**Title**

HSG.C – *Math 101: How to Pick Up Chicks*

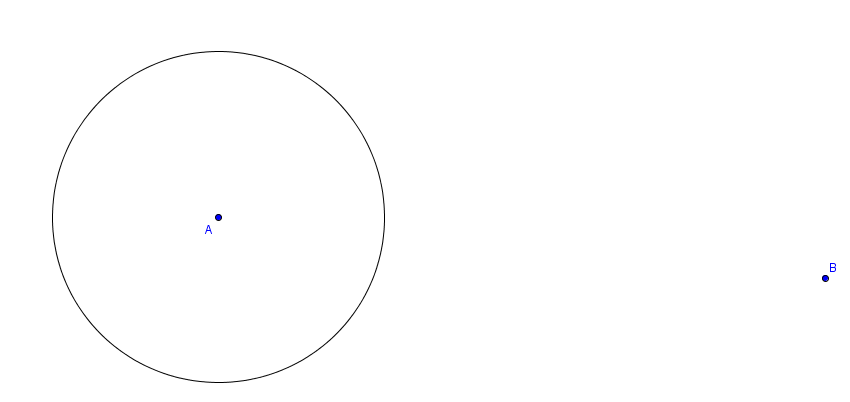
**Alignment to Content Standards**

[CCSS.Math.Content.HSG.CO.D.12](http://www.corestandards.org/Math/Content/HSG/CO/D/12/)  
Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line*.

[CCSS.MATH.CONTENT.HSG.C.A.4](http://www.corestandards.org/Math/Content/HSG/C/A/4/)  
(+) Construct a tangent line from a point outside a given circle to the circle.

[CCSS.MATH.CONTENT.HSG.CO.A.1](http://www.corestandards.org/Math/Content/HSG/CO/A/1/)  
Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc

**Tasks**



Scheme:

1. Using the above circle *A* and point *B* draw segment *AB*.
2. Construct the Perpendicular Bisector of *AB* and label the point of intersection *M*.
3. What is point M in relation to segment AB?
4. What can you say about segments *AM* and *BM*?
5. Construct a new circle centered at *M* with radius *BM* and label the points of intersection between circles A and *M*, as *Q* and *R*.
6. Draw segments *BQ* and *BR*.
7. What can you say about the length of segments *BQ* and *BR*? Explain with specifics.
8. Draw segments *AQ* and *AR*.
9. Describe what you notice about *AQ*, *BQ*, and segment *AB*.
10. Describe what you notice about *AR*, *BR*, and segment *AB*.
11. What is the relationship between *BQ* and *BR*? Explain and justify.

**Commentary**

The purpose of this task is to apply definitions from previous topics to be able to be precise when presenting mathematical arguments. This exercise uses many of the definitions from previous topics like perpendicular or line segment to explain why the segments *BQ* and *BR* are tangent to circle A. Even though the main plan was for students to construct a line tangent to a circle, this task also brings in other topics that teachers can review easily or branch into. For example, in the questions asked to the students during the task, students needed to understand that segments BQ and BR are congruent and why this was so. Thus, this task has a purpose, bringing together many pervious topics and showing students the continuity that exits and is necessary in Mathematics.

**Solution**

The bottom of the solutions page has the required diagram.

Scheme:

1. Using the above circle *A* and point *B* draw segment *AB*.
2. Construct the Perpendicular Bisector of *AB* and label the point of intersection *M*.
3. What is point *M* in relation to segment AB?

The midpoint of segment *AB*.

1. What can you say about segments *AM* and *BM*?

They are congruent in length.

1. Construct a new circle centered at *M* with radius *BM* and label the points of intersecting circles *Q* and *R*.
2. Draw segments *BQ* and *BR*.
3. What can you say about the length of segments *BQ* and *BR*? Explain with specifics.

The lengths of *BQ* and *BR* are congruent. This is true by of the way points *Q* and *R* were constructed, being the same radius as point *B* from circle centered at *M*.

1. Draw segments *AQ* and *AR*.
2. Describe what you notice about *AQ*, *BQ*, and segment *AB*.

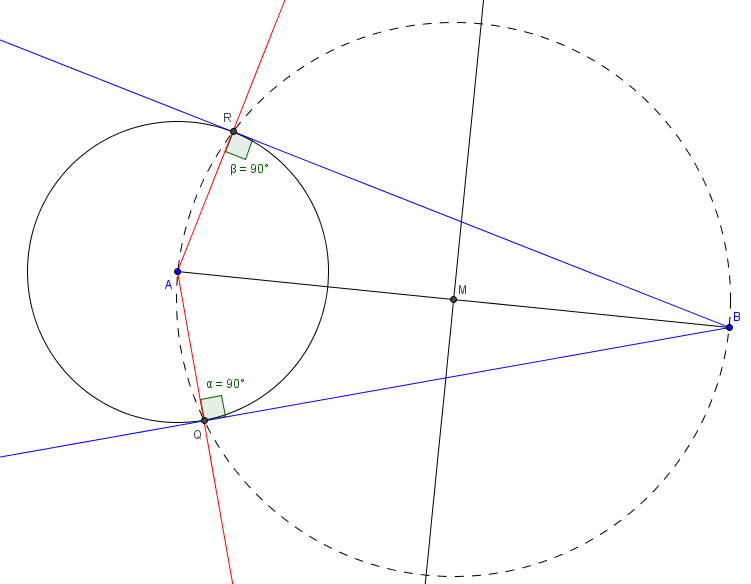
Since *AB* is the diameter of the second circle, lines *AR*, *AB*, *BR* for a triangle inside a semicircle then angle ∠*ARB* is right. Thus, segments *AR* and *BR* will meet at 90 degrees. Similarly, segments *AQ* and *BQ* meet at 90 degrees.

1. Describe what you notice about *AR*, *BR*, and segment *AB*.

Since *AB* is the diameter of the second circle, lines *AR*, *AB*, *BR* for a triangle inside a semicircle then angle ∠*ARB* is right. Thus, segments *AR* and *BR* will meet at 90 degrees. Similarly, segments *AQ* and *BQ* meet at 90 degrees.

1. In relation to circle *A* what are *BQ* and *BR*? Explain this relationship.

Rays *BQ* and *BR* are tangent to circle *A*. This is true because of meeting the radius from circle *A* at a 90-degree angle, rays *BQ* and *BR* touching the circle *A* in only one place.



Author Note: Since this diagram was constructed with GeoGebra, I used rays instead of segments to amplify the image. However, most students will probably only draw the segment and not extend it past points of intersections, so be away of the answer keys variation.