

Activity Overview

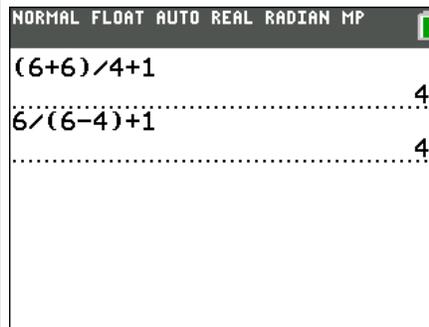
In this activity, students use the order of operations and number properties to create a unique expression from a set of numbers that must equal another number. Then they will place parenthesis in a number statement to make it true. Students will also identify properties commonly used evaluating expressions.

Topic: Numbers and Operations

- Understand meanings of operations and how they relate to one another.
- Use the associative and commutative properties of addition and multiplication and the distributive property of multiplication over addition to simplify computations with integers, fractions, and decimals.

Teacher Preparation and Notes

- To download the student worksheet, go to education.ti.com/exchange/wdtpg



This activity utilizes MathPrint™ functionality and includes screen captures taken from the TI-84 Plus C Silver Edition. It is also appropriate for use with the TI-83 Plus, TI-84 Plus, and TI-84 Plus Silver Edition but slight variances may be found within the directions.

Compatible Devices:

- TI-84 Plus Family
- TI-84 Plus C Silver Edition

Associated Materials:

- Where_Did_Parenthese_Go_Stu dent.pdf
- Where_Did_Parenthese_Go_Stu dent.doc

Tech Tips:

- Access free tutorials at <http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials>
- Any required calculator files can be distributed to students via handheld-to-handheld transfer.

Part 1 – The Right Combination

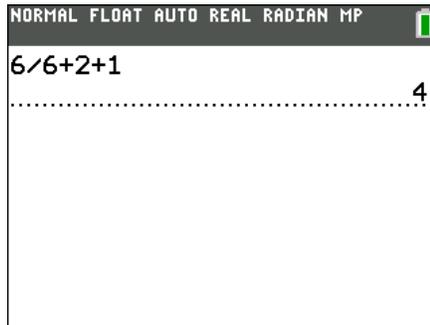
Students may or may not have prior experience with the Commutative and Associative Properties of Addition and Multiplication. They may solve the problems with trial and error, as long as they are following correct order of operations.

Questions 1–4

Operations can be performed on the Home screen to verify student results. Using an overhead projector or TI SmartView emulator, the whole class can see different approaches to solving the same problem.

For example, to evaluate Exercise 1, press $6 \div 6 + 2 + 1$. If you wish, insert parentheses around division to ensure students understand that it needs to be performed first. This becomes more important as students work with more complex entries later.

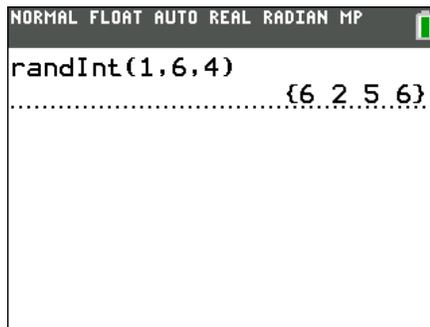
If needed, generate additional examples to use with students. To quickly generate 4 numbers between 1 and 6, use the **randInt**(command. Press **MATH** ► ► ► to PRB and select number **5:randInt**(. On the home screen, then enter the minimum value, 1 , maximum value, 6 , quantity of numbers you would like generated, and 4 **ENTER**. For example, to generate 4 numbers, enter **randInt(1,6,4)** and press **ENTER**.



NORMAL FLOAT AUTO REAL Radian MP

$$6/6+2+1$$

..... 4.



NORMAL FLOAT AUTO REAL Radian MP

$$\text{randInt}(1,6,4)$$

..... {6 2 5 6}.

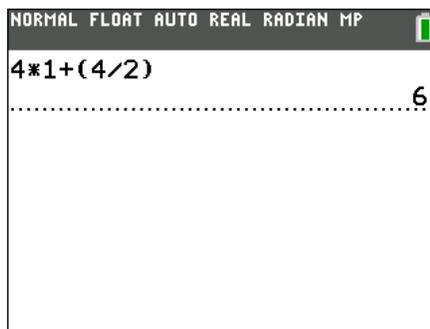
Question 5

Students may have arrived at different answers to the problems. Make sure they can show how their answer is correct.

Question 6

Have students explain verbally what the calculator is doing in the entry Sarah used. Then, have someone enter the correct problem and see the answer.

The key presses for the problem to the right are $4 \times 2 + 4$.



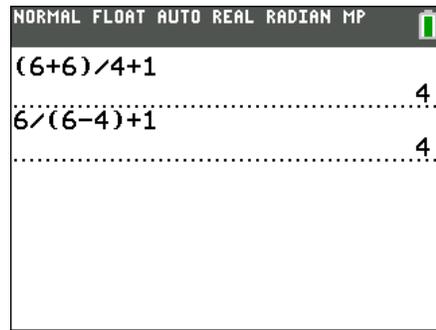
NORMAL FLOAT AUTO REAL Radian MP

$$4*1+(4/2)$$

..... 6.

