
Can You Make My Graph?

by – Amanda Williamson

Activity overview

Students are to find the equations of graphs of trigonometric functions (using sine and cosine) and will also identify values for the amplitude, period, phase shift, and vertical shift.

This activity is a modified version of the activity “What’s the Equation?” originally made by Laura Jensen.

Concepts

- *Representation and interpretation using Graphs and Geometry*
- *Modeling of trigonometric functions*
- *Transformation of trigonometric functions*

Teacher preparation

This investigation offers opportunities for review and consolidation of key concepts related to trigonometric functions. As such, care should be taken to provide ample time for ALL students to engage actively with the requirements of the task, allowing some who may have missed aspects of earlier work the opportunity to build new and deeper understanding.

- *At the Advanced Algebra/Pre-Calculus level, this activity can serve to consolidate earlier work on trigonometric functions. It offers a suitable introduction to exploring trigonometric graphs, model fitting using trigonometric functions, and interpretation of graphs.*
- *Begin by reviewing with students the general trigonometric form of the cosine function $f(x) = A\cos(kx - c) + h$ where **A** is amplitude, $2\pi/k$ is the period, $-c/k$ is the phase shift, and **h** is vertical shift. Do the same for the sine function.*
- *The screenshots on page 2 demonstrate expected student results. Refer to the screenshots on pages 3–4 for a preview of the student .tns file.*

Classroom management tips

This activity is intended to be **student-centered**, with students working in **small cooperative groups**. You should seat your students in pairs so they can work together on their handhelds. Students will use the file provided by you on their handhelds, although the majority of the ideas and concepts are only presented in **this** document; be sure to cover all the material necessary for students’ total comprehension.

- There is a student worksheet for this activity, so students may record their answers on the document. You may also wish to have a class discussion about the questions posed in the .tns file.

