

## Getting Triggy With It

ID: 9774

 Time required  
45 minutes

## Activity Overview

Students systematically explore the effect of the coefficients on the graph of sine or cosine functions. Terminology describing the graph—amplitude, period, frequency, phase shift, baseline, and vertical offset—is introduced, then reinforced as the student calculates these values directly from the graph using the graphing calculator.

## Topic: Trigonometric Functions &amp; Equations

- Approximate the zeros, minima and period of the primary trigonometric functions by graphing.
- Approximate the amplitude, frequency, and phase shift of the primary trigonometric functions by graphing.
- Given the equation of a primary trig function, state its range, amplitude, frequency, period and phase shift.
- Describe how the graph of a trigonometric function  $y = f(x)$  changes under transformations.

## Teacher Preparation and Notes

- Students should already have been introduced to the basic sine and cosine graphs.
- **To download the student worksheet, go to [education.ti.com/exchange](http://education.ti.com/exchange) and enter "9774" in the search box.**

## Associated Materials

- *PrecalcWeek13\_GettingTrig\_Worksheet\_TI84.doc*

## Suggested Related Activities

To download any activity listed, go to [education.ti.com/exchange](http://education.ti.com/exchange) and enter the number in the quick search box.

- *Vertical and Phase Shifts (TI-84 Plus)* — 9608
- *Transforming the Sine Function (TI-84 Plus and TI-Navigator)* — 8727
- *Trig Transformations (TI-Nspire technology)* — 9732
- *What's My Sine? (TI-Nspire technology)* — 10091
- *Ferris Wheel Ride (TI-Nspire technology)* — 10088

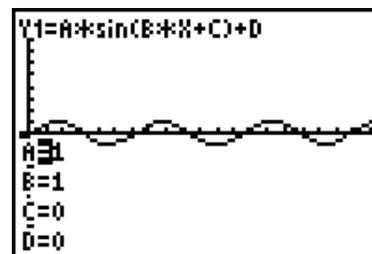
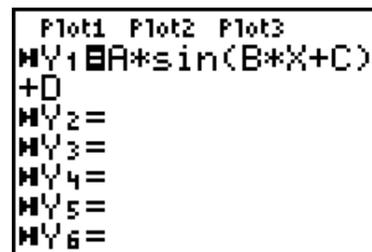
### Problem 1 – A general trigonometric function

Students should start by opening the *Transformation Graphing* app by pressing [APPS] and choosing **Transfrm** from the list. (Hint: Press [ALPHA] [4] to jump to the Ts.)

In  $Y_1$ , they should enter the general sine function  $A * \sin(B * X + C) + D$ . Next, adjust the window settings so that  $x$  goes from  $-0.5$  to  $20$  and  $y$  goes from  $-10$  to  $10$ .

The *Transformation Graphing* app will allow students to change the values of  $A$ ,  $B$ ,  $C$ , and  $D$  by pressing [◀] or [▶]. They can also move up or down to a different variable by pressing [▲] or [▼].

Students can use the **zero**, **minimum**, and **maximum** commands ([2nd] [CALC]) to find these features of the graph. The graph has many zeros.



### Problem 2 – The effect of the coefficients $A$ , $B$ , $C$ , and $D$

By changing the coefficients systematically, students can figure out which coefficients affect which graph features. Students will examine each of the coefficients individually to see the effects of each on the graph of the function.

The value of  $A$  is the **amplitude** of the graph. The amplitude of the graph of a sine or cosine function is the “height” of the wave. It is equal to half of the difference between its maximum and minimum values.

The value of  $B$  is the **frequency** of the graph. The frequency affects the **period**. The period of the graph of a sine or cosine function is the “width” of one cycle of the wave. It is the distance from one peak of the curve to the next. When  $B = 1$ , the period of the graph is  $2\pi$ .

The value of  $C$  shifts the graph horizontally. Because the graph extends infinitely in both directions, shifting it horizontally does not actually move it. The value of  $C$  is called the **phase shift**, which shifts the point where a new cycle of the graph starts horizontally.

The phase shift of a sine function is the horizontal distance from the  $y$ -axis to the first point where the graph intersects the baseline. The phase shift of a cosine function is the horizontal distance from the  $y$ -axis to the top of the first peak.

The value of  $D$  shifts the graph vertically and affects the **baseline**. The baseline is the midpoint of the vertical oscillation. In a basic sine graph, the baseline is the  $x$ -axis,  $y = 0$ . The value of  $D$  is called the **vertical offset** and is equal to distance from the  $x$ -axis to the baseline.

### Problem 3 – A closer look at amplitude, period, and frequency

Next, students will enter the general cosine function shown in  $Y_1$ . They will use this function to study the amplitude, period, and frequency of trigonometric graphs in more detail.

