Order of Operations Using a Scientific Calculator

M005.1
Directed Learning Activity – Order of Operations Using a Scientific Calculator

Description: In this Directed Learning Activity (DLA), you will discover how to enter an algebraic expression into a scientific calculator using the order of operations.

Prior Knowledge: In order to complete this DLA you will need to know the order of operations.

Order of operations
1) Symbols of Grouping ( ), [ ], { }, \sqrt{ }, \frac{ }{ }
2) Exponents
3) Multiplication or Division from LEFT TO RIGHT
4) Addition or Subtraction from LEFT TO RIGHT

\[(4 + 4 \cdot 6) \div 4 \cdot 3^2 + 5\]
1) Symbol of Grouping
\[(4 + 4 \cdot 6)\]
\[(4 + 24)\]
\[(28)\]
2) Exponents
\[3^2\]
\[3 \cdot 3\]
\[9\]
3) Multiplication or Division from LEFT TO RIGHT
\[28 \div 4\]
\[7\]
4) Multiplication or Division from LEFT TO RIGHT
\[7 \cdot 9\]
\[63\]
5) Addition or Subtraction from LEFT TO RIGHT
\[63 + 5\]
\[68\]

Materials: A scientific calculator will be needed. A TI-30XIIS is recommended, but other brands will work. If you have a different calculator and are unable to find a particular function on it, please ask a tutor for help. This exercise is to help you become more comfortable with your own calculator.

Directions: Please read the following examples and questions carefully and in order. Please do not skip ahead. If you have a question, please ask for help.

After reading the examples, spend some time thinking about what is being presented. After you feel you understand the examples, try and answer the practice questions.

When you are finished, please spend some time thinking about this activity and complete the reflection section. This is a learning activity, and you are not being graded.
**Step One: Symbols of Grouping (Basic)**

Let’s start at the beginning:

\[ 4 + 3(2 - 1) \]

Enter the expression exactly as it appears.

![Calculator Display](image)

Your scientific calculator already knows how to simplify an expression using order of operations. If you enter the expression correctly, then the calculator will compute the correct answer.

**Step Two: The Arrows**

If you use the up arrow on the , it will allow you to scroll over what you have just typed. You can use this feature to check your work.

You can also use the left or right arrow to fix mistakes:

Given: \( 4 - 3 + 7 \)

I accidentally enter: \[ 4 + 3 \ 1 \]

I need to change the plus to a minus.

Using the left arrow ,

I scroll back until the blinking cursor is over the plus sign and press the minus key. Now the plus is a minus.

I can scroll back to where I left off with the right arrow key, , and continue entering the +7.
Step Three: The INS/DEL Key

You can insert and delete any entry using the INS/DEL key.

4+(7-2)
I accidentally enter:

4  +  8  7  -  2  )

Using the left arrow,
I scroll back to the 8 and press the key.
The 8 is now gone.

Oh, no: I still need a parenthesis between the + and the 7. I should have just replaced the 8 with a (. Don't press clear just yet. Leaving my blinking cursor on the 7 because I want the parenthesis to be in front of the 7,

I enter

The activates the INS in blue above the DEL key.
There is now a ( in the correct location.

Try:
1) $7(4 + 3 - 2) \cdot 5$  
2) $(6 \div 2 \cdot 3) \div 3$  
3) $7 - (4 + 15 \div 3)$

Answers: 1) 175  2) 3  3) -2

Step Four: The Negative Sign

The negative sign key is near the bottom right corner

-5 is entered
Step Five: Symbols of Grouping (Fractions)

The numerator and denominator are groups.

\[
\frac{\frac{14-5}{4-5}}{\frac{14-5}{4-5}}
\]

needs to be written like this \(\frac{(14-5)}{(4-5)}\), so when we enter this into the calculator, we must use one set of parentheses for the numerator and one set of parentheses for the denominator.

We enter this expression as follows:

\[
\begin{align*}
( & 1 \quad 4 \quad - \quad 5 \quad ) \\
\div & \\
( & 4 \quad - \quad 5 \quad )
\end{align*}
\]

The bar represents division.

Try:

1) \(\frac{4+3\cdot2}{25-20}\)  
2) \(\frac{14}{7.5}\)  
3) \(\frac{4+3(2+5)}{5}\)

Answers: 1) 2  2) 0.4  3) 5

Step Six: Exponents and Roots

Example 1: \(5^7\)  
Entering this into your calculator requires the caret key. The caret key, \(^\wedge\), is right above the \(x^2\) key. The caret key lets the calculator know the next entry is the exponent. We enter this expression as follows:

\[
\begin{align*}
5 & \wedge 7 \\
\text{Enter}
\end{align*}
\]
Example 2: \( \sqrt[5]{225} \) If you look right above the caret key, \(^2\), you will see \( \sqrt{\phantom{0}} \). We enter this expression as follows:

\[
\begin{array}{c}
5 \quad 2nd \quad ^2 \quad 2 \quad 2 \quad 5 \quad \text{Enter}
\end{array}
\]

The \( 2nd \quad ^2 \) activate the \( \sqrt{\phantom{0}} \) in blue.