TI-Nspire Applications

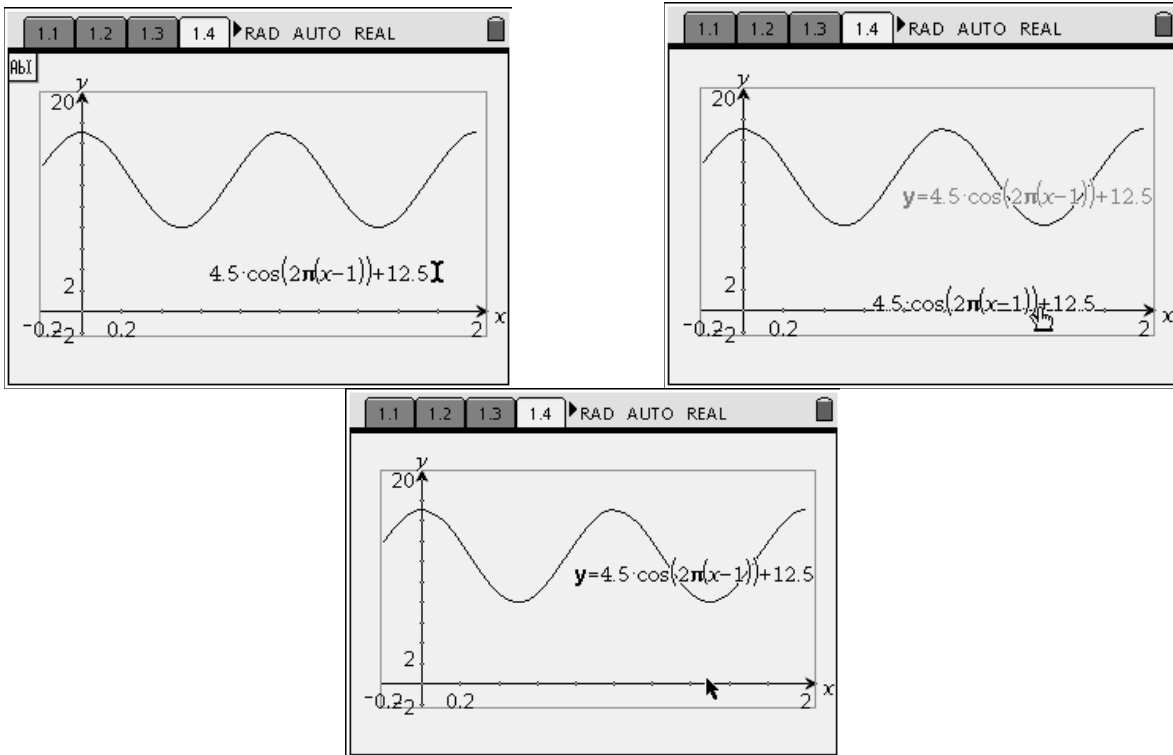
Calculator, Graphs & Geometry, Notes

Step-by-step directions

This activity provides a series of graphs of trigonometric functions. Students are to trace the graph to identify the minimum and maximum values, period, and vertical and phase shifts to match the given graphs with a trigonometric function.

Given each graph, students study and trace the graph to find the A , k , c , and h values of the trigonometric function. The students may insert a *Calculator* page as needed to determine these values.

Instruct students to use the **Text** tool to display the trig function—in the form of an expression—that they think matches the graph. After entering the expression, they should press **(esc)** to exit the **Text** tool, grab the expression, and drag it to the x -axis, which will graph it as a function. The text box changes to read “ $y=expression$.”



If only one graph is displayed, then they have correctly identified the function! If there are two, students should modify their function until it corresponds with the original function. You may wish to do two examples together as a class to check student understanding before they break apart to work in pairs.

It may be helpful to tell students which function to use (sine or cosine) although either function can be used for any of these graphs. (In the student worksheet, the function is identified for them.) Also keep in mind that because sine and cosine are periodic, there are an infinite number of solutions, so you may wish to graph students' responses to check if their functions work.

You may have students complete as many pages as you see fit. There are 16 different functions provided in the .tns file. Should you not wish students to complete all of them, simply delete any unnecessary pages from the file before distributing to your students.

Assessment and evaluation

Solutions:

Page 1.4: $f(x) = 4.5 \cos 2\pi x + 12.5$

Page 1.5: $f(x) = 10.45 \cos(\pi/5x - 3\pi/5) + 3.15$

Page 1.6: $f(x) = 1.5 \sin(\pi/2x - \pi/2) + 4.5$

Page 1.7: $f(x) = 10 \cos(\pi/10x - \pi) + 15$

Page 1.8: $f(x) = 7.5 \sin \pi/2 - 2.5$

Page 1.9: $f(x) = 37.5 \cos(2x + 2.28) + 22.5$

Page 1.10: $f(x) = 10 \sin \pi/6x - 25$

Page 1.11: $f(x) = 0.06 \cos(5\pi x - \pi/2) + 0.01$

Page 1.12: $f(x) = 14 \sin(\pi/12x - 2\pi/3) + 7$

Page 1.13: $f(x) = 15 \sin(\pi/4x - 5\pi/4) + 5$

Page 1.14: $f(x) = 100 \cos(\pi/45x + 10\pi/9) + 200$

Page 1.15: $f(x) = 9 \sin(\pi/8x + 3\pi/4) + 3$

Page 1.16: $f(x) = 0.04 \cos(\pi/200x + 3\pi/2)$

Page 1.17: $f(x) = 30 \sin \pi/75x - 50$

Page 1.18: $f(x) = 5.5 \cos(\pi/12x + 4\pi/3) + 1.5$

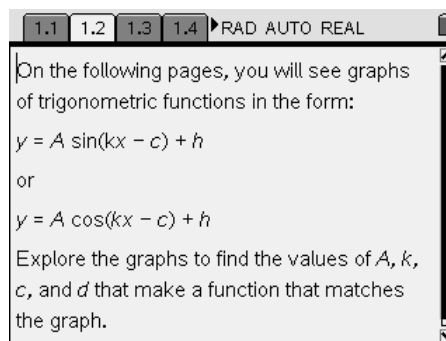
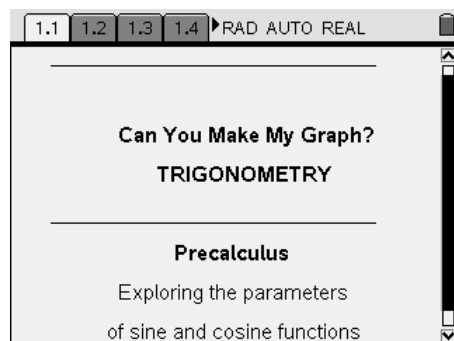
Page 1.19: $f(x) = 14 \sin(10x - 40) + 21$

Activity extensions

As an extension, have students use the transformation capabilities of the handheld. For instance, once they have an equation that fits the graph, they can transform their graph to the corresponding sine or cosine function, exploring the relationship of the phase shift difference between the two functions.

