

# ZERO AND NEGATIVE EXPONENTS



A nonzero number to the zero power is 1.

$$a^0 = 1$$

Examples: Evaluate.

1.  $5^0$

1

2.  $(-3)^0$

1

3.  $(\frac{1}{9})^0$

1

$$-3^0 = -1$$

Zero raised to the zero power is undefined.



## NEGATIVE EXPONENTS

$$\frac{a^{-n}}{1} = \frac{1}{a^n} \quad \text{or} \quad a^n = \frac{1}{a^{-n}}$$

Examples: Evaluate.

4.  $2^{-2}$

$\frac{1}{2^2}$

$$\frac{1}{2^2} = \frac{1}{4}$$

5.  $(-3)^{-4}$

$$\frac{(-3)^4}{1} = 81$$

6.  $(\frac{1}{4})^{-3}$

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$\frac{4^3}{1^3} = \frac{64}{1} = 64$

Examples: Evaluate.

7.  $6^{-4} \cdot 6^4$

$6^{-4+4}$

$6^0 = 1$

8.  $(2^{-3})^{-2}$

$2^6 = 64$

9.  $(-3 \cdot 2)^{-2}$

$(-3)^{-2} \cdot (2)^{-2}$

$\frac{1}{(-3)^2} \cdot \frac{1}{(2)^2}$

$\frac{1}{9} \cdot \frac{1}{4} = \frac{1}{36}$

10.  $(3^{-2})^{-2}$

$3^4 = 81$

11.  $(2 \cdot 5)^{-2}$

$(10)^{-2}$

$\frac{1}{(10)^2} = \frac{1}{100}$

12.  $4^2 \cdot 4^{-3}$

$4^{2+(-3)} = 4^{-1} = \frac{1}{4^1} = \frac{1}{4}$

Examples: Rewrite using positive exponents.

$$13. \quad 2x^{-2}y^3$$

$$\frac{2y^3}{x^2}$$

$$14. \quad \frac{5c^{-4}}{d^{-5}}$$

$$\frac{5d^5}{c^4}$$

$$15. \quad (5a)^{-3}$$

$$\frac{1}{(5a)^3}$$

$$\frac{1}{125a^3}$$

$$16. \quad \frac{4k^{-3}}{m^8p^{-2}}$$

$$\frac{4p^2}{k^3m^8}$$

Examples: Rewrite using positive exponents.

$$17. \quad (3x^{-2}y^2)^3$$

$$(3^3)(x^{-2})^3(y^2)^3$$

$$27x^{-6}y^6$$

$$\frac{27y^6}{x^6}$$

$$18. \quad \frac{4x^{-2}y^4}{8xy^6}$$

$$\frac{4}{8}x^{-2-1}y^{4-6}$$

$$\frac{1}{2}x^{-3}y^{-2}$$

$$\frac{1}{2x^3y^2}$$

$$19. \quad \left(\frac{2g^{-1}h^{-3}}{3g^{-3}h^4}\right)^2$$

$$\left(\frac{2}{3}g^{-1+3}h^{-3-4}\right)^2$$

$$\left(\frac{2}{3}g^2h^{-7}\right)^2$$

$$\left(\frac{2g^2}{3h^7}\right)^2 = \frac{4g^4}{9h^{14}}$$

$$20. \quad \left(\frac{-5j^{-6}k^8}{4j^{-2}k^4}\right)^3$$

$$\left(\frac{-5j^{-6+2}k^{8-4}}{4j^{-2}k^4}\right)^3$$

$$\left(\frac{-5j^{-4}k^4}{4j^{-2}k^4}\right)^3 = \frac{-125k^{12}}{64j^{12}}$$