac{3^{16} \times 3^8 \div 3^4}{3^6 \times 3^6}\right)^0$

# Exponent Laws

# Class/Homework

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