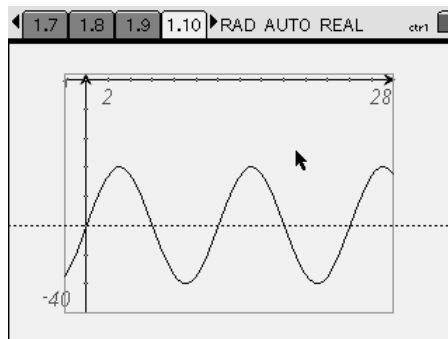
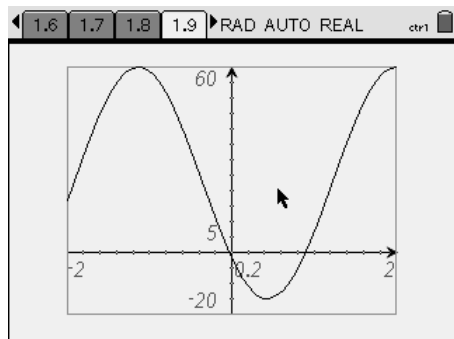
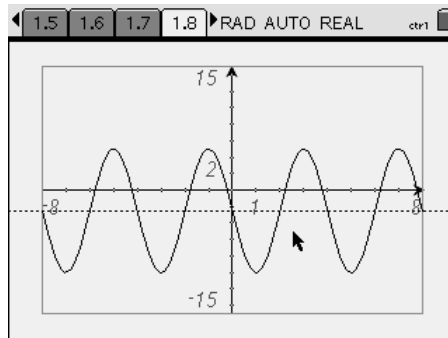
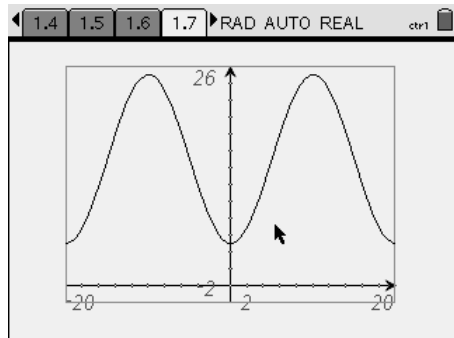
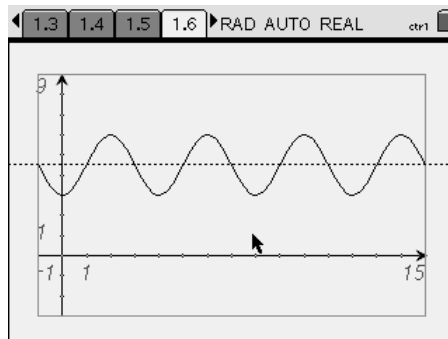
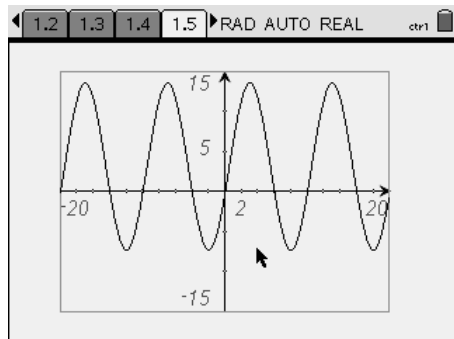
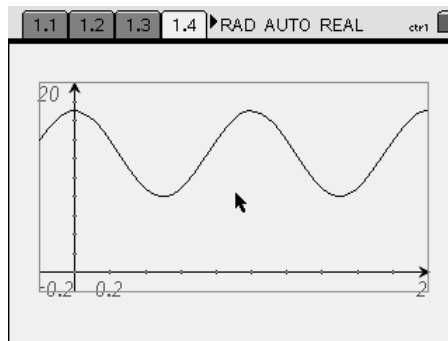
Student TI-Nspire Document

