Constant of Variation

ID: 11196

Time Required
45 minutes

Activity Overview

In this activity, students will explore how the constant of variation, a, affects the graph of direct and inverse variations. Students will apply what they have learned to real world problems. As an extension or homework, students determine the type of variation of the given graph and then calculate the constant of variation.

Topic: Sequences, Series & Functions

- *Direct Variation*
- *Indirect Variation*
- *Hyperbolas*
- *Constant of Variation*

Teacher Preparation and Notes

- *This activity uses the Transformation Graphing App (Transfrm).*
- ***To download the student worksheet, go to education.ti.com/exchange and enter "11196" in the quick search box.***

Associated Materials

- *ConstantVariation_Student.doc*

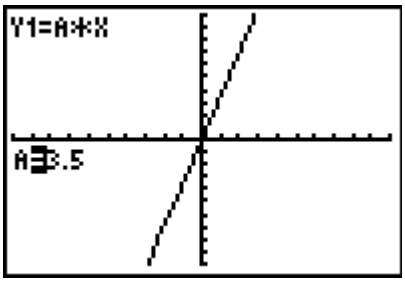
Suggested Related Activities

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

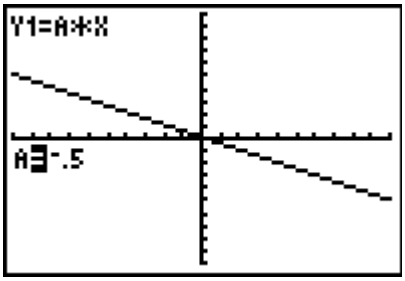
- *Inverse Variation (TI-Nspire technology) — 9840*
- *Inverse Variation (TI-84 Plus) — 8203*
- *Airport Impact Study (TI-84 Plus) — 9319*

Problem 1 – Effect of *a* on direct variation

On the worksheet, students are introduced to the definition of direct variation. You may want to give further explanation of the constant of variation, *a*. Textbooks will probably refers to the constant using the letter *k*.



Students are to use the left and right arrow keys to change the value of *a*, which then changes the graph, $y = ax$. They should observe the graph for positive and negative values of *a*.



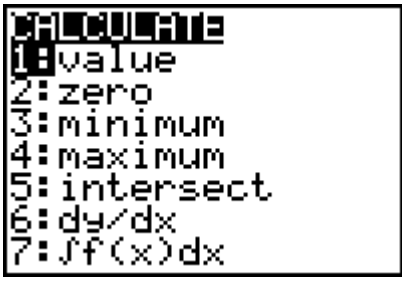
Overall, students should notice that *a* affects the slope of the line and that the *x*- and *y*-values increase or decrease together.

Discussion Questions:

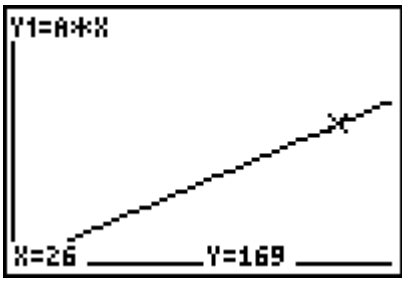
- How does direct variation relate to linear functions?
- Why must *a* be a non-zero number?

Problem 2 – Application of direct variation

Students are given an example of direct variation, an hourly employee. They are to determine which part of the equation represents the constant of variation (wage).



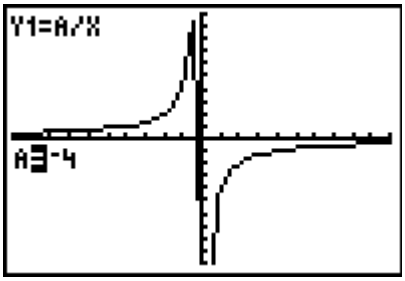
First, students are to rewrite the direct variation equation for different values of wages. Then students will use a graph of the function and a point on the graph to determine the amount of money the employee will make for a certain number of hours.



Students will need to update the graph for the question and then use the **value** command from the **Calc** menu to find the answer.

Problem 3 – Effect of *k* on inverse variation

Students are introduced to inverse variation. They should see that now *a* is divided by *x*, instead of multiplied by *x*.



Once again, students are to investigate the effect of *a* on the graph of an inverse variation using the arrow keys.

For further understanding, students can use ■ and write down the coordinates of a couple points on the graph and *a*-value. If the *x*- and *y*-coordinates are multiplied, the product is the *a*-value.

Overall, students should notice that *k* affects how close the graph comes to the origin and that the *x*- and *y*-values increase or decrease opposite of each other.

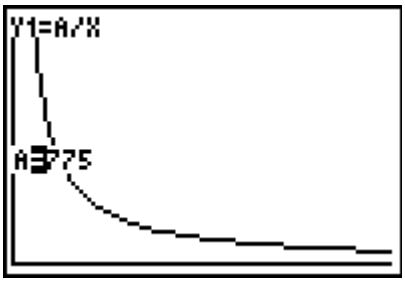
Discussion Questions:

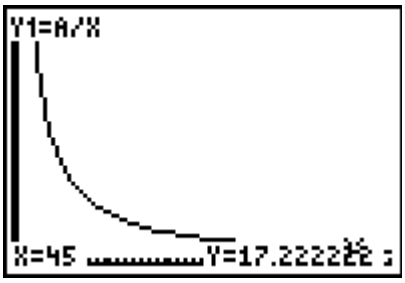
- How are the graphs different from direct variation? Why are they different?
- Why must *k* be a non-zero number?
- Do we need both branches of the graph?
- How does the product of the coordinates of a point on the graph relate to the constant of variation?

Problem 4 – Application of inverse variation

Students are given an example of inverse variation, an salaried employee. They are to determine which part of the equation represents the constant of variation (salary).

First, students are to rewrite the inverse variation equation for different weekly salaries. Then students will use a graph of the function and a point on the graph to determine the amount per hour an employee will make for a certain number of hours worked.





Problem 5 – Extension/Homework Problems

Students will examine a graph of a variation equation with a point labeled. They should find the value of the constant of variation and then write the equation on their worksheet.

For direct variation, students calculate *a* by dividing *y* by *x* and for inverse variation, they calculate *a* by multiplying *x* and *y*.

Discussion Questions:

- How do you know which variation equation to use?
- How can you use the point to find *a*?
- Can there be more than one equation for the graph?

Solutions – student worksheet

Problem 1

- The *y*-value increases; the *y*-value decreases.
- the *y*-intercept is always zero
- when *a* is positive; when *a* is negative
- zero
- *a* affects the slope of the graph

Problem 2

- *w*
- $P = 6.50 * h$
- $P = 9*h$
- $169
- $159.75

Problem 3

- the *y*-value decreases; the *y*-value increases
- quadrants 1 and 3 when *a* is positive; quadrants 2 and 4 when *a* is negative
- zero
- *a* affects the distance of the graph from the origin and the quadrants in which the graph appears

Problem 4

- *s*
- $R = 900/h$
- $R = 650/h$
- $17.22
- $25

Problem 5

- Direct; $a = 2$; $y = 2x$
- Direct; $a = -\frac{4}{3}$; $y = -\frac{4}{3}x$
- Indirect; $a = -3$; $y = -\frac{3}{x}$
- Indirect; $a = \frac{5}{2}$; $y = \frac{5}{2x}$