Raise Your Cup

ID: 11397

Time Required
15 minutes

Activity Overview

Students will investigate inequalities. Applications of inequalities to volume and perimeter provide motivation to develop a deeper understanding of the topic. Students can put into practice what they have learned with extension/homework questions.

Topic: Inequalities

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

Teacher Preparation and Notes

- *The student worksheet provides instructions and question to guide the inquiry and focus the observations.*
- ***To download the student worksheet, go to education.ti.com/exchange and enter "11397" in the keyword search box.***

Associated Materials

- *RaiseYourCup_Student.doc*

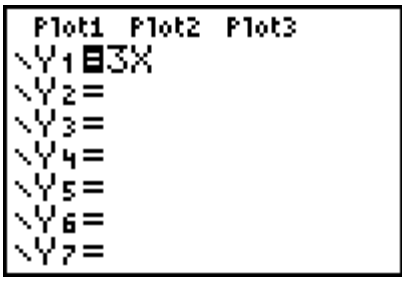
Suggested Related Activities

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

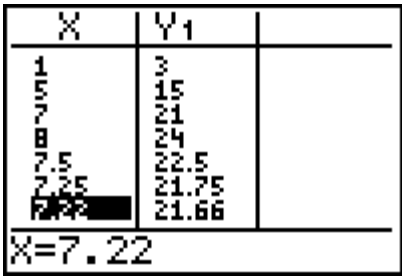
- *The Impossible Task (TI-Nspire technology) — 9317*
- *Linear Inequalities (TI-Nspire technology) — 8770*
- *Linear Inequalities (TI-84 Plus family) — 8773*

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 juice?" They are also given that the base of the cup is 3 inches^2 and the parameter that their cup cannot be taller than 10 inches or it will not fit in their cabinets.



As the students enter their heights into the table, they should observe when their volume is at least 12 ounces (which is converted to 21.65 in^3 in the problem so that the units match.) as well as what the volume is when the cup is 10 inches tall.



Students can clear an entry from the table by pressing DEL when the entry is highlighted.

Use of the number line is also reinforced.

Solutions:

1. $V \geq 12$ fl oz or $V \geq 21.7$ in^3

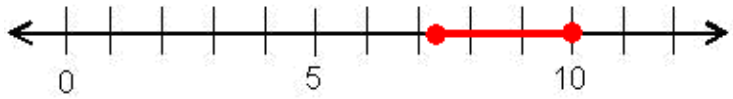
2. $h \leq 10$ in.

3. $V = \pi r^2 h = 3x$

4. 7.21875 in.

5. 30 fl oz

6. 7.21875 in. ≤ h ≤ 10 in.

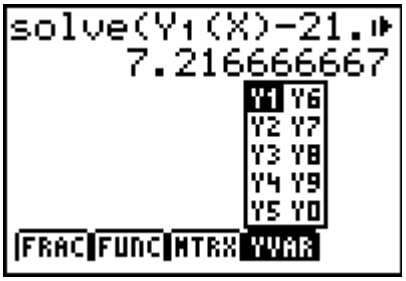


If using Mathprint™ OS:

Students can confirm their answers using the **Solve** command from the Catalog 2nd [CATALOG]. Then they can enter the expression:

Solve(expr, variable, guess, {low bd, high bd})

where the expression is entered as if already set equal to 0 and the low and high bounds are optional. For the first problem, enter **Y1(X) – 21.65**. To enter Y1 quickly, students can press ALPHA [F4] and select **Y1**.

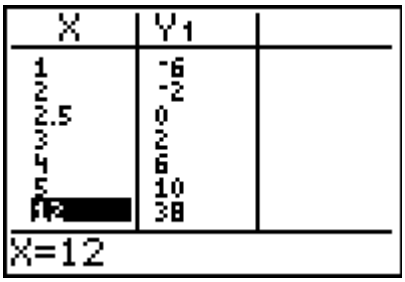


For further thought, students could be asked how their answer would be different if the shelf height was higher. What if they did not have to be concerned with the shelf height? Could the cup be infinitely tall (with an infinite volume)? What is the volume if the formula $V = \pi r^2 h$ is used with a rounded value for r? Would the calculations be different?

Problem 2 – Inequality Applied to Perimeter

In this problem, students will see that the length of a side cannot be less than zero. They first solve $2x - 6 > 0$.

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



Solutions:

7. $x > 3$

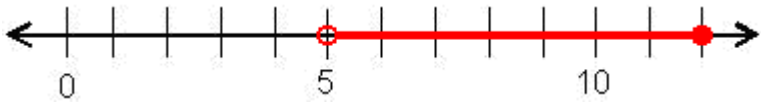
8. $P \leq 38$

9. $P = x + x + (x - 5) + (x - 5) = 4x - 10$

10. Answers may vary but should be greater than 5.

11. 12

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



Extension/Homework

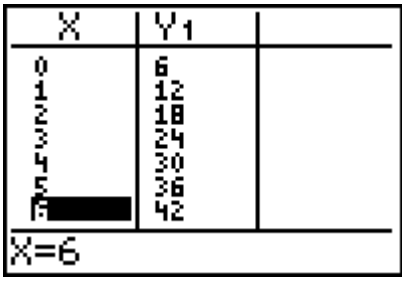
Problem 3

The perimeter of a rectangle with sides $2x$ and $x+3$ must be at least 42. Find all values of x where this is true.

Students will enter their expression into the [Y=] screen and again use the table to investigate different values for x and the resulting perimeter.

Perimeter = $6x + 6$

Solution: $x \geq 6$



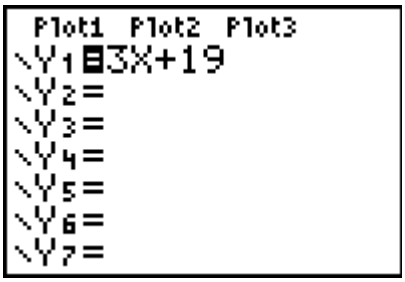
Problem 4

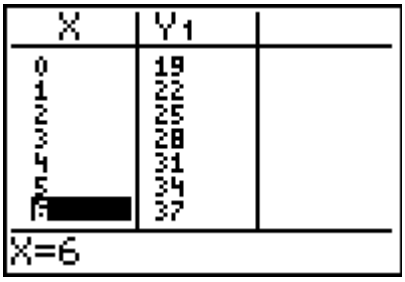
A trapezoid has sides x, $2x + 3$, $16 - x$, and x.

Since the length of each side must be greater than zero, write and simplify an inequality for each side. Solution:

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

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





Find all values of x so that the perimeter is less than 37.

Solution:

Perimeter: $3x + 19 < 37$ solves to $x < 6$.

So $0 < x < 6$.