Question 7

Have students explain verbally what the calculator is doing in the entries Steven and Jalil used. When students enter these expressions into the calculator, they will see that the both equal 4 because $12/4$ and $6/2$ both equal 3.



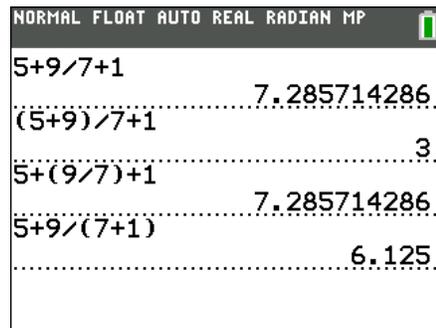
Part 2 – Where Have All the Parentheses Gone?

Questions 9–12

Students need to pay close attention to the order of operations. Have students determine which solutions, if any, are correct just by following the order of operations and actually need no parentheses.

Questions 13–18

Again, some of the exercises would evaluate correctly just by following the order of operations. However, students should begin learning to group calculations together to ensure they are performing the actual calculation desired, to result in a correct answer. Using an overhead calculator or emulator software, the problem could be displayed in different manners (placing parentheses in different locations). Have students explain what you have “told” the calculator to do.



Part 3 – Using Properties

Questions 19–24

After using the different properties in solving problems earlier, this is an opportunity for students to correctly apply the properties.



Solutions – Student Worksheet

Part 1

1. 6 6 2 1 Answer: 4 **Answer:** $\frac{6}{6} + 2 + 1 = 4$

2. 3 2 2 5 Answer: 2 **Answer:** $\frac{3+2}{5} \times 2 = 2$

3. 3 6 1 2 Answer: 5 **Answer:** $\frac{6}{3} + 2 + 1 = 5$

4. 2 3 5 2 Answer: 1 **Answer:** $2 - \frac{2+3}{5} = 1$

5. With a partner, compare the number sentences for Exercises 1–4. Did you come up with the same sentence? If not, are both correct?

Answer: Answers will vary. Students should verify that each approach, if different, arrives at the same result.

6. Sarah is given the numbers 4, 1, 2, and 4 to make 6. She has entered the following number sentence on her calculator. Will she get the expected 6? If not, how can she correct her mistake?

Answer: No, she will not. The first + sign should be * and the parentheses need to be around (4/2) instead.

7. Steven and Jalil are discussing their results. For the numbers 6, 6, 4, and 1, they are supposed to create a result of 4. Steven has entered the first line and Jalil entered the second line. Is either correct? Explain.

Answer: Yes, they are both correct. Both number sentences evaluate to 4.

8. Ayana was given the numbers 4, 1, 5, and 5 to total 3. She thinks all the following are possible number sentences. Do you agree? Explain.

Answer: Yes, all four number sentences evaluate to the same number. She has just used the Commutative Property and parentheses to reorder or rearrange the addends.



Part 2

9. Jason: $6 + 4 - 6 - 1$ **Answer: No parenthesis needed**
10. Rosie: $4 \times 1 - 6 \div 6$ **Answer: No parenthesis needed but it can be rewritten as $(4 \times 1) - (6 \div 6)$**
11. Khemal: $6 \div 6 \times 4 - 1$ **Answer: No parenthesis needed but it can be rewritten as $(6 \div 6) \times 4 - 1$**
12. Use the Associate Property to make it easier to see that the answer to Jason's number sentence in Exercise 9 is 3. **Answer: $6 - 6 + 4 - 1$; This makes it easier to see that $6 - 6$ is 0 and $4 - 1$ is 3.**
13. $5 + 9 \div 7 + 1 = 3$ **Answer: $(5 + 9) \div 7 + 1 = 3$**
14. $2 \times 10 + 6 - 3 \times 6 \div 2 = 23$ **Answer: $2 \times (10 + 6) - 3 \times (6 \div 2) = 23$**
15. $15 \div 5 + 30 \div 6 \times 2 = 13$ **Answer: $(15 \div 5) + (30 \div 6) \times 2 = 13$**
16. $32 \div 2 + 6 + 6 = 10$ **Answer: $(32 \div (2 + 6)) + 6 = 10$**
17. $12 \div 4 + 2 \times 8 = 16$ **Answer: $12 \div (4 + 2) \times 8 = 16$**
18. $24 \div 2 + 4 \div 2 = 2$ **Answer: $(24 \div (2 + 4)) \div 2 = 2$**

Part 3

19. Commutative Property of Addition
 $5 + 3 + 2 =$ **Answer: $3 + 5 + 2$**
20. Commutative Property of Multiplication
 $12 \times 5 =$ **Answer: 5×12**
21. Associative Property of Addition
 $(5 + 3) + 2 =$ **Answer: $5 + (3 + 2)$**
22. Distributive Property
 $6 \times (4 + 1) =$ **Answer: $6 \times 4 + 6 \times 1$**
23. Associative Property of Multiplication
 $7 \times (2 \times 6) =$ **Answer: $(7 \times 2) \times 6$**