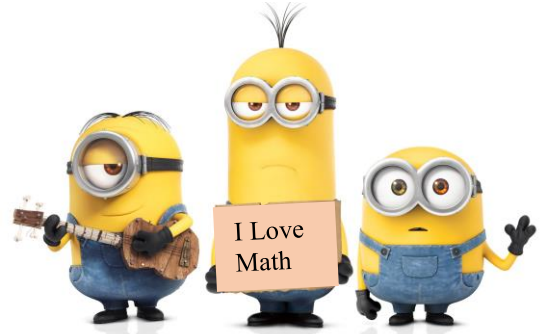# ~ Section 1.6 Notes Order of Operations & Evaluate Expressions ~
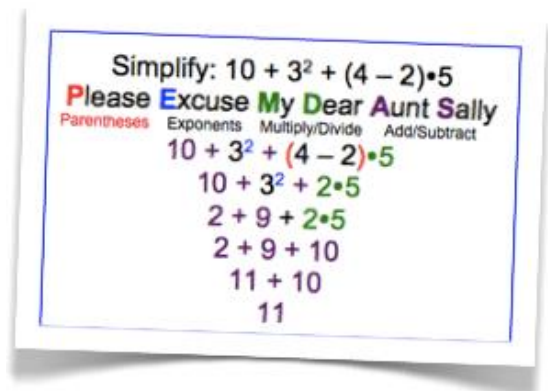
Use the order of operations to simplify expressions.

Order of Operations

When a numerical or algebraic expression contains more than one operation symbol, the **order of operations** tells which operation to perform first.

Order of Operations	
First:	Perform operations inside grouping symbols.
Second:	Evaluate powers.
Third:	Perform multiplication and division from left to right.
Fourth:	Perform addition and subtraction from left to right.

Simplify: $10 + 3^2 + (4 - 2) \cdot 5$
Please **E**xcuse **M**y **D**ear **A**unt **S**ally
Parentheses Exponents Multiply/Divide Add/Subtract
$10 + 3^2 + (4 - 2) \cdot 5$
$10 + 3^2 + 2 \cdot 5$
$2 + 9 + 2 \cdot 5$
$2 + 9 + 10$
$11 + 10$
11

Grouping symbols include parentheses $(\ )$, brackets $[\ ]$, and braces $\{ \ \}$. If an expression contains more than one set of grouping symbols, evaluate the expression from the innermost set first.

Simplify each expression below using the order of operations.

(a) $15 - 2 \cdot 3 + 1$

(b) $12 - 32 + 10 \div 2$

(c) $-20 \div \left[-2(4 + 1) \right]$

(d) $14 - 32 \div (8) \cdot \dfrac{1}{4}$

Fraction bars, radical symbols, and absolute-value symbols can also be used as grouping symbols. Remember that a fraction bar indicates division.

(e) $\dfrac{2(-4) + 22}{4^2 - 9}$

(f) $3 \, | \, 42 + 8 \div 2 |$

Evaluating Algebraic Expressions

Evaluate the expression for the given value of x.

10 − *x* · 6 for *x* = 3

$10 - x \cdot 6$	*First substitute 3 for x.*
$10 - 3 \cdot 6$	*Multiply.*
$10 - 18$	*Subtract.*
-8	

You Try!!!

Evaluate the expression for the given value of x.

(a) $4^2(x + 3)$ *for* $x = -3$

(b) $14 + x^2 \div 4$ *for* $x = 2$

(c) $(x \cdot 2^2) \div (2 + 6)$ *for* $x = 6$

(d) $\dfrac{x^3 - 2}{2x - 5}$ *for* $x = -2$

Application Example

A shop offers gift-wrapping services at three price levels. The amount of money collected for wrapping gifts on a given day can be found by using the expression $2B + 4S + 7D$. On Friday the shop wrapped 10 Basic packages B, 6 Super packages S, and 5 Deluxe packages D. Use the expression to find the amount of money collected for gift wrapping on Friday.

The shop collected _____ for gift wrapping on Friday.

Practice WS (1)
Evaluate the expression using order of operations. [PE MD AS]

1. $2\left[3\left(4\div2\right)+6\right]-5$

2. $3\cdot8\div2-9\div3$

3. $3+\left[\left(4-1\right)\cdot5\right]$

4. $4+\left(6\div2\right)-1$

5. $8\cdot3\div\left(4+3^2-1\right)$

6. $10\left(3+1\right)-16$

7. $8+\left[\left(84\div12\right)-4\right]^2-7+3$

8. $23-\left[\left(45\div15\right)^3\div9\right]^2$

9. $5^2+2\left(5\right)+1$

10. $13+\left(3\cdot2\right)^2-8$

11. $16-6^2\div12$

12. $18+6\div2-7\left(2\right)$

In 13 – 15, evaluate each expression for the given values. Let $r=8$ and $m=-9$.

13. $\left(r+m\right)-10$

14. r^2+m

15. $\dfrac{9r}{m}$

In 16 – 18, evaluate each expression for the given values. Let $a=-5$, $b=8$ and $c=-9$.

16. c^2-b^2

17. $\dfrac{b\cdot c}{a^2+11}$

18. $\left(8+b\right)-c$

Practice WS (2)

Evaluate the expression using order of operations. [PE MD AS]

1. $3 - \left[(4 \div 2) + 1 \right]$

2. $3 \cdot 7 + \left[9 - (18 \div 6) \right]$

3. $\dfrac{3(5)}{(8-7) \cdot 3}$

4. $\left[(4+16) \div 5 \right] - 2$

5. $4 + 21 \div 3 - 3^2$

6. $\dfrac{9 - 1 \cdot 7}{2}$

7. $\dfrac{6 + 2^2}{17 - 6 \cdot 2}$

8. $\dfrac{15 - 3(2)}{3}$

9. $\left(3^3 + 3 - 7 \right) - 20$

In 10 – 12, evaluate each expression for the given values. Let $r = -4$ and $m = 10$.

10. $(r + m) - 10$

11. $r + m^2$

12. $\dfrac{5r}{m}$

In 13 – 15, evaluate each expression for the given values. Let $a = -3$, $b = 9$ and $c = -2$.

13. $c^2 - b^2$

14. $\dfrac{b \cdot c}{a^2 + 9}$

15. $(8 + b) - c$

Order of Operations & Evaluate Quick Quiz Review
Use order of operations to simplify each expression.

1. $\left(10 \div 5\right) - \left(27 \div (-3)\right)$

2. $-3\left[2(3+4)\right]$

3. $\left(-4\sqrt{18 \cdot 2}\right) \div 8$

4. $\dfrac{19-9}{-3 \cdot 2 + 1}$

5. $-2\left[4(8 \div 2) + 3\right]$

6. $9 \cdot 4 \div 6 + 5$

7. $2 + \left[(14-10) \cdot 5\right]$

8. $25 + (30 \div 2) - 1^{210}$

9. $10 \cdot 4 \div (17 - 7 + 10)$

10. $6(9-5) \div 4$

11. $5 + \left[(45 \div 9) - 2\right]^2$

12. $11 - \left[(18 \div 3) + 9\right]$

13. $4^2 + 3(7) - 11$

14. $16 - (2 \cdot 2 \div 4)^2 + 1$

15. $18 + 27 \div 9 - 4(2)$

Evaluate each expression for the indicated variable.

16. $-10x + 3$ _for_ $x = -2$

17. $|x - 3| + 8 \div 2$ _for_ $x = -8$

18. $\dfrac{4 + x^3}{-2}$ _for_ $x = -2$