Raise Your Cup

ID: 11399

Time Required
15 minutes

Activity Overview

In this activity, students will investigate inequalities. Applications of inequalities to volume and perimeter provide motivation to develop a deeper understanding of the topic. Dynamic sliders and self-check questions make this activity approachable for Algebra 1 students. Students can put into practice what they have learned with extension/homework questions.

Topic: Equations and Inequalities

- *Application questions for inequalities*
- *Volume and perimeter*

Teacher Preparation and Notes

- *The student worksheet provides instructions and questions to guide inquiry and focus observations.*
- *When on a question page, students can press ctrl ▲ to self-check their answer. Before using in another class, either have students not save changes or have them press* ***MENU > Clear Answers > Document*** *on a Question application.*
- *Solutions to the problems are given in this document and can also be seen if the student .tns file is opened with the TI-Nspire Teacher Edition Software.*
- ***To download the student TI-Nspire document (.tns file) and student worksheet, go to education.ti.com/exchange and enter "11399" in the quick search box.***

Associated Materials

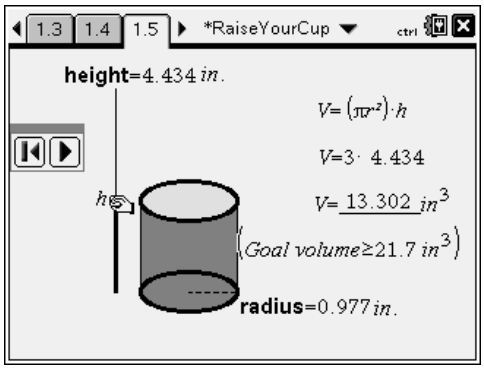
- *RaiseYourCup.tns*
- *RaiseYourCup_Student.doc*

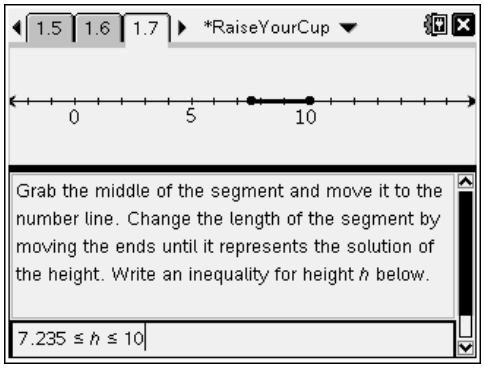
Suggested Related Activities

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

- *The Impossible Task (TI-Nspire technology) — 9317*
- *Linear Inequalities (TI-Nspire technology) — 8770*

Problem 1 – Inequality Applied to Volume

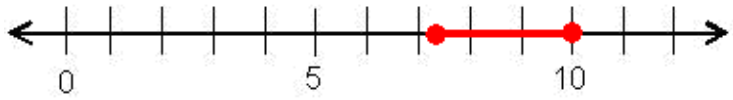




Students are asked "How high should you make a cylindrical cup so it can hold at least 12 ounces of apple juice?" They are also given that the base of the cup is 3 inches² and the parameter that their cup cannot be taller than 10 inches or it won't fit in their cabinets.

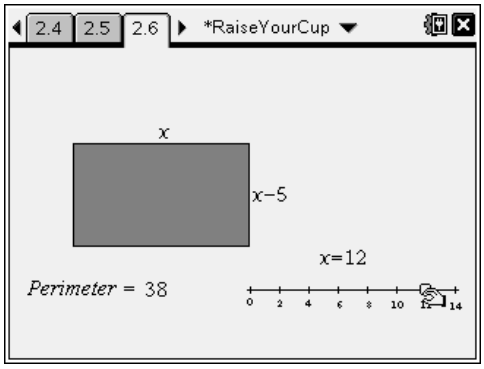
The units are converted so that they agree, and some true/false self-check questions are asked. A dynamic visual of the situation is provided on page 1.5. As the height is raised, students should observe the changing volume. They can approximate the height that corresponds to 21.7 in^3, but they could also be encouraged to calculate the minimum height on a calculator like page 1.3.

For further thought, students could be asked how their answers would be different if the shelf height were higher. What if they didn't have to be concerned with the shelf height? Could the cup be infinitely tall (with an infinite volume)?

- $V \geq 12$ fl. oz. or $V \geq 21.7$ in^3
- $h \leq 10$ inches
- 

- 7.21875 in. ≤ h ≤ 10 in.

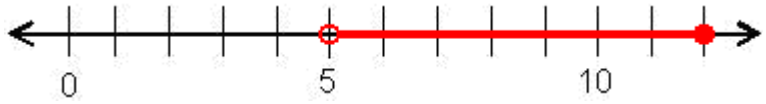
Problem 2 – Inequality applied to perimeter



Students will see that the length of a side cannot be less than zero. They first solve the multiple choice question $2x - 6 > 0$.

- $x > 3$

Then, the student is taken step by step to find all values of x for which the perimeter of a rectangle with sides x and $x - 5$ is at most 38.

- $P \leq 38$
- $P = x + x + (x - 5) + (x - 5) = 4x - 10$
- 

- With the parameter that $x - 5 > 0$, implying $x > 5$, the solution is $5 < x \leq 12$

Extension/Homework

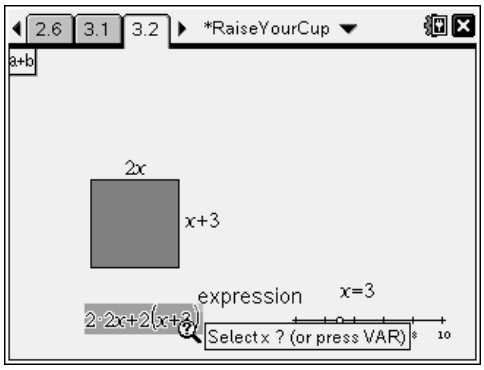
Exercise 1

The perimeter of a rectangle with side $2x$ and $x+3$ must be at least 42.

Find all values of x where this is true.

Solution: $x \geq 6$

Students can use the **Text** tool to write the expression for the perimeter on page 4.2. Then, they can use the **Calculate** tool, select the expression, and then select $x = 6$ to calculate the value of the perimeter.



Exercise 2

A trapezoid has sides x, $2x + 3$, $16 - x$, and x.

Since the length of each side must be greater than zero, write and simplify an inequality for each side. Find all values of x so that the perimeter is less than 37.

Solution:

$x > 0$, $2x + 3 > 0$, so $x > -\frac{3}{2}$.

$16 - x > 0$, so $x < 16$.

And $3x + 19 < 37$ gives $3x < 18$.

So $0 < x < 6$.