

## “Triangle in a semi-circle: length of one side vs length of other side”

### General

For a triangle fixed inside a semicircle, how do the two shorter sides vary against one another as you move around the circumference of the circle?

What does the graph of points look like?

### Student Specific

Use the ‘Thought-Sheet’ (page 4) 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 (refer to page 2 of these notes, or HG061’s Construction Movie for the general process of how to transfer lengths from a diagram to a set of axes within CabriJr), or use a pre-made file. There are obvious benefits to the students’ underlying appreciation of the problem if they do construct it themselves.

### Acknowledgements

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

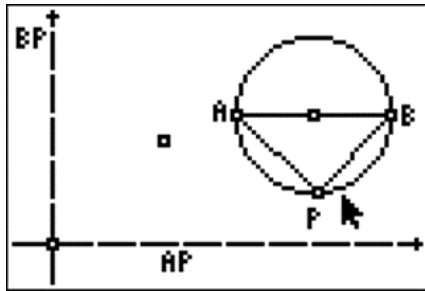
### Feedback

Do you have any comments on these notes?

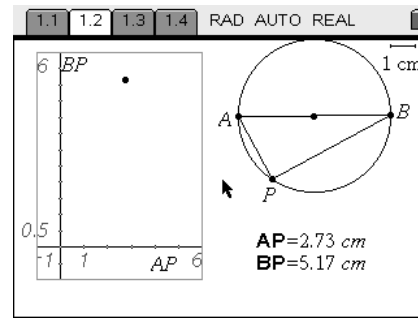
Please get in Contact via the website and help improve them further.

All contributors are acknowledged.

## Construction Suggestions for HG064



CabriJr Construction



TI-Nspire Construction

### Construction Suggestion for CabriJr .8xv file:

F5 > Hide/Show > Axes

Grab and drag origin to bottom left of screen.

Construct a segment, mark on its midpoint and draw a circle using this midpoint as its centre and segment as its diameter.

Construct a point P on the circumference, then construct a triangle through points A, B and P.

Measure the lengths of AP and BP

F3 > Compass to capture length AP and place the generated circle with its centre on the origin.

Draw in perpendicular to x-axis through intersection point of this circle with the x-axis.

F5 > Hide/Show > Object and hide this circle

Repeat the process for length BP against the y-axis

Mark the point of intersection of the two perpendicular lines, and then hide the lines.

### 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 a segment, mark on its midpoint and draw a circle using this midpoint as its centre and segment as its diameter.

Construct a point P on the circumference, then construct a triangle through points A, B and P.

Measure the lengths of AP and BP

Move the cursor over each numerical measure and press Var > Store Var

Type in names of Vars to be ap and bp, one at a time.

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

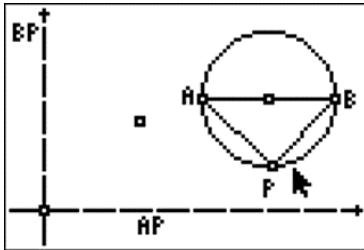
Cont./

- Page 1.3 Label columns with `ap.c` and `bp.c`  
[the “.c” bit is a chosen code to mean “the captured value of the variable”]  
Type in `capture(ap,1)`  
Type in `capture(pb,1)`  
[the parameter of “1” means capture automatically. Use “0” for manual capture]
- Page 1.4 Click on each axis and select from the variables that end in “.c”  
After some data has been captured, Menu > Window/Zoom > Zoom-Data to automatically scale axes.

Name: \_\_\_\_\_

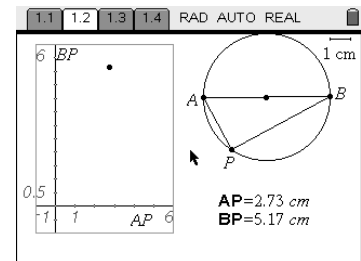
Date: \_\_\_\_\_

## Connections – HG064 – Thought Sheet



For a triangle fixed inside a semicircle, how do the two shorter sides vary against one another as you move around the circumference of the circle?

What does the graph of points look like as you move the point P?



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