We still enter the expression in the order of appearance, therefore the 5, 5th root, goes first.

Step Seven: Symbols of Grouping (Radicals)
The quantity inside of the radical is also a grouping. 
\( \sqrt{6 + 5 \cdot 2} - 5 \cdot 3 \) really looks like this \( \sqrt{(6 + 5 \cdot 2)} - 5 \cdot 3 \), so when we enter this into the calculator, we must use a parenthesis for the quantity inside the radical. We enter this expression as follows:

\[
\begin{array}{c}
2nd \quad x^2 \quad 6 \quad + \quad 5 \quad \cdot \quad 2 \quad ) \quad - \quad 5 \quad \cdot \quad 3 \quad \text{Enter}
\end{array}
\]

The \( 2nd \quad x^2 \) activate the \( \sqrt{\phantom{0}} \) in blue.

Example 2: \( \sqrt[5]{225 + 7} \) If you look above the caret key, \(^2\), you will see \( \sqrt{\phantom{0}} \). We enter this expression as follows:

\[
\begin{array}{c}
5 \quad 2nd \quad ^2 \quad ( \quad 2 \quad 2 \quad 5 \quad + \quad 7 \quad ) \quad \text{Enter}
\end{array}
\]

The \( \sqrt{\phantom{0}} \) does not give a (, so a ( must be added.

Try (Give answers to two decimal places):
1) \( \sqrt{4 \cdot 2 + 8} \) \hspace{1cm} 2) \( \sqrt{3 - 5 \div 7} \) \hspace{1cm} 3) \( \sqrt[7]{12566 + .55(2) - 3} \)

Hint: Don't forget the parentheses \hspace{1cm} Hint: Close the parentheses before -3

Answers: 1) 4 \hspace{1cm} 2) 1.09 \hspace{1cm} 3) 0.85
Example 3: \(500 \left(1 + \frac{0.06}{12}\right)^{60}\)

We enter everything as it appears from left to right.

\[
\begin{array}{ccccccccccccccc}
5 & 0 & 0 & ( & 1 & + & 0 & . & 0 & 6 & \div & 1 & 2 & ) & ^ & 6 \\
0 & & & & & & & & & & & & & & \\
\end{array}
\]

\[
\begin{array}{c}
500(1+.06/12)^{60}
\end{array}
\]

\[
\begin{array}{c}
674.4250763
\end{array}
\]

Example 4: \(\left(\frac{700}{52}\right)^{\frac{251}{12}}\)

This expression needs to be written like this: \(\left(\frac{700}{52}\right)^{\frac{251}{12}}\). The parentheses are assumed.

\[
\begin{array}{ccccccccccccccc}
( & 7 & 0 & 0 & \div & 5 & 2 & ) & ^ & ( & 2 & 5 & 1 & \div & 1 & 2 \\
) & & & & & & & & & & & & & & \\
\end{array}
\]

\[
\begin{array}{c}
(700/52)^{(251/12)}
\end{array}
\]

\[
\begin{array}{c}
4.13901880283
\end{array}
\]

Step Eight: Test Your Knowledge

Round to two decimal places, if necessary.

Hints: Parentheses are needed for \(\frac{\text{numerator}}{\text{denominator}}\), \(x^{\sqrt{\text{inside}}}\), base \(^{\text{exponents with computations}}\)

\[
a) \ 3 - \left(2 + 5 \left(\frac{7}{2}\right)\right) \quad b) \ \frac{2 + 5 \div 3^{2.5}}{7 - 11.23} \quad c) \ 500 \left(1 + \frac{0.085}{52}\right)^{52.7}
\]
\[
\frac{\sqrt{5.55 + 312}}{7.15 \cdot 0.86} \quad e) \quad 1 - \sqrt[4]{32} \quad f) \quad -9^2 + \sqrt{25} - 4(12 \div 2 \cdot 3)
\]

Hint for d: To help you get started with letter d, you will need two sets of parentheses – one for the radical and one for the numerator. You will also need one for the denominator.

Answers: a) -16.5  b) -0.55  c) 906.08  d) 7.19  e) -1.38

Step Nine: Reflection

a) Why did you (or your instructor) decide that completing this activity was a valuable learning experience?

b) Name one thing that you understand better about the scientific calculator and order of operations as a result of completing this activity.

b) Name one thing that you still do not understand about the scientific calculator and order of operations.

c) Can you think of a way to make this activity more useful to you and other students?

STOP. Please go over your work with a tutor at this time.
For Follow-Up:

_______ The student completed the entire activity.

_______ The student attempted to answer every question

_______ The student demonstrated an understanding of the processes during the discussion of his/her work

Additional Comments:

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PRINT INSTRUCTOR/TUTOR NAME ___________________________ DATE ________________

INSTRUCTOR/TUTOR SIGNATURE

STUDENT – DO NOT FORGET TO TURN THIS SHEET IN AT THE FRONT DESK!

You may not get credit for completing this DLA if you fail to leave this sheet with the front desk receptionist.