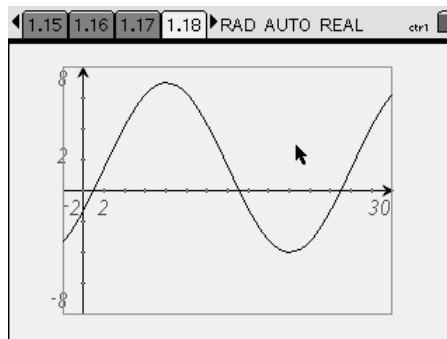
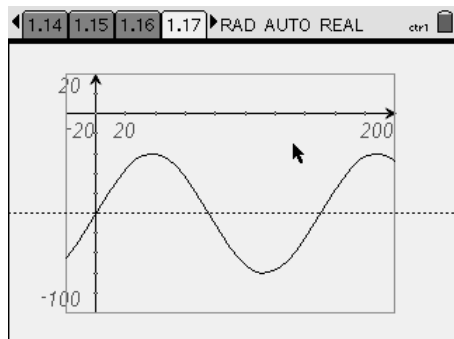
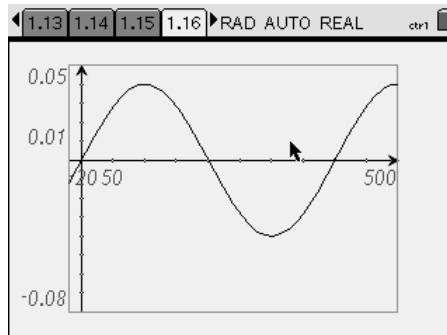
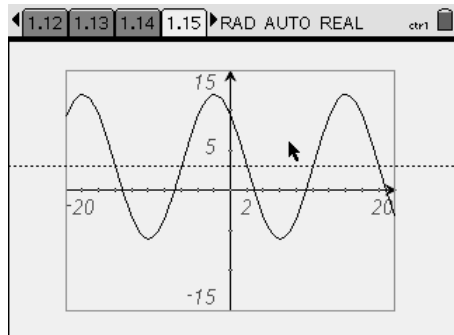
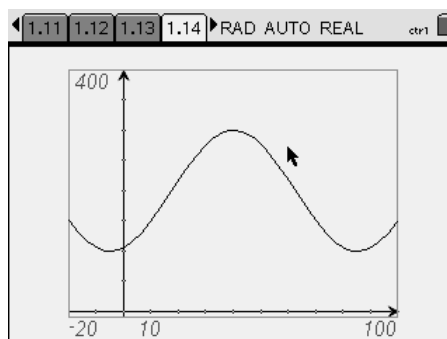
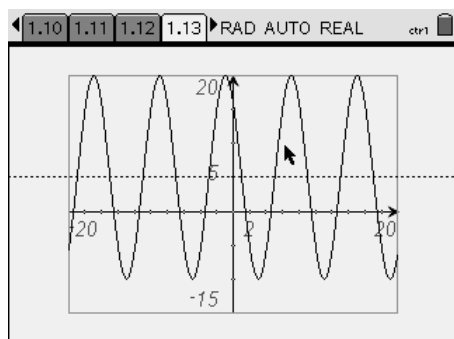
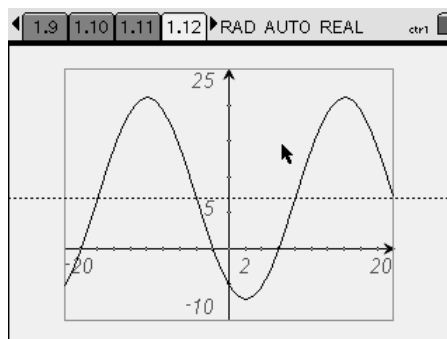
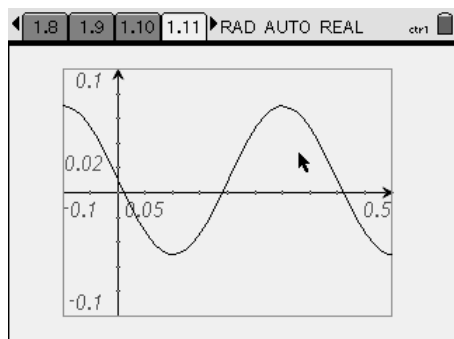
CanYouMakeMyGraph

