

“Rectangle with fixed area: length of base vs length of height”

General

The area of a rectangle is fixed. As you change the width, how does the height change?
What does the graph of points look like?

Student Specific

Use the ‘Thought-Sheet’ (page 3) to guide you through how to consider the dynamics of this situation, and what sort of relationship it reveals. This task is best done by thinking about it first and then doing it second, in order to see how well formed your thoughts were.

Teacher Specific

The students can either construct this themselves or use a pre-made file. There are obvious benefits to the students’ underlying appreciation of the problem if they do construct it themselves.

Extension Suggestion for TI-Nspire document

Once the students are satisfied that this creates an inverse proportional graph, you can draw on the axes the function $f1(x)=\text{area}/x$

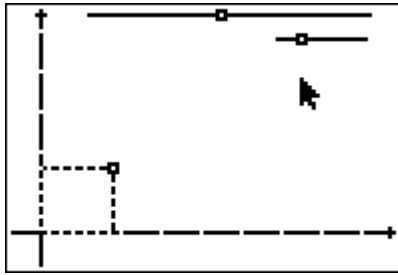
Acknowledgements

Original source of the idea for the TI-Nspire style of interactive geometry construction came from Mr Eugene Olmstead, Elmira Free Academy (retired), Dundee, New York State, USA.

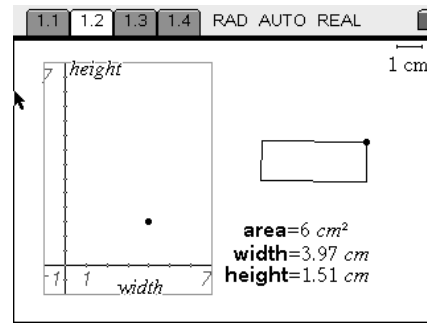
Feedback

Do you have any comments on these notes?
Please get in Contact via the website and help improve them further.
All contributors are acknowledged.

Construction Suggestions for HG070



CabriJr Construction



TI-Nspire Construction

Construction Suggestion for CabriJr .8xv file:

A rather long and convoluted construction with lots of hidden calculations on numbers generated by the two sliders at the top of the screen! Calculated answers then were used as enlargement factors transforming segments on each axis, that then generated the base and height of the rectangle. Use F1 > Undo > Explore as well as F5 > Hide/Show to reveal and explore the full inner workings!

Construction Suggestion for TI-Nspire .tns file:

Page Add Graphs & Geometry

1.2 Menu > View > Plane Geometry View

Menu > View > Show Analytic Window

Ctrl + G to Hide Entry Line

Resize top and bottom edges of the Analytic Window to the full height of the screen.

Construct the rectangle, starting in the bottom left corner and ending up top right corner.

Measure the rectangle's area, width and height.

Move the cursor over each numerical measure and press Var > Store Var, then type in the names of the Vars to be area, width and height, respectively.

Move the cursor over the area measure and press Ctrl > Menu > Attributes

Alter the displayed decimal precision and then activate the lock attribute.

Menu > Construction > Measurement Transfer, then click on a Var, then click on an axis.

Construct Perpendiculars to axes through the respective Measurement Transferred points.

Plot point at intersection of perpendiculars.

Hide appropriate items by Ctrl > Menu

Page Label columns with width.c and height.c [the ".c" bit is a chosen code to mean "the
1.3 captured value of the variable"]

Type in capture(width,1) [the parameter of "1" means capture automatically]

Type in capture(height,1) Use "0" for manual capture]

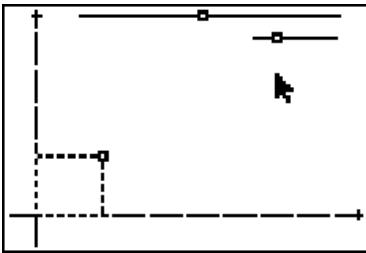
Page Click on each axis and select from the variables that end in ".c"

1.4 After some data has been captured, Menu > Window/Zoom > Zoom-Data to automatically scale axes.

Name: _____

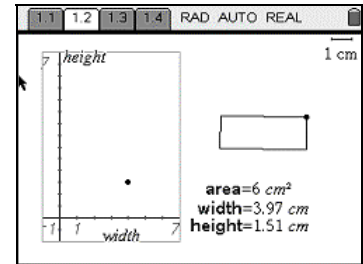
Date: _____

Connections – HG070 – Thought Sheet



The area of a rectangle is fixed. As you change the width, how does the height change?

What does the graph of points look like?



For the geometrical construction detailed above, jot down your answers to the following key questions:

1. Is the data relationship linear, or non-linear?
 - a) If it's linear, what is the slope of the line?
 - b) If it's non-linear, is the curve upwards or downwards?

2. Is there a direct, or indirect variation?

3. Is the data relationship symmetrical in any way?

4. Is there a maximum, or a minimum?

5. Are there places where it cuts the x-axis (called 'zeros') and, if so, what do they represent?

6. Does it cut the y-axis and, if so, what does that point represent?

7. Can you now draw the shape of the curve?
Sketch on it the axes on one of the screenshots at the top of this sheet.
8. Can you now construct this interactive geometry file, or use the one provided to you, to check all of your thoughts so far?
9. Can you use algebra to work out the equation of the curve?

If you are using a TI-Nspire, you can check how good your answer is by plotting your resultant function on Page 1.2's axes. Alternatively, you can fit a regression curve to the captured data that will be displayed on Page 1.4