

1.2 ALGEBRAIC EXPRESSIONS & MODELS

base

exponent

power

$$2^3 = 2 \cdot 2 \cdot 2$$

Exponential
Form

Words

Meaning

4^2

four to the second
power or four
squared

$4 \cdot 4$

8^3

eight to the third
power or eight cubed

$8 \cdot 8 \cdot 8$

x^5

x to the fifth power

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

EXAMPLE 1: Evaluate the following.

a) $(-3)^4 = -3 \cdot -3 \cdot -3 \cdot -3 = 81$

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

c) $4^4 = 4 \cdot 4 \cdot 4 \cdot 4 = 256$

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

e) $5^3 = 5 \cdot 5 \cdot 5 = 125$

f) $(-2)^6 = -2 \cdot -2 \cdot -2 \cdot -2 \cdot -2 \cdot -2 = 64$

g) $-2^6 = -64$

ORDER OF OPERATIONS

1. Do operations that occur within grouping symbols.

 Parenthesis () and brackets []

2. Evaluate powers.

3. Do multiplication and division from left to right.

4. Do addition and subtraction from left to right.

EXAMPLES: Use the order of operations.

$$2. \quad 15 + 6 \cdot 2$$

$$15 + 12$$

$$\boxed{27}$$

$$3. \quad 2 \cdot 3^2 + 5$$

$$2 \cdot 9 + 5$$

$$18 + 5$$

$$\boxed{23}$$

$$4. \quad 2^4 - 5 \cdot 3$$

$$16 - 5 \cdot 3$$

$$16 - 15$$

$$\boxed{1}$$

$$5. \quad 16 \div 4 \cdot 2 + 5^2$$

$$16 \div 4 \cdot 2 + 25$$

$$4 \cdot 2 + 25$$

$$8 + 25$$

$$\boxed{33}$$

Variable - a letter used to represent a number

→ *does not have equal sign*

Algebraic expression - consists of variables, numbers, operations, and/or grouping symbols

Evaluate means to replace the variables with numbers and simplify.

Evaluate the variable expression when $m = 3$.

6. $m^2 - 2 \cdot 3$

$$3^2 - 2 \cdot 3$$

$$9 - 2 \cdot 3$$

$$9 - 6$$

$$\boxed{3}$$

7. $\frac{15}{m} + 2^3 - 10$

$$m$$

$$\frac{15}{3} + 2^3 - 10$$

$$\frac{15}{3} + 8 - 10$$

$$5 + 8 - 10$$

$$13 - 10 \rightarrow$$

$$\boxed{3}$$

8. $m + 3m^4$

$$3 + 3(3)^4$$

$$3 + 3(81)$$

$$3 + 243$$

$$\boxed{246}$$

9. $\frac{24}{m} \cdot 5$

$$m$$

$$\frac{24}{3} \cdot 5$$

$$8 \cdot 5$$

$$\boxed{40}$$

10. Evaluate $-4x^2 + 6x - 5$ when $x = -3$.

$$-4(-3)^2 + 6(-3) - 5$$

$$-4(9) + 6(-3) - 5$$

$$-36 + -18 - 5$$

$$-54 + -5$$

$$\boxed{-59}$$

11. Evaluate $2x^3 + 3x^2 + 27$ when $x = -4$.

$$2(-4)^3 + 3(-4)^2 + 27$$

$$2(-64) + 3(16) + 27$$

$$-128 + 48 + 27$$

$$-80 + 27$$

$$\boxed{-53}$$

The fraction bar is another grouping symbol. It indicates that the numerator and denominator should each be treated as a single value.

$$\frac{16 + 8}{8 - 2} \longrightarrow (16 + 8) \div (8 - 2)$$

Try $\frac{9 \cdot 4 + 2 \cdot 6}{5^2 - 1} = \frac{36 + 12}{25 - 1} = \frac{48}{24} = \boxed{2}$

$(9 \cdot 4 + 2 \cdot 6) \div (5^2 - 1)$

12. Evaluate the variable expression when $x = 4$.

$$\frac{x - 2}{x^2 - 2 \cdot 5} = \frac{4 - 2}{4^2 - 2 \cdot 5} = \frac{2}{16 - 2 \cdot 5} = \frac{2}{16 - 10} = \frac{2 \div 2}{6 \div 2} = \boxed{\frac{1}{3}}$$

13. $\frac{13 - 4}{18 - 4^2 + 1} = \frac{9}{18 - 16 + 1} = \frac{9}{2 + 1} = \frac{9}{3} = \boxed{3}$

14. Evaluate $\frac{x^2}{2y+1}$ when $x = -3$ and $y = 2$.

$$\frac{(-3)^2}{2(2)+1} = \frac{9}{4+1} = \boxed{\frac{9}{5} \text{ or } 1.8}$$

15. Evaluate $\frac{4(x-2y)}{x+y}$ when $x = 4$ and $y = -2$.

$$\frac{4(4 - 2(-2))}{4 + -2} = \frac{4(4 + 4)}{2} = \frac{4(8)}{2} = \frac{32}{2} = \boxed{16}$$

Terms - the parts that are being added or subtracted

Coefficient - the number in front of the variable

Like terms - MUST have the same variable(s) and exponent(s)

Constant terms - numbers without variables

Example 16: Simplify by combining like terms.

$$a) \underline{7x} + \underline{4x} = 11x$$

$$b) \boxed{3n^2} + n \boxed{-1n^2} \quad 2n^2 + n$$

$$c) \begin{array}{l} \overbrace{7(x^2 - 3)} - \overbrace{3(x + 4)} \\ 7x^2 \boxed{-21} - 3x \boxed{-12} \end{array} \quad 7x^2 - 3x - 33$$

$$d) \begin{array}{l} \overbrace{2(x + 1)} - \overbrace{1(x + 4)} \\ \underline{2x + 2} \quad \underline{-x - 4} \\ x - 2 \end{array}$$

$$e) \begin{array}{l} \underline{7x^2} \boxed{+ 12x} - \underline{x^2} \boxed{- 40x} \\ 6x^2 - 28x \end{array}$$