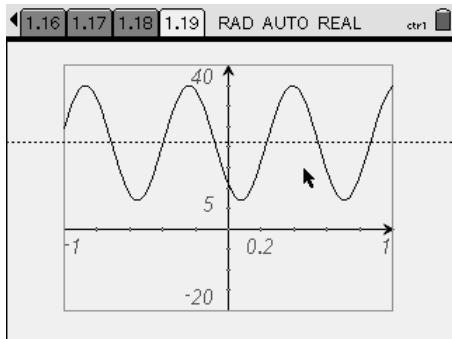


1.1 1.2 1.3 1.4 ▸ RAD AUTO REAL

Once you think you have the correct values, use the **Text** tool to display an expression on the graph. Then drag the text box onto the x -axis. If there is only one trigonometric graph, then you have found the correct function! If there is more than one graph, then you need to modify the $y=$ equation on the screen.







Can You Make My Graph?
TI-Nspire Advanced Algebra/Trigonometry/Pre-Calculus Activity
Student Worksheet

Name: _____

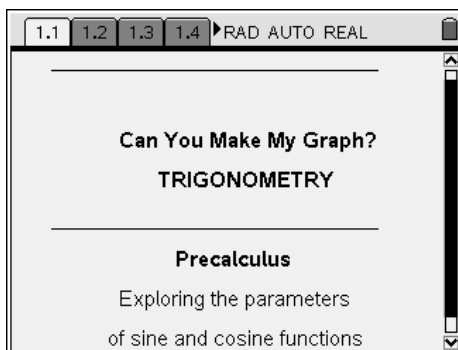
Activity Overview: Students are to find the equations of graphs of trigonometric functions (using sine and cosine) and will also identify values for the amplitude, period, phase shift, and vertical shift.

Concepts:

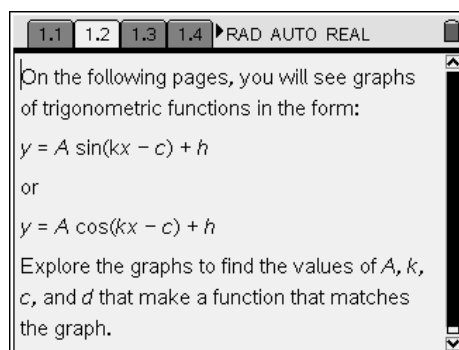
- Representation and interpretation using Graphs and Geometry
- Modeling of trigonometric functions
- Transformation of trigonometric functions

Directions:

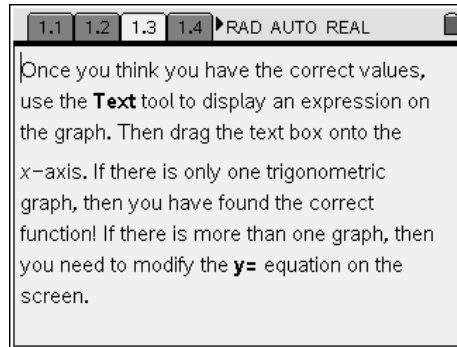
1. Open the file CanYouMakeMyGraph document that is located on your calculator.
2. You are to flip between pages by using the CTRL and Right Arrow key on the NavPad.
3. Record all answers on this handout.



