

Variables on Both Sides

ID: 11133

Time required
15–20 minutes

Activity Overview

In this activity, students will encounter various scenarios involving perimeters of polygons. The students will write an equation and solve it in order to answer the questions provided.

Topic: Solving Equations with Variables on Both Sides

- *The student will use algebraic expressions to form equations relating two different perimeters to each other.*
- *The student will solve equations with variables on both sides.*
- *The student will answer a deeper level inquiry question regarding the relationship between two regular polygons and the difference in their perimeters for different lengths of sides.*

Teacher Preparation and Notes

- *This activity is meant as a review of solving equations with variables. Students should be able to set up and solve equations with variables on both sides prior to starting this activity. These equations include the Distributive Property.*
- *Students should also be encouraged to show their work, whether it be on paper or in the document itself.*
- *The teacher may wish to change the Document Type of the TI-Nspire document from Self-Check to Exam in the Question Properties window.*
- ***To download the student, extension, and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter “11133” in the keyword search box.***

Associated Materials

- *VariablesOnBothSides_Student.doc*
- *VariablesOnBothSides.tns*
- *VariablesOnBothSides_Soln.tns*
- *VariablesOnBothSides_Extension.tns*

Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

- *Solving Equations with a Calculator? No Way! (TI-Nspire CAS technology) — 8758*
- *Doin' the TI Two-Step – Solving Equations (TI-Nspire CAS technology) — 9153*

Problem 1 – A Square and a Rectangle

The student should observe the labels for the length of the sides, and be certain to understand the translation from the descriptions on the left to the figures on the right. They can grab the open circle and change the size of the square and rectangle.

Students are asked to write expressions for the perimeter of the square and of the rectangle.

On page 1.5, students will pick the equation that is true given the information from the question and the expressions from pages 1.3 and 1.4.

Next, students will solve the equation they selected to find out what value of x makes the equation true.

1.1 1.2 1.3 VariablesOn...des

A square has sides of length x . A rectangle has one side that is twice as long, and another that is 3 units longer than the sides of the square.

Diagram: A square with side length x and a rectangle with side lengths $2x$ and $x+3$.

1.3 1.4 1.5 *VariablesOn...des

If the rectangle has a perimeter that is 10 units longer than the perimeter of the square, which of the following equations are true?

- ☒ $4x + 10 = 2(x + 3) + 2(2x)$
- ☐ $4x - 10 = 2(x + 3) + 2(2x)$
- ☐ $4x = (x + 3) + 2x + 10$
- ☐ None of these

Problem 2 – An Equilateral Triangle and a Square

Students should analyze the description of the figures on page 2.1. They can grab the open circle and change the size of the equilateral triangle and square. Students will again need to write expressions describing the perimeters of the figures on pages 2.2 and 2.3.

On page 2.4, students are to come with an equation that describes the relationship between the perimeter of the triangle and the perimeter of the square using the information from page 2.1 and the expressions from pages 2.2 and 2.3. The equation should be in a similar format to the equation from page 1.5.

Students will solve the equation and should be able to find out the length of the sides of each figure.

1.5 1.6 2.1 *VariablesOn...des

An equilateral triangle has sides of length x . A square has sides that are 1 more than twice that length. The perimeter of the square is 19 cm more than that of the triangle.

Diagram: An equilateral triangle with side length x and a square with side length $2x+1$.

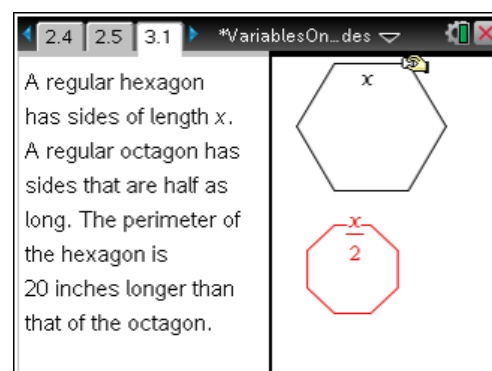
2.2 2.3 2.4 *VariablesOn...des

Write an equation that shows the relationship between the perimeter of the triangle and of the square.

