

# Exponents and Order of Operations

$$2^3 = \underbrace{2 \cdot 2 \cdot 2}_{3 \text{ times}} = 8$$

$$2^4 = 16$$

$$2^5 = 32$$

$$2^6 = 64$$

$$2^7 = 128$$

$$2^8 = 256$$

$$2^9 = 512$$

$$2^{10} = 1024$$

$$3^2 = 9$$

$$3^3 = 27$$

$$3^4 = 81$$

$$3^5 = 243$$

$$4^2 = 16$$

$$4^3 = 64$$

$$4^4 = 256$$

$$4^5 = 1024$$

$$5^2 = 25$$

$$5^3 = 125$$

$$5^4 = 625$$

Remarks:

①  $a^1 = a$ , FOR ANY REAL NUMBER  $a$

$$5^1 = 5$$

②  $a^0 = 1$ , FOR  $a \neq 0$  ( $0^0$  UND)

$$\left(\frac{2}{7}\right)^0 = 1$$

Ex 1

$$(-2)^2 = (-2) \cdot (-2) = 4$$

$$(-2)^3 = (-2) \cdot (-2) \cdot (-2) = -8$$

$$(-2)^4 = (-2)(-2)(-2)(-2) = 16$$

$$-2^4 = -\underline{2 \cdot 2 \cdot 2 \cdot 2} = -16$$

$$\underset{\substack{\uparrow \\ \text{base}}}{(-3)^4} = (-3)(-3)(-3)(-3) = 81$$

$$-3^4 = -3 \cdot 3 \cdot 3 \cdot 3 = -81$$

$$(-2)^5 = (-2)(-2)(-2)(-2)(-2) = -32$$

$$-2^5 = -2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = -32$$

Remarks :

$$\begin{array}{l} \textcircled{3} \quad (-a)^{\text{EVEN}} = \text{POSITIVE} \\ \quad \quad (-a)^{\text{ODD}} = \text{NEGATIVE} \\ \quad \quad -a^{\text{EVEN/ODD}} = \text{NEGATIVE} \end{array} \quad \left| \quad a > 0 \right.$$

$$\begin{array}{l} \textcircled{4} \quad 1^n = 1 \\ \quad \quad 1^{2013} = 1 \end{array}$$

Ex 2

$$\begin{array}{l} (-1)^0 = 1 \quad \text{--- -- -- -- -- EVEN} \\ (-1)^1 = -1 \quad \text{--- -- -- -- -- ODD} \\ (-1)^2 = (-1)(-1) = 1 \quad \text{--- -- -- -- -- EVEN} \\ (-1)^3 = (-1)(-1)(-1) = -1 \quad \text{--- -- -- -- -- ODD} \\ (-1)^4 = (-1)(-1)(-1)(-1) = 1 \quad \text{--- -- -- -- -- EVEN} \\ (-1)^{2013} = -1 \end{array}$$

Ex 3  $(-3)^2 \cdot 2^3 = 9 \cdot 8 = 72$

Ex 4  $\left(\frac{2}{5}\right)^3 = \left(\frac{2}{5}\right)\left(\frac{2}{5}\right)\left(\frac{2}{5}\right) = \frac{2 \cdot 2 \cdot 2}{5 \cdot 5 \cdot 5} = \frac{2^3}{5^3} = \frac{8}{125}$

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

Ex 5  $\left(-\frac{2}{3}\right)^3 = \left(-\frac{2}{3}\right)\left(-\frac{2}{3}\right)\left(-\frac{2}{3}\right) = \frac{(-2)(-2)(-2)}{3 \cdot 3 \cdot 3}$   
 $= \frac{(-2)^3}{3^3}$   
 $= \frac{-8}{27} = \left(-\frac{8}{27}\right)$

$$-\frac{2}{3} = \frac{-2}{3} \text{ or } \frac{2}{-3}$$

ORDER OF OPERATIONS :

- ① GROUPS
- ② EXP
- ③ MULT / DIV
- ④ ADD / SUB

Ex6

$$1 - \underbrace{2 \cdot 3} = 1 - 6 = -5$$

Ex7

$$\begin{aligned} & 12 - 24(8-5) \div 2^2 \\ &= 12 - 24(3) \div 2^2 \\ &= 12 - 24 \cdot (3) \div 4 \\ &= 12 - 72 \div 4 \\ &= 12 - 18 \\ &= -6 \end{aligned}$$

ALT

$$\begin{aligned} &= 12 - 24 \cdot (3) \div 4 \\ &= 12 - 18 \\ &= -6 \end{aligned}$$

Ex8

$$\begin{aligned} & \frac{4+8}{2+1} - |3-1| + 2 \\ &= \frac{12}{3} - |2| + 2 \\ &= 4 - 2 + 2 \\ &= 4 \end{aligned}$$

Ex9

$$\begin{aligned} & 27 \div 3^2 + (-3)^2 \cdot 4 \\ &= 27 \div 9 + (9) \cdot 4 \\ &= 3 + 36 \\ &= 39 \end{aligned}$$

Ex 10  $6 \div [4 - (6 - 8)] + 2^2$   
 $= 6 \div [4 - (-2)] + 2^2$   
 $= 6 \div [6] + 2^2$   
 $= 6 \div [6] + 4$   
 $= 1 + 4$   
 $= 5$

Ex 11  $4 - 3[4 - 2(6 - 3)] \div 2$   
 $= 4 - 3[4 - 2 \cdot (3)] \div 2$   
 $= 4 - 3[4 - 6] \div 2$   
 $= 4 - 3 \cdot [-2] \div 2$   
 $= 4 - (-3)$   
 $= 4 + 3$   
 $= 7$