Trig Transformations

ID: 9732

Time required
45 minutes

Activity Overview

Students will explore function notation and transformational graphing of trigonometric functions.

Concepts

- *Function notation*
- *Transformational graphing with trigonometric functions*

Teacher Preparation and Notes

- *This investigation has students explore what function notation is as well as transformational graphing. The students should have already graphed the three basic trigonometric functions (sine, cosine, and tangent). This activity shows students how these graphs can be transformed into other graphs.*
- *This activity is intended to be **teacher-led**. You may use the following pages to present the material to the class and encourage discussion.*
- ***To download the student TI-Nspire document (.tns file) and student worksheet, go to education.ti.com/exchange and enter "9732" in the keyword search box.***

Associated Materials

- *TrigTransformations_Student.doc*
- *TrigTransformations.tns*

Suggested Related Activities

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

- *Transforming the Sine Function (TI-84 Plus and TI-Navigator) — 8727*

Problem 1 – Function Notation with Trigonometric Functions

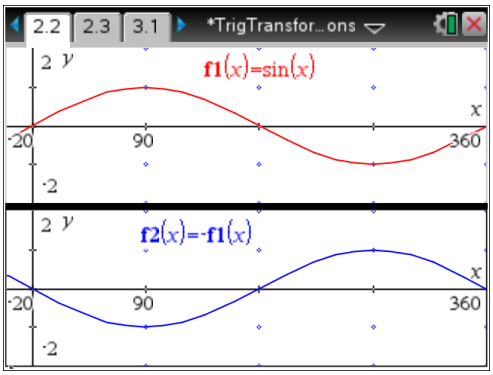
This first part of the activity introduces function notation to students. Depending upon the student's ability, it might be necessary to do a few more function notation representations.

Answer: $g(x-4)-12 \rightarrow \sin(x-4)+\cos(x-4)-12$

Problem 2 – Transformational Graphing Part I

In transformational graphing part 1, students will observe that multiplying the function by a negative value, results in the graph reflecting over the *x*-axis.

Students may decide to investigate *f*(–*x*). They will observe that the graph is reflected over the *y*-axis. This points out an interesting fact. With function notation, any changes inside the parentheses usually results in transformations in a horizontal direction, while changes outside the parentheses usually results in transformations in a vertical direction.

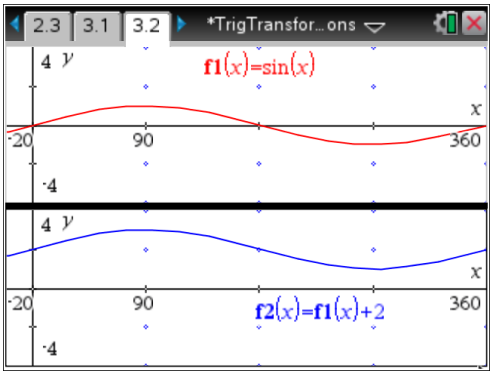


TI-Nspire™ Navigator™ Opportunity: *Live Presenter & Class Capture*

See Note 1 at the end of this lesson.

Problem 3 – Transformational Graphing Part II

For this problem, the students will discover that adding or subtracting a value to the function will result in vertical translations.



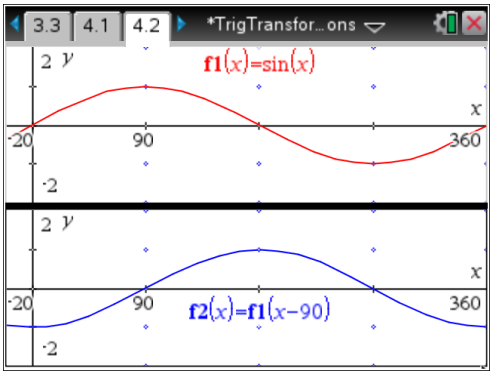
TI-Nspire™ Navigator™ Opportunity: *Live Presenter & Quick Poll*

See Note 2 at the end of this lesson.

Problem 4 – Transformational Graphing Part III

For this problem, students will discover that adding or subtracting a value inside of the function will result in horizontal translations.

One of the best ways for students to keep clear which direction the horizontal translation goes is to ask themselves *"What value of x results in a zero for the parenthesis?"* The answer to this question is the direction of the translation.

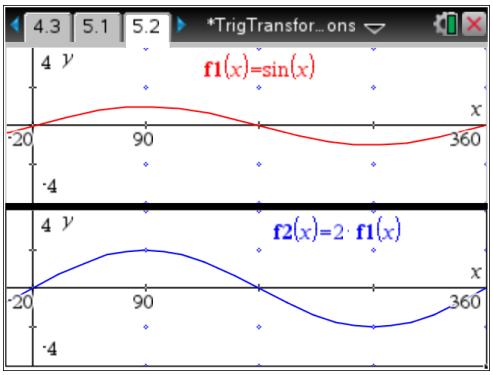


TI-Nspire™ Navigator™ Opportunity: *Live Presenter & Quick Poll*

See Note 3 at the end of this lesson.

Problem 5 – Transformational Graphing Part IV

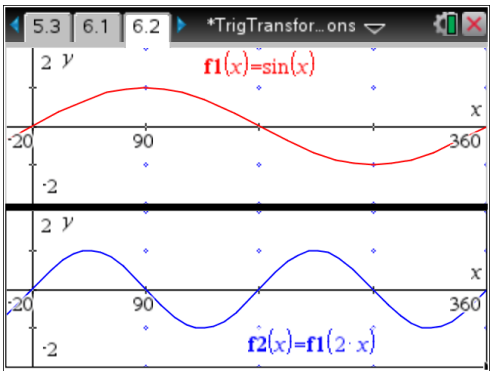
For this problem, the students will discover that multiplying the function by a value results in a vertical stretch or compression by the value it was multiplied with. The correct term for the multiplied value is the **factor**.



Problem 6 – Transformational Graphing Part V

For this problem, the students will discover that multiplying the variables of a function written in function notation results in a horizontal stretch or compression.

To determine the factor by which the function is stretched or compressed, the students need to ask themselves, *"What value of x results in a value of one for the parenthesis?"* The answer to this question is factor to be multiplied by.



Solutions – Student Worksheet Exercises

a. Vertical stretch by a factor of 2 and a horizontal stretch by a factor of $\frac{1}{3}$.

b. Vertical stretch by a factor of 4, reflect over the x-axis and a translation of 5 units.

c. Vertical stretch by a factor of 2, horizontal translation of –24 units and a vertical translation of –3 units.

d. Vertical stretch by a factor of 3, reflection over the *x*-axis, horizontal stretch by a factor of 5 and a vertical translation of 9 units.

TI-Nspire™ Navigator™ Opportunities

Note 1
Problem 2, *Live Presenter and Class Capture*
Use Live Presenter to demonstrate how to enter the equation –f1(*x*) into the bottom graphing window. Then use it for the follow-up questions with changing the top graph to cos(*x*) and tan(*x*). Continue using Live Presenter to facilitate the discussion with the students in mathematically describing the transformation. Use Class Capture to monitor students' progress as they explore how f2(*x*) relates to f1(x) as sin(*x*), cos(*x*), and tan(*x*).

Note 2
Problem 3, *Live Presenter and Quick Poll*
Use Live Presenter to facilitate the discussion with the students in mathematically describing the transformation. Send a Quick Poll asking for the student's response to the question on page 3.1

Note 3
Problem 4, *Live Presenter and Quick Poll*
Use Live Presenter to facilitate the discussion with the students in mathematically describing the transformation. Send a Quick Poll asking for the student's response to the question on page 4.1