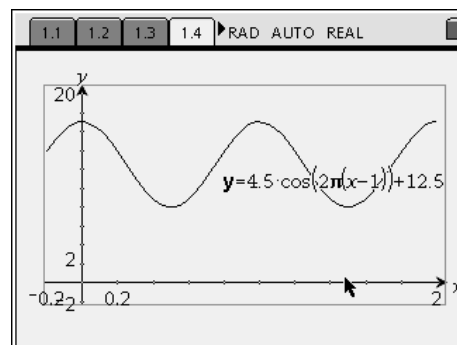
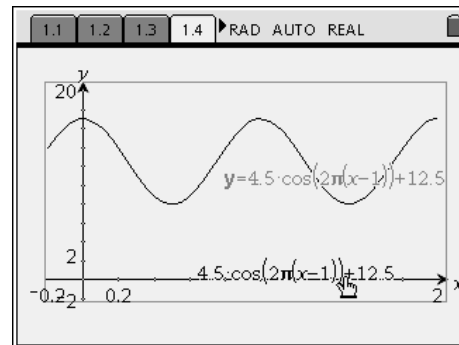
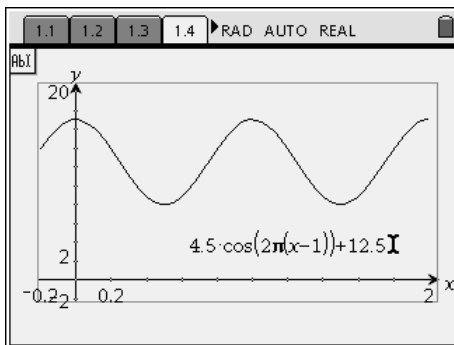
This activity provides a series of graphs of trigonometric functions. Students are to trace the graph to identify the minimum and maximum values, period, and vertical and phase shifts to match the given graphs with a trigonometric function.



Given each graph, you need to study and trace the graph to find the A , k , c , and h values of the trigonometric function. To trace the curve, press Menu, Trace, Graph Trace. This allows you to move along the curve and see ordered pairs for points on the curve. Use the points to help find A , k , c , and h . You may insert a *Calculator* page as needed to determine these values. To insert a calculator page, press c and choose 1: Calculator.



Use the **Text** tool to display the trig function—in the form of an expression—that you think matches the graph. To begin using the text tool, press Menu, Tools, Text. You will have a symbol that resembles an I displayed on your graph. Click once to open the textbox and type in the expression. When finished, press enter.



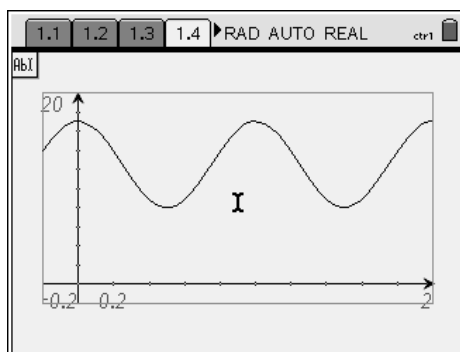
After entering the expression, you should press ESC to exit the **Text** tool, grab the expression, and drag it to the x -axis, which will graph it as a function. To grab the expression, you will move your pointer to the expression until the pointer turns to a hand. Once you have the hand, press

CTRL click and your hand will close and drag to the x-axis. The text box changes to read “ $y=expression.$ ”

If only one graph is displayed, then you have correctly identified the function! If there are two, you should modify you function until it corresponds with the original function.

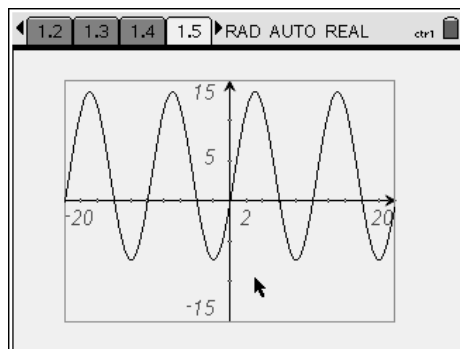
Problem 1: Tab 1.4 Write an equation for the graph of cosine.

A = _____ k = _____ c = _____ h = _____ Expression = _____



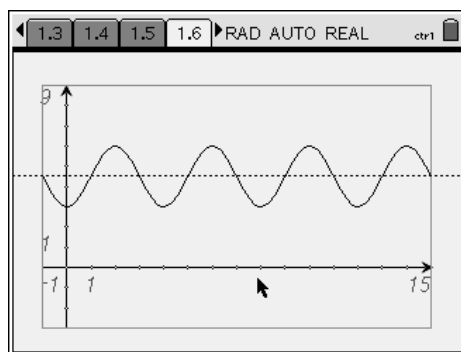
Problem 2: Tab 1.5 Write an equation for the graph of cosine.

