Order of Operations

When a problem involves multiple operations, do the steps in the following order:

1. Parentheses ( ) – Perform the operations inside the parentheses or remove parentheses starting with the innermost set.
   ** other grouping symbols like brackets [ ], braces { }, and the bar of a fraction or square root also fall under this category.**
2. Exponents – Simplify expressions or perform any operations involving exponents.
3. Multiply and Divide – Do multiplication and division from left to right.
4. Add and Subtract – Do addition and subtraction from left to right.

The order in which to evaluate an expression can be remembered using the following mnemonic:

Please Excuse My Dear Aunt Sally

EXAMPLES:

1. $3+5\times 2$
   $3+10$
   13

   Do multiplication first.

2. $4+2^3\div(-2)$
   $4+8\div(-2)$
   $4+(-4)$
   0

   Step 1: Simplify exponential expressions.
   Step 2: Divide.
   Step 3: Add.

3. $3-(4+3(1-1))-7\times 2$
   $3-(4+3(0))-7\times 2$
   $3-(4+0)-7\times 2$
   $3-4-7\times 2$
   $3-4-14$
   $-1-14$
   -15

   Step 1: Innermost parenthesis – Subtract.
   Step 2: Inside parentheses – Multiply.
   Step 3: Inside parentheses – Add.
   Step 4: Multiply.
   Step 5: Subtract from left to right.

4. $\dfrac{6-10}{8-6}$

   The bar of the fraction is acting as a grouping symbol. Do work in the numerator and denominator, then divide.
   This problem is equivalent to: $(6-10)\div(8-6)$.

PROBLEMS:

1. $(-4)(3)+6$
2. $7+(-3)(5)-2$
3. $2\times5+7\times3-5\times2$
4. $6+4\times(3-5)$
5. $7-2^3\times5+3$
6. $5(-3)-(6+2)^2+4$
7. $1-16\times2\div4+3$
8. $4+27\div(-3)\times2-6$
9. $8-3+(2+4)-6$
10. $\dfrac{3(-5)+7}{9-4(-2)}$
11. $5(-4)\div2(6-8)$
12. $10-[3-(2-7)]$
13. $\dfrac{-4+(-2)}{8-5}$
14. $20-2\{5-[3-5(6-2)]\}$
15. $27\div(-3)^2-5\left\{6-\dfrac{8-4}{5}\right\}$
16. $\sqrt{13^2-12^2}$
17. $2(-6)\div[3(8-4)]$
19. $24-((-6)+18)$
20. $17-((-9)+15)$
21. $(12-(-19))-16$
22. $11-(5+8)-24$
23. $20-(5-(7-10))$
24. $\dfrac{7+(-12)}{8-3}$
25. $\sqrt{3^2+4^2}$
26. $17-(6-(9-2(2-7)))$
27. $32\div(-2)^3-5(7-\dfrac{6-2}{5})$
28. $(-14+(-2))\div(9-5)$
39. $((-8)+(-16))+((-3)-14)$
30. $[(-5)+(-16)+9]+(-17)$
31. $-2+3\times4-6\div3$
32. $(-4)^3-(5)\times(-3)$
33. $\dfrac{(-6)^2-(5)^2}{-11}$
34. $-5[-11+6]-[-7-(11-19)+5]$
35. $\dfrac{5^2+12^2}{-13}+\dfrac{6^2-6}{-2(5)}$

18. $5(-4) \div 2(9-4)$

Hierarchy of Operations: Answers

1. -6
2. -10
3. 21
4. -2
5. -30
6. -75
7. -4
8. -20
9. 5
10. $\frac{-8}{17}$
11. 20
12. 2
13. -2
14. -24
15. -23
16. 5
17. -1
18. -50
19. 12
20. 11
21. 15
22. -26
23. 12
24. -1
25. 5
26. 30
27. -35
28. -4
29. -41
30. -29
31. 8
32. -49
33. -1
34. 19
35. -16