

MTG 3203
Homework 4
Sept. 16, 2009

To begin: Download “hw4.gsp”. All of your constructions will be done on this page. When you are asked to list your steps or explain why your construction works, then this should be written up on separate paper or typed onto the Sketchpad page.

1-4) In the first four constructions, you are given a line segment \overline{AB} of length 1 and line segments \overline{CD} and \overline{EF} of length m and n , respectively. Your goal is to construct line segments of length:

- 1) $m + n$ and $m - n$
- 2) mn
- 3) m/n
- 4) \sqrt{m}

For these constructions, you may use the buttons on the left and anything found in the “Construct” menu. After constructing, measure the lengths of your constructed segments to verify your constructions (measuring is done through the “Measure” menu). If your constructions are correct, you should be able to change the lengths of \overline{CD} and \overline{EF} and still have the constructions work (i.e., your entire picture will change appropriately).

5) Given a circle and a point C on the circle, construct a line through C which is tangent to the circle. Do the construction in Sketchpad, then write out your steps, then explain *why* your construction works. The construction (and the reason why it works) is dependent on one of the “Useful Construction Theorems”, but you have to read through them to figure out which one. If done correctly, this is a very short construction.

6) Given a circle and a point C which is outside of the circle, construct the two lines that are tangent to the circle and also pass through the point C . Do the construction in Sketchpad, then write out your steps, then explain why your construction works. You will need Useful Construction Theorems 11 and 12 to do the construction and prove the construction works.

7) Given three points A, B, C which do not all lie on the same line, construct the circle that passes through all three points. Do the construction in Sketchpad, then write out your steps, then explain why your construction works. Obviously, you MAY NOT use the “Arc through 3 Points” option in the “Construct” menu. (*Hint: Your main task is to find the center of the circle, say point D . Determine the relation between \overline{AD} , \overline{BD} , and \overline{CD} , and then figure out how you can use the relationship to your advantage. Useful Construction Theorem 9 will be really useful.*)

8) The following is an alternative construction of the number \sqrt{m} , given a length m and a base length 1. Draw this construction, and then prove the construction works. The proof depends on the fact that the triangle CDG is similar to the triangle GDE .

- a) Let \overline{CD} be a line segment of length m . Extend the segment to a line, and draw the point E one unit past D (so \overline{CD} and \overline{DE} are on the same line, and the length of \overline{DE} is one).
- b) Bisect the segment \overline{CE} , and call the midpoint F .
- c) Draw the circle centered at F , passing through the points C and E .
- d) Draw the line perpendicular to \overline{CE} passing through D . This line will intersect the circle in two points, say G and H . The length of the line segment \overline{DG} is \sqrt{m} .