A = _____ k = _____ c = _____ h = _____ Expression = _____



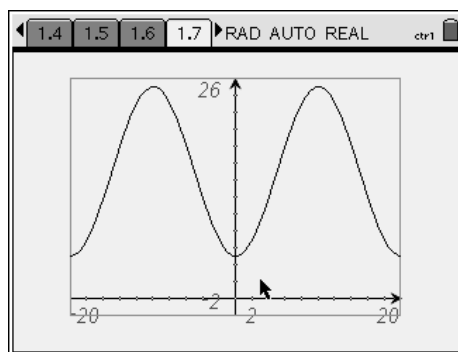
Problem 3: Tab 1.6 Write an equation for the graph of sine.

A = _____ k = _____ c = _____ h = _____ Expression = _____



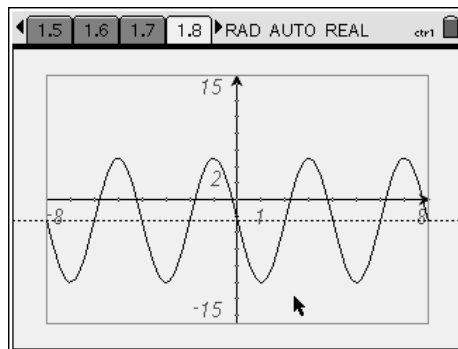
Problem 4: Tab 1.7 Write an equation for the graph of cosine.

A = _____ k = _____ c = _____ h = _____ Expression = _____



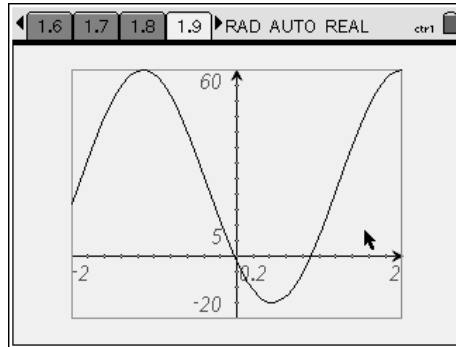
Problem 5: Tab 1.8 Write an equation for the graph of sine.

A = _____ k = _____ c = _____ h = _____ Expression = _____



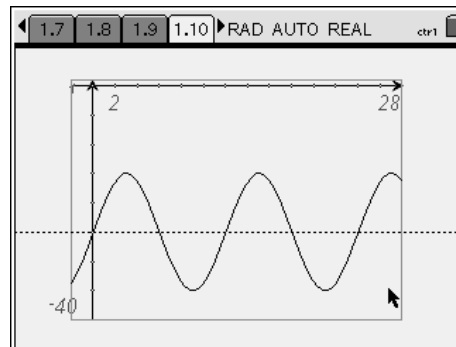
Problem 6: Tab 1.9 Write an equation for the graph of cosine.

A = _____ k = _____ c = _____ h = _____ Expression = _____



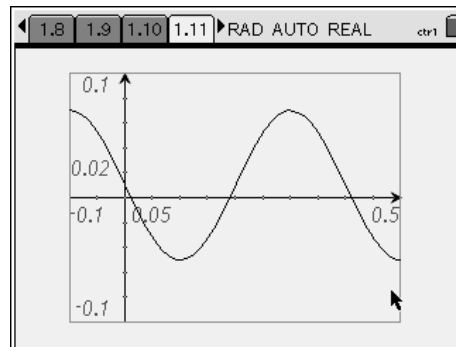
Problem 7: Tab 1.10 Write an equation for the graph of sine.

A = _____ k = _____ c = _____ h = _____ Expression = _____



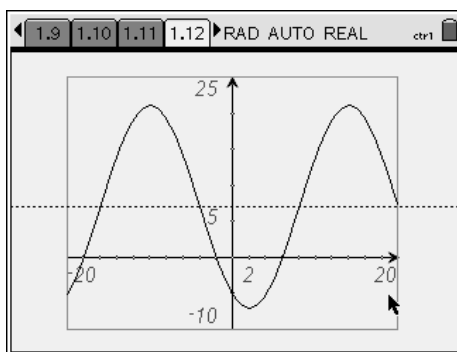
Problem 8: Tab 1.11 Write an equation for the graph of cosine.

