KIPP: SCHOOL SUMMIT 2010

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Max/Min and Related Rate Problems Across the Curriculum and Using Technology to Visualize Solutions

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8/3/10

Example 1

Of all rectangles with area 500 square feet, find the one with the smallest perimeter.

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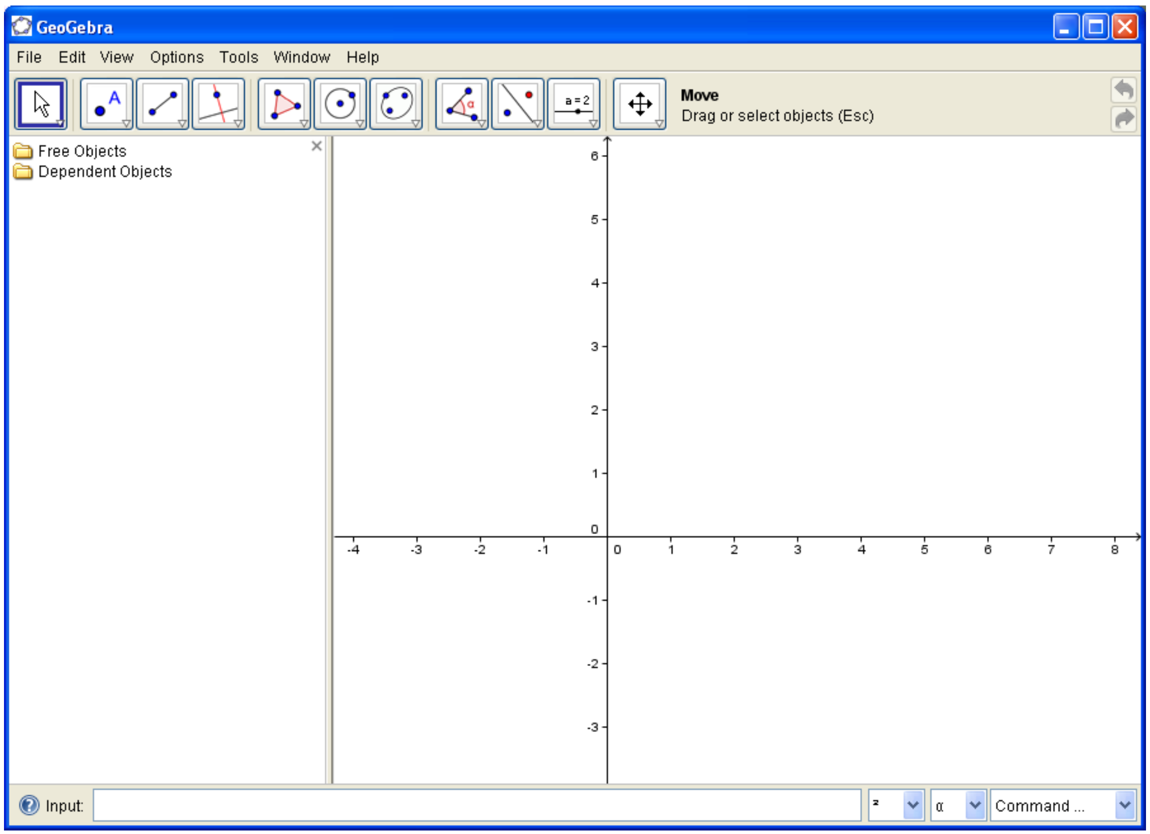
GeoGebra



Of all rectangles with area 500 square feet, find the one with the smallest perimeter.

GeoGebra

We will begin by making a slider to represent x:

In the input window type a=500

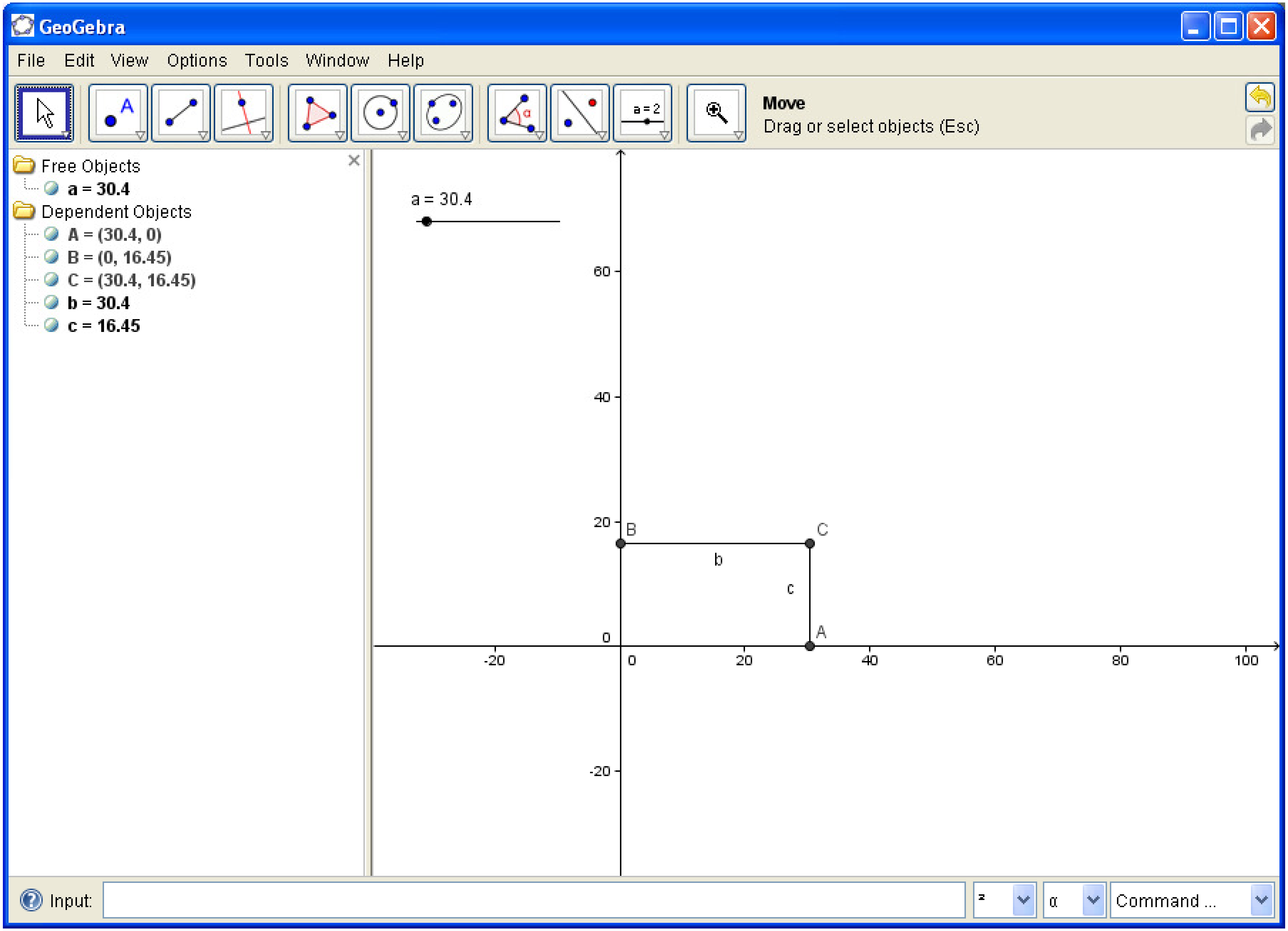
Now right click on a (under free objects) and ‘show object’

Now lets make some points:

In the input window enter A=(a,0) <enter>, B=(0,$\boxed{\quad}$) <enter>

and C=(a,$\boxed{\quad}$) <enter>

Now lets connect our points using the segment tool.


GeoGebra
File Edit View Options Tools Window Help
Move
Drag or select objects (Esc)
Free Objects
a = 30.4
Dependent Objects
A = (30.4, 0)
B = (0, 16.45)
C = (30.4, 16.45)
b = 30.4
c = 16.45
a = 30.4
Input:
Command ...

Now, lets look at our question again:

Of all rectangles with area 500 square feet, find the one with the smallest perimeter.

On the Geogebra screen, what would represent the perimeter of our rectangle?

Example 2

Square corners are cut from a rectangular piece of tin that is 24 cm by 45 cm. The edges are folded up to form an open box. Find the length of the side of the square corner removed in order to have a box with a maximum volume.

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Can we write the volume as a function of x (the length of the corners)?

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Using the graphing calculator to visualize this function:

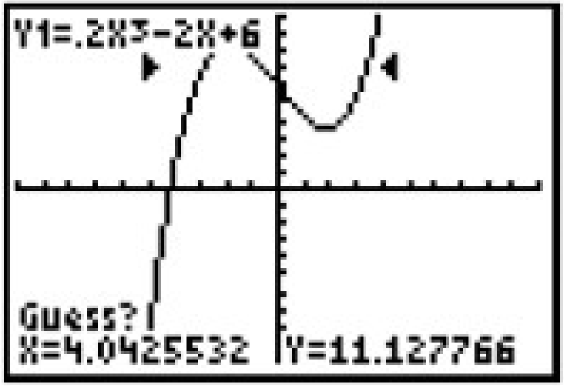
Press [Y=] to get to the Y= editor, and type in the function. Then choose GRAPH.

As you look at the graph, if you want to follow along the function and find certain values, press [TRACE]. Use the right and left arrows to travel along the function.

Calculating Min and/or Max

Press [2ND]{CALC}[3] to find the minimum and [2ND]{CALC}[4] to find the maximum.

Using the left and right arrows (or enter in a X value), move the cursor to the left bound that you want to find the min/max value in, and press [ENTER]. Then use the left and right arrows to get the cursor to the right bound that you want to find the min/max value in, and press [ENTER]. Press [ENTER] once more, and the cursor will move to the location of the min/max value.



Example 3

Find the coordinates of the point(s) on the curve

$8y = 40 - x^2$ that are closest to the origin.

Example 4

A closed box, whose length is twice its width, is to have a surface area of 192 cm^2. Find the dimensions of the box when the volume is a maximum.

Example 5

A rectangle is inscribed in a right triangle whose vertices are (8, 0), (0, 6) and (0, 0). Two sides of the rectangle lie along the legs and the remaining vertex of the rectangle lies on the hypotenuse of the triangle. What dimensions will maximize the area of the rectangle?

Example 6

Maximize the volume of a box, open at the top, which has a square base and which is composed of 600 square inches of material. Let x represent each dimension of the base and let y represent the height of the box.

Example 7

Suppose that a window has the shape of a rectangle with an equilateral triangle attached to the top. Assuming that the perimeter of the window is 12 feet, find the dimensions that will allow the maximum amount of light to enter.

Example 8

An industrial tank is formed by adjoining a hemisphere to each end of a right circular cylinder. The tank must have a volume of 3000 cubic feet. If the construction cost of the hemispherical ends is twice as much per square foot of surface area as the sides, find the dimensions that will minimize cost.

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