Technology-Integrated Mathematics
Class Notes

Arithmetic: Order of Operations (Section 1.5)

*These rules were set down long ago so that we would be consistent.*

Compare the following calculations. How do the parentheses make a difference?

$$3\times 4+2 \qquad\qquad (3\times 4)+2 \qquad\qquad 3\times(4+2)$$

**Order of Operations** is the set of rules that mathematicians adopted years ago to help avoid confusion. I use the mnemonic device **PEMDAS**. This gives us the order in which we should do calculations that appear in a string. It stands for

**Parentheses**
**Exponents**
**Multiplication / Division**
**Addition / Subtraction**

*In the last two, we do these operations in order **from left to right**.*

*We will not see **Exponents** 'til later.*

*I calculate all terms (things we are adding or subtracting) and then go left to right.*

expl 1: Perform all operations in the correct order.

a.) $48\div 8-2$
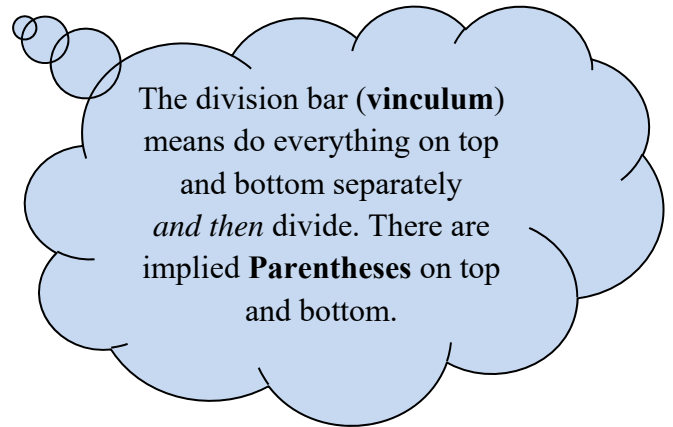
b.) $8+3\times(9-4)$

c.) $24\div 8-14\div 7+8\times 6$

d.) $22+11-7$

e.) $18\div(3\times 2)$

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expl 1 continued: Perform all operations in the correct order.

f.) $\dfrac{44+12}{11-3}$

g.) $\dfrac{6+12\times4}{15-3\times2}$

The division bar (**vinculum**) means do everything on top and bottom separately *and then* divide. There are implied **Parentheses** on top and bottom.

Many of the previous problems you may have found easy enough to do on paper. Feel free to use the calculator when they get nastier. Be aware that the calculator can misinterpret what we enter.
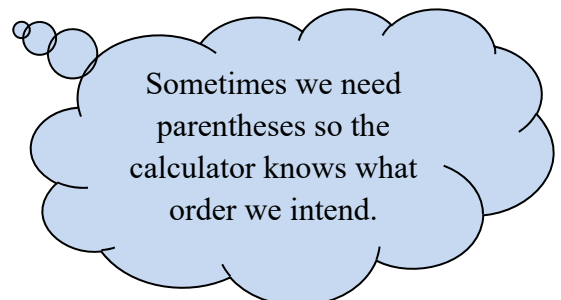
expl 2:  Let's practice a few of those last problems on the calculator.

a.) $24 \div 8 - 14 \div 7 + 8 \times 6$

b.) $8 + 3 \times (9 - 4)$

c.) $\dfrac{6+12\times4}{15-3\times2}$

d.) $\dfrac{44+12}{11-3}$

Sometimes we need parentheses so the calculator knows what order we intend.

expl 3: Bob purchased seven 2x4 boards at $10 each and returned (and received credit for) four gallons of paint at $14 each. Write out the mathematical statement that gives the amount of money he spent and then calculate the amount.

expl 4: Gerry's Graphics charges $80 per hour for the work of its most senior graphic artists, $60 per hour for the work of a production designer, and $23 per hour for the work of an apprentice. A certain job used 30 hours of work from a senior graphic artist, 15 hours of work from a production designer, and 65 hours from an apprentice. The client will also be charged $1200 for materials. Write out the mathematical statement that gives the total charge for the job and then calculate the amount.

**Worksheet: PEMDAS for Arithmetic:**
This worksheet focuses on a mnemonic device for remembering the order of operations, PEMDAS. Some problems are worked completely as examples; some are left for you. Write out all steps for better understanding. Check by practicing with the calculator.