A = _____ k = _____ c = _____ h = _____ Expression = _____



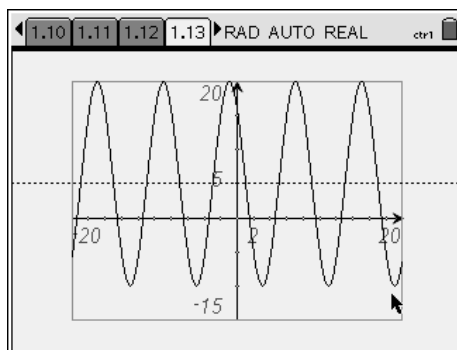
Problem 9: Tab 1.12 Write an equation for the graph of sine.

A = _____ k = _____ c = _____ h = _____ Expression = _____



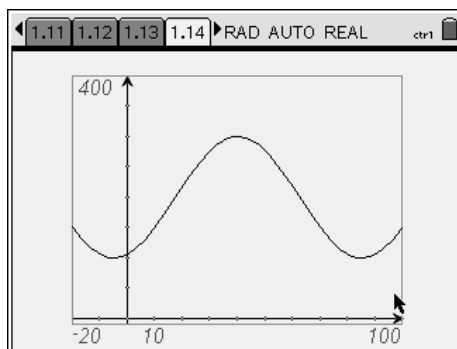
Problem 10: Tab 1.13 Write an equation for the graph of sine.

A = _____ k = _____ c = _____ h = _____ Expression = _____



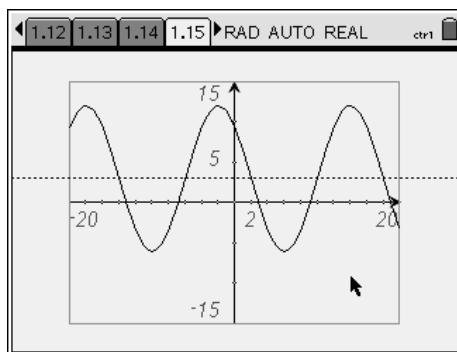
Problem 11: Tab 1.14 Write an equation for the graph of cosine.

A = _____ k = _____ c = _____ h = _____ Expression = _____



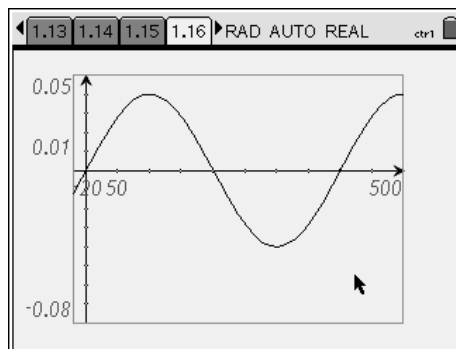
Problem 12: Tab 1.15 Write an equation for the graph of sine.

A = _____ k = _____ c = _____ h = _____ Expression = _____



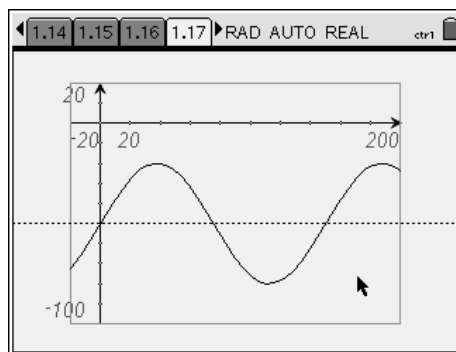
Problem 13: Tab 1.16 Write an equation for the graph of cosine.

A = _____ k = _____ c = _____ h = _____ Expression = _____



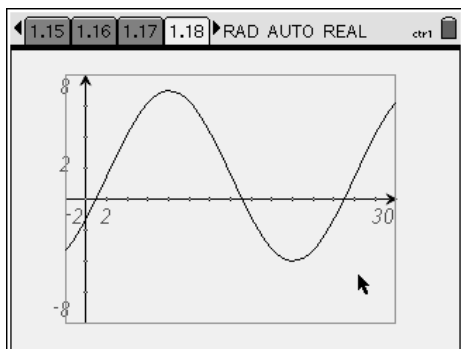
Problem 14: Tab 1.17 Write an equation for the graph of sine.

A = _____ k = _____ c = _____ h = _____ Expression = _____



Problem 15: Tab 1.18 Write an equation for the graph of cosine.

A = _____ k = _____ c = _____ h = _____ Expression = _____



Problem 16: Tab 1.19 Write an equation for the graph of sine.

A = _____ k = _____ c = _____ h = _____ Expression = _____

