MATH 341 — FALL 2011
ASSIGNMENT 8

Due October 17, 2011

I strongly suggest — in fact, demand — that you use *GeoGebra* or *Geometer's Sketchpad* to do this homework. The calculations by hand would be daunting, to say the least. You should upload your solutions to *BlackBoard* — either the *GeoGebra* file or a *Word* document with your work — by 11:59 PM on Monday, October 17, 2011.

1. Consider the triangle with vertices $A = (0,0)$, $B = (10,0)$ and $C = (1,9)$. Find the coordinates of the following points and the lengths of the following segments.
   (a) area of $\triangle ABC$;
   (b) midpoints of the sides, M_A