

EXPONENTS

Answers

- Identify the base in each exponential expression.
- Simplify each expression using the laws of exponents.
- Evaluate where possible.

For all expressions the following is true: Every variable stands for a real number and none of the variables is equal to zero.

LEVEL 1

Expression	Base	Simplified Expression	Evaluated Expression
$a^4 \times a^5$	a	$a^{4+5} = a^9$	N/A
$2^7 \div 2^4$	2	$2^{7-4} = 2^3$	8
$\frac{x^{10}}{x^3}$	x	$x^{10-3} = x^7$	N/A
$(y^3)^0$	y	$y^{(3)(0)} = y^0 = 1$	1
240^1	240	240^1	240
$(-1)^4$	-1	$(-1)^4$ $= (-1)(-1)(-1)(-1) = +1$	1

LEVEL 2

Expression	Base	Simplified Expression	Evaluated Expression
$a^2 \times a^3 \times a$	a	$a^{2+3+1} = a^6$	N/A
$3^2 \div 3^{-4}$	3	$3^{2-(-4)} = 3^6$	729
$\frac{2a^{10}}{14a^8}$	a	$\frac{2}{14} \cdot \frac{a^{10}}{a^8} = \frac{1}{7} \cdot a^{10-8}$ $= \frac{1}{7} a^2 = \boxed{\frac{a^2}{7}}$	N/A
$[(5^4)^2]^3$	5 5^4 $(5^4)^2$	OR $5^{(4)(2)(3)} = 5^{24}$ $[5^{(4)(2)}]^3 = (5^8)^3 = 5^{(8)(3)} = 5^{24}$	5^{24} is very large
$\left(\frac{3}{2}\right)^{-2}$	$\frac{2}{3}$	$\left(\frac{3}{2}\right)^{-2} = \left(\frac{2}{3}\right)^2$	$\frac{4}{9}$
-3^3	3	$-3^3 = (-1)(3^3) = (-1)(27) = -27$	-27

LEVEL 3

Expression	Base	Simplified Expression	Evaluated Expression
$2(a^2)(a^3)(a^3)^{-1}$	a	$2 a^{2+3} \cdot a^{3(-1)} = 2a^5 \cdot a^{-3} = 2a^2$	N/A
$6x^2 \div (2x^3)^{-4}$	x $2x^3$	$\frac{6x^2}{1} \div \left(\frac{1}{2x^3}\right)^4 = \frac{6x^2}{1} \div \frac{1^4}{2^4(x^3)^4} = \frac{6x^2}{1} \times \frac{16x^{12}}{1} = 96x^{2+12} = 96x^{14}$	$96x^{2+12} = 96x^{14}$
$\frac{-24a^3b^8}{12ab^7}$	a, b	$\frac{-24}{12} \cdot \frac{a^3}{a^1} \cdot \frac{b^8}{b^7} = \frac{-2}{1} \cdot a^{3-1} b^{8-7} = -2 \cdot a^2 b^1 = -2a^2b$	N/A
$[(4x^3)^{-2}]^4$	x $4x^3$ $(4x^3)^{-2}$	$\left[(4x^3)^{-2}\right]^4 = \left[4x^3\right]^{(-2)(4)} = (4x^3)^{-8} = \frac{1}{(4x^3)^8} = \frac{1}{4^8 x^{24}}$	$\frac{1}{65536 x^{24}}$
$\left(\frac{5ac^{-3}}{30a^5bc^4}\right)^{-2}$	a, c, b $\frac{5ac^{-3}}{30a^5bc^4}$	$\left[\frac{30a^5bc^4}{5ac^{-3}}\right]^2 = \left[\frac{6a^{5-1}b^1c^{4-(-3)}}{1}\right]^2 = (6a^4bc^7)^2 = 36a^8b^2c^{14}$	N/A
$-100\,000^0$	$100\,000$	$-100\,000^0$	-1

LEVEL 4

Expression	Base	Simplified Expression	Evaluated Expression
$-4(-a^2)(a^{-3})(a^3)^{-5}$	a	$(-4)(-1)a^{2+(-3)} \cdot a^{3(-5)}$ $+4a^{-1} \cdot a^{-15} = 4a^{-16} = \frac{4}{a^{16}}$	N/A
$\underbrace{[8x^2 \div (4x^3)^{-1}]^2}_{\text{base}}$	x $4x^3$	$\left[\frac{8x^2}{4x^{-3}} \right]^2 = [4x^{2-(-3)}]^2$ $= [16x^{10}]$	N/A
$\left[\frac{-4a^{-5}p^{-7}}{12aa^3p^{-2}} \right]^{-2}$ <u>base</u>	a, p	$\left[\frac{12a^4p^{-2}}{-4a^{-5}p^{-7}} \right]^2 = \left[-\frac{12}{4} \cdot a^{4+5} \cdot p^5 \right]^2$ $= (-3a^9p^5)^2 = 9a^{18}p^{10}$	N/A
$-[6(-3a^5)^9]^2$	a $-3a^5$ $6(-3a^5)^9$	$(-1)[6(-3^9a^{45})]^2$ $= (-1)[36(-3^9)^2(a^{90})]$ $= (-1)(36)(+3^{18})(a^{90})$	$-36 \cdot 3^{18} a^{90}$ N/A
$\left(\frac{25x^{-5}yz^{-3}}{40x^2y^6z^{-4}} \right)^{-2}$	x y z	$\left[\frac{40x^2y^6z^{-4}}{25x^{-5}y^1z^{-3}} \right]^2 = \left[\frac{8}{5}x^7y^5z^{-1} \right]^2$ $= \frac{64}{25}x^{14}y^{10}z^{-2} = \frac{64x^{14}y^{10}}{25z^2}$	N/A
$\underbrace{[-(-3000^0)^4]^5}_{\text{base}}$ <u>base</u>		$[-(-3000^0)^4]^5 = [-(-1)^4]^5$ $= [-(-1)]^5 = (-1)^5 = -1$	-