



Is This Triggy or What?

Area
Solving Equations
Graphing
Equations
Direct Variation

Heron of Alexandria lived somewhere around 75 AD (debate ranges between 150 BC to 250 AD). He wrote extensively on mathematics and physics. It is thought that he was an Egyptian with Greek training. He wrote for practicality as opposed to theory. He provided a scientific foundation for engineering and land surveying. Heron devised a method for finding the square root of a number, n , that is quite similar to the process used by computers today.

Assume $n = ab$. It is then

the case that $\sqrt{n} \approx \frac{a+b}{2}$.

This process is repeated

with $a_2 = \frac{a_1 + \frac{n}{a_1}}{2}$ where a_1

is the first approximation of the square root.

“An Introduction to the History of Mathematics”
 Howard Eves.

Using G-Solv to Find Maximums

Graph the equations

Press F5 (G-Solv)

(F3 (V-Window))

F2 (MAX)

Standards: Problem Solving, Communication, Reasoning, Algebra, Functions, Geometry from Algebraic Perspective, Trigonometry, and Calculus.

Materials: CFX-9850G or CFX-9850Ga PLUS

Calculator Menus: RUN and GRAPH

You know the area of a triangle can be expressed as $A = \frac{1}{2}bh$. You may

know about Heron’s formula $\sqrt{s(s-a)(s-b)(s-c)}$ where a , b , and c are

sides of the triangle and $s = \frac{a+b+c}{2}$ which also gives the area of any

triangle. There is another formula for the area of a triangle:

$A = \frac{absin\theta}{2}$ which can be used to find the area of the triangle in Figure 1.

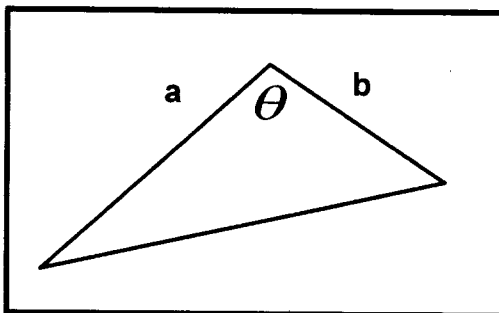


Figure 1


Since the formula contains four variables, two will be held constant and the other two will be graphed. Express the angle in either degrees or radians, but be sure the calculator is set accordingly. Suppose the angle is 45° and the a side length is 1.5 units. Substitute X for b and the formula becomes $A = 1.5Xsin45^\circ$. Let $A = Y1$ and graph.

Describe the graph **A**.

Is This Triggery or What?

De-selecting an Equation in the GRAPH Menu

Highlight the equation
Press F1 (SEL)
The = sign will turn blue when de-selected.

 represents a high level question

Changing from Degrees to Radians

Press Shift key
Menu key
Down Arrow to Angle
F2 (Rad)
Exit key

Zooming In or Out

While the graph is on the screen:

Press F2 (ZOOM)
F4 (OUT) zoom out
or F3 (IN) zoom in
Repeat the process you have the desired graph window.

Changing the Color of an Equation and Graph in the GRAPH Menu

Highlight the equation.
Press F4 (COLR)
Select desired color:
F1 (Blue),
F2 (Orng), or
F3 (Grn)
Exit key

Deleting an Equation in the GRAPH Menu

Highlight the equation
Press F2 (DEL)
F1 (YES)

This activity is adapted from "Graphing Area-Trigonometry Relationships" by Litwiller and Duncan, Centroid (NCCTM) Fall, 1996

What is the impact on the area as the length side a changes? **B.**

Select different values for the angle and side a. Graph these results and describe the similarities and differences between this graph and the previous ones. Strange things will happen. Describe one. **C.**

Let sides a and b equal 2. Let the A be Y1 and the angle be X yielding

$$A = \frac{2 \cdot 2 \cdot \sin X}{2}. \text{ Graph this equation and describe the graph. } \mathbf{D.}$$

Select different values for each side length. Let the area be Y1 and the angle be X. Graph this equation and describe the graph. **E.**

With the two sides fixed at some value (same or not) and the angle changing, graph the equation. Find the max value for the area in both radians and degrees using G-Solv. When will the area be the greatest? **F.**

Assign a value to the area and side a. Substitute Y1 for side b and X for the angle. Note: you will have to solve the equation in terms of Y1 and may have to zoom out to view the graph. Graph this equation and describe the graph. **G.**



When will the shortest possible side occur? **H.**

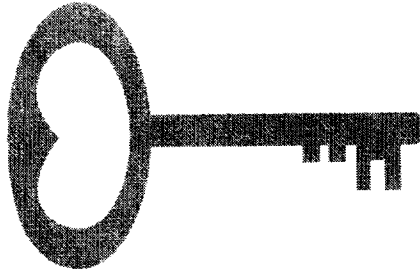
Assign a value to the area and the angle. Substitute X for side a and Y1 for side b. Solve the equation for Y1. Graph this equation and describe the graph. What strange thing will happen? **I.**



Assign different values for the area and angle. Substitute X and Y1 for side a and b. Graph this equation and describe the graph. **J.**

Select another formula with at least 3 possible variables and investigate the impact of fixing different arrangements of all but 2 variables. **K.**

Solution Key



Is This Triggy of What?

- A.** Linear graph with positive slope through the origin.
- B.** The area of the graph varies directly with the length of side a .
- C.** The area of the graph varies directly with the length of side a and the angle measure. When the angle measure is greater than 180 and less than 360 , the slope is negative demanding a negative value of X which implies a negative side length.
- D - E.** Answers will vary. Degrees: linear. Radians: sine curve.
- F.** Answers will vary. Degrees: there is no maximum. Radians: varies with the amplitude.
- G.** Answers will vary. Degrees: curve with the positive axis as asymptotes. Radians: parabolas with asymptotes at multiples of π .
- H.** When the area goes to zero.
- I - J.** Answers will vary. Hyperbolas in first and third quadrants with the X and Y axis as asymptotes. The third quadrant does not make sense.
- K.** Answers will vary.