

Inverse Variation

ID: 10232

Time required

40 minutes

Activity Overview

Students explore multiple representations of the inverse variation function, beginning with a geometric representation (a rectangle with fixed area), and progressing to a table of values, an algebraic expression, and finally a graph.

Topic: Rational Functions & Equations

- Given the values of two variables that vary inversely, determine the rational function that relates them.

Teacher Preparation

- This activity is designed to be used in an Algebra 1 classroom. It can also be used as a review in Algebra 2.
- This activity assumes basic knowledge of functions, as represented by tables of values, equations, and graphs.
- Notes for using the TI-Nspire™ Navigator™ System are included throughout the activity. The use of the Navigator System is not necessary for completion of this activity.
- To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter “10232” in the keyword search box.

Associated Materials

- *InverseVariation_Student.doc*
- *InverseVariation.tns*
- *InverseVariation_Soln.tns*

Suggested Related Activities

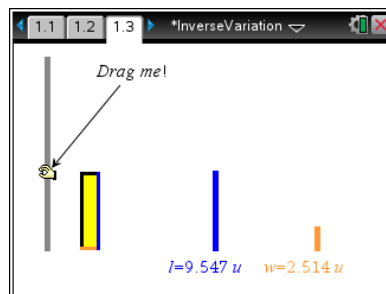
To download any TI-Nspire technology activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

- *Constant of Variation (TI-Nspire technology)* — 11197
- *Families of Rectangles (TI-Nspire technology)* — 10168
- *Comparing Perimeter to Area of a Square (TI-Nspire technology)* — 13141

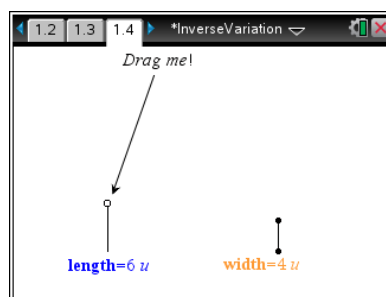
Problem – A Square with a Fixed Area

Introduce the geometric model on page 1.3. Dragging the white point along the slider on the left side of the screen adjusts the length of the gray rectangle. The width of the rectangle changes with the height in order to maintain a constant area.

The blue and orange bars on the right side of the screen are another representation of the length and width of the rectangle. Allow students to explore the model independently and answer the questions on their worksheets.



Page 1.4 is a closer look at the same geometric model. The two line segments represent the length and width of the rectangle with fixed area. Dragging the white point adjusts the length. This time, however, only whole number values for length are possible. This makes it easier for students to observe the numerical relationship between the length and the width.



Allow students time to explore the model independently and answer the questions on their worksheets.

TI-Nspire Navigator Opportunity: Class Capture
See Note 1 at the end of this lesson.

Page 1.6 is set up to capture the values of the length and width on page 1.4 and then store the values in the table.

Direct students to return to page 1.4. They should adjust the length, then press **ctrl** + **+** to capture the values of **length** and **width**, and repeat these steps until they have gathered 10 sets of values. Students should confirm that these values are stored on page 1.6.

	lengthvals	widthvals	
1	22	1.09091	24.
2	20	1.2	24.
3	18	1.33333	24.
4	16	1.5	24.
5	14	1.71429	24.
6	12	2	24.

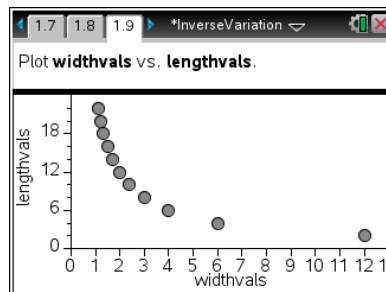
Explore the table of values with students. *Can you see a relationship between the length and the width? What relationship would make sense based on the formula for the area of a rectangle?*

Direct students to find the products of the lengths and widths by typing **=a[]*b[]** in the formula bar of Column C and then answer the questions on their worksheet.

This relationship, when x and y have a constant product, is called “inverse variation.” Have students define **inverse variation** in their own words.

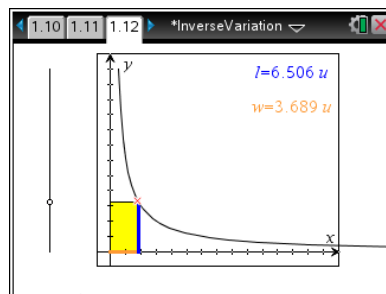
An equation of the form $x \cdot y = k$ or $y = \frac{k}{x}$, where $k \neq 0$, is an inverse variation. The constant of variation is k .

Students should plot the data they gathered as a scatter plot on page 1.9. It does not matter which variable is plotted on the x -axis and which is plotted on the y -axis. In fact, you may wish to have half of the class plot **lengthvals** on the x -axis and the other have plot **widthvals** on the x -axis, and then compare the results.



Discuss the shape of the curve.

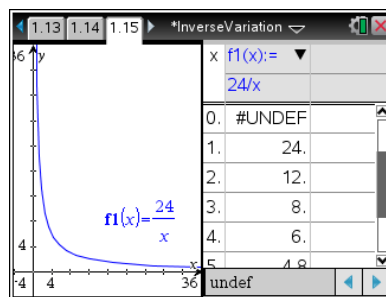
Page 1.12 ties the various representations of the inverse variation function together. Direct students to pay attention to the point marked X as they drag the slider. *What path does it appear to trace? Where have you seen this shape before?*



Students should draw the locus of this point by going to **MENU > Construction > Locus**, clicking the X point, and then clicking the white point. The curve that appears resembles the shape of the scatter plot on page 1.9 and represents all of the possible lengths and widths of a rectangle with an area of 24.

TI-Nspire Navigator Opportunity: Class Capture/Live Presenter
See Note 2 at the end of this lesson.

On page 1.15, direct students to enter the equation they found $\left(y = \frac{24}{x}\right)$ in **f1** and compare the resulting graph with the locus they drew. They should notice that a new section of the curve appears in quadrant three. Demonstrate how to grab and drag the graphing window in order to get a better view of this section of the curve. Alternatively, they could adjust their window settings from **MENU > Window/Zoom**. Have them add a table of values (**MENU > View > Add Function Table** or **ctrl + T**), and then complete their worksheets.



TI-Nspire Navigator Opportunity: Class Capture/Live Presenter
See Note 3 at the end of this lesson.

TI-Nspire™ Navigator™ Opportunities**Note 1****Problem 1, *Class Capture***

Use *Class Capture* to verify that students are manipulating the slider point correctly.

Note 2**Problem 1, *Class Capture and Live Presenter***

Use *Class Capture* to verify that students are able to correctly display the scatter plot on page 1.9. On page 1.13, after all students have had an opportunity to construct the locus curve, perhaps a student could be selected as a *Live Presenter* to demonstrate how to find the locus.

Note 3**Problem 1, *Class Capture and Live Presenter***

Use *Class Capture* to verify that students are using the correct equation for $f1(x)$. Additionally, the students' progress with adjusting the window size and obtaining the table of values could be monitored. Using a student as a *Live Presenter* could also be utilized in demonstrating these findings.