**Activity 4.4.4 Dividing Segments into Parts**

Materials: Compass and straightedge

After doing so well on your last unit test your teacher has given you and your group a bar of chocolate to share. However, there’s a problem. After purchasing the bars of chocolate your teacher left them in the car for a day and they melted. This has caused the chocolate bar to lose all of its divisions but not it’s rectangular shape. Your task is to find a way to divide the chocolate into three congruent pieces using only a compass and straightedge. Oh, by the way, you don’t have a ruler to measure with.







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Photo1 Credit: http://www.wikiwand.com/en/Hershey\_bar

Photo2 Credit: https://myvirtualsongbook.wordpress.com/guide/campfire-planning/

Photo3 Credit http://Jupiterimages/Comstock/Getty Images

1. Perform these steps to divide the chocolate bar.

*Step 1*: Focus on one side of the chocolate bar by focusing on just a segment, $\overbar{AB}$. If we divide the segment or one side of the bar into three congruent parts then we can divide the bar into three congruent parts.



*Step 2*: Construct $\vec{AC}$.



*Step 3*: Open your compass so that you can create three (any length) congruent segments along $\vec{AC}$. Name the congruent segments $\overbar{AP}, \overbar{PM}, $and $\overbar{MN}$.



*Step 4*: Construct $\overbar{NB}$.



*Step 5*: Construct parallel lines to $\overbar{NB}$ through points *P* and *M*. Name the points of intersection with $\overbar{AB}$ points *Q* and *R*.

2. Explain why $\overbar{AQ}≅\overbar{QR}≅\overbar{RB}$ in the construction above.

3. What would you do differently in the construction if you wanted to divide the segment into a different number of congruent parts? For example, dividing the candy bar or segment into 5 congruent segments.



4. Open GeoGebra and create a segment $\overbar{AB}$. Using the method shown above, divide $\overbar{AB}$ into 7 congruent segments. You may use any tool available including the one that draws parallel lines.

5. Take a sheet of lined notebook paper and a note card. Position a longer edge of the card so that the corners lie on two parallel lines and the edge intersects 8 other lines. Mark the card where it meets these lines to divide the edge of the card into 9 congruent parts.

6. Keisha says she can divide a segment into 4 congruent parts. “First I find *C,* the midpoint of the segment $\overbar{AB}$, using the construction we learned in Unit 2. Then I find midpoints *D* and *E* of each of segments $\overbar{AC}$ and $\overbar{CB}$. I have now divided $\overbar{AB}$ in four congruent segments.”

1. Does Keisha’s method work? Explain.
2. Could Keisha’s method be used to divide a segment into three congruent parts? Explain.