U2:L5 – Exponent Laws 3,4,5+6

Consider the power:

$(x^{2\times3})$ → 2×3

$(x\cdot x)^3$

Write using repeated multiplication:

$(x\cdot x)\cdot(x\cdot x)\cdot(x\cdot x) = x^6$

This gives us the third law of exponents:

$$(a^m)^n = a^{m\times n}$$

Write each power as a single power, then evaluate (if possible).

a) $(2^3)^2$ $2^{3\times2} = 2^6 = 2\times2\times2\times2\times2\times2 = 64$

b) $(3^2)^4$ $3^{2\times4} = 3^8 = 3\times3\times3\times3\times3\times3\times3\times3 = 6{,}561$

c) $(a^3)^5$ $a^{3\times5} = a^{15}$

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Consider the power:

$(2x)^2$

$2 \cdot x \cdot 2 \cdot x$

$2 \cdot 2 \cdot x \cdot x$

$2^2 \cdot x^2$

$4x^2$

Write using repeated multiplication:

$(2x)(2x)$

This gives us the fourth law of exponents:

$$(ab)^m = a^m b^m$$

Write each power as a single power, then evaluate (if possible).

a) $[2 \times (-3)]^4$ $\quad a \quad b$

$2^4(-3)^4 = 16(81) = 1,296$

b) $[(-1) \times (-2)]^3$

$(-1)^3(-2)^3 = (-1)(-8) = 8$

c) $(3a)^3$

$3^3 a^3 = 3 \times 3 \times 3 \times a^3 = 27a^3$

d) $(4x^2)^4$

$4^4 (x^2)^4 = 4^4 x^8 = 256x^8$

e) $(x^2y^3)^5$

$(x^2)^5 (y^3)^5 = x^{10} y^{15}$

Consider the power:

$$\left(\frac{x}{y}\right)^2 = \frac{x^2}{y^2}$$

Write using repeated multiplication: $\frac{x \cdot x}{y \cdot y}$

This gives us the fifth law of exponents:

$$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$$

Write each power as a single power, then evaluate (if possible).

a) $\left(\frac{3}{4}\right)^0$ $\frac{3^3}{4^3} = \frac{3 \times 3 \times 3}{4 \times 4 \times 4} = \frac{27}{64} = 0.42$

b) $\left(\frac{-2}{5}\right)^2$ $\frac{(-2)^2}{5^2} = \frac{(-2) \times (-2)}{5 \times 5} = \frac{4}{25} = 0.16$

c) $\left(\frac{2x}{z}\right)^4$ $\frac{(2x)^4}{z^4} = \frac{2^4 x^4}{z^4} = \frac{16x^4}{z^4} = 16\left(\frac{x}{z}\right)^4$

d) $\left(\frac{3z}{6y}\right)^2$ $\frac{(3z)^2}{(6y)^2} = \frac{3^2 z^2}{6^2 y^2} = \frac{9z^2}{36y^2} = \frac{9}{36}\left(\frac{z}{y}\right)^2 = 0.25\left(\frac{z}{y}\right)^2$

e) $\left(\frac{2xy}{4zyx^3}\right)^2$ $\frac{(2xy)^2}{(4zyx^3)^2} = \frac{2^2 x^2 y^2}{4^2 z^2 y^2 (x^3)^2} = \frac{4x^2y^2}{16z^2y^2x^6} = \frac{1}{4}x^4z^2$

$\frac{x \cdot x \cdot y \cdot y}{x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot y \cdot y \cdot z \cdot z} = \frac{}{x^4 z^2}$

Evaluate 3^0 using a table

Power	Value
3^4	81
3^3	27
3^2	9
3^1	3
3^0	1

$3 \times 3 \times 3 \times 3$
$3 \times 3 \times 3$
3×3

Determine the pattern in the values

Just like we have already seen, we have a sixth exponent law:

$$a^0 = 1$$

TRY IT OUT:

a) $(-5)^0$ $\boxed{1}$

b) -5^0 $(-)(5^0) = (-)(1) = \boxed{-1}$

c) $-(5)^0$ $\boxed{-1}$

d) 5^0 $\boxed{1}$

e) $(5xy^0z)^2$ $5^2 x^2 (y^0)^2 z^2 = 25x^2 y^0 z^2$ $= \boxed{25x^2z^2}$

f) $(5xy^2z)^0$ $\boxed{1}$