$3x + 19 = 4(2x + 1)$

Problem 3 – A Hexagon and an Octagon

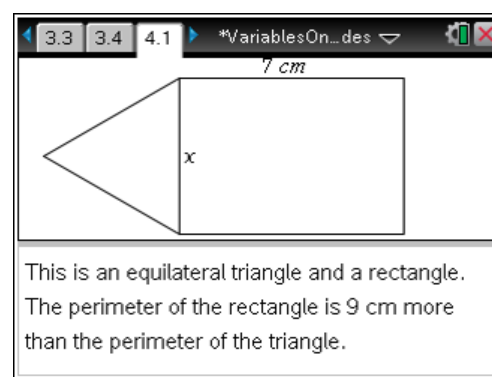
In Problem 3, students will investigate the perimeters of the given hexagon and octagon. Students can grab the open circle and change the size of the hexagon and octagon. For this problem, students are not asked to write out an equation that represents the relationship between the perimeters of the figures. It is expected that students will write an equation in order to answer the question on page 3.4.



A regular hexagon has sides of length x .
A regular octagon has sides that are half as long. The perimeter of the hexagon is 20 inches longer than that of the octagon.

Problem 4 – An Equilateral Triangle and a Rectangle

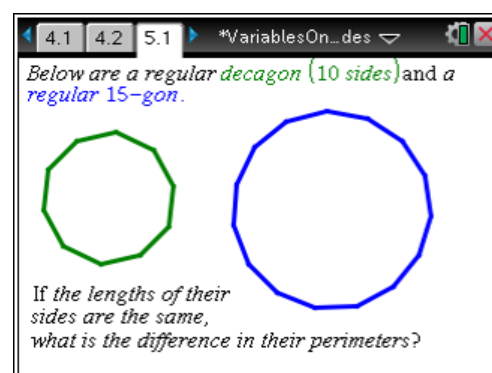
In Problem 4, students are given even less of the intermediate steps. Students should now be able to solve for the length of the sides of the triangle.



This is an equilateral triangle and a rectangle.
The perimeter of the rectangle is 9 cm more than the perimeter of the triangle.

Problem 5 – A Regular Decagon and 15-gon

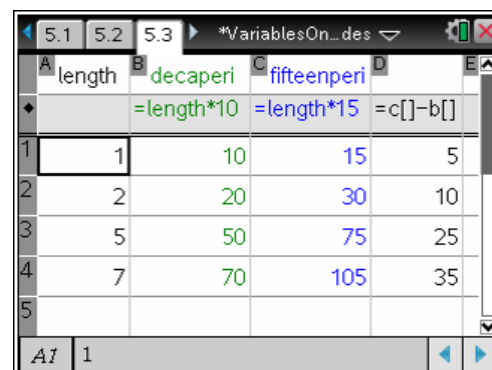
In Problem 5, students are to figure out the difference between the perimeters of the figures. Students can solve this problem experimentally using the spreadsheet on page 5.3 or algebraically as before.



Below are a regular decagon (10 sides) and a regular 15-gon.
If the lengths of their sides are the same, what is the difference in their perimeters?

If students choose to use the spreadsheet, then students will need to enter several values into the length column and find the pattern for the difference of the **decaperi** column and the **fifteenperi** column.

If students choose to figure out this problem algebraically, then they may need a hint to get started. Suggest that students represent the side length as a variable and the difference in the perimeters as a second variable.



	length	decaperi	fifteenperi	
		$=\text{length} \times 10$	$=\text{length} \times 15$	$=\text{c}[] - \text{b}[]$
1	1	10	15	5
2	2	20	30	10
3	5	50	75	25
4	7	70	105	35
5				
A1	1			

Extension

The student will experiment with age problems. Various scenarios will be worked out by using the Spreadsheet function.

First, the student is asked to solve by Guess and Check. Then, the student must attempt to write and solve an equation that verifies the solution

In the next problem, the student is asked to come up with two different ages for people and then write a description expressing the relationship between the ages. The student is expected to create a working spreadsheet for another student to use in order to solve the problem, as well as write and solve the equation him or herself. This type of question provides excellent information for the teacher about the depth of the student's knowledge or understanding of how variables and equations are used to solve problems. The additional skill of creating a spreadsheet with formulas is a great benefit.

	camila	ben	total
			=2*camila=ben
1	2	4	6
2	10	20	30
3	20	40	60
4	15	30	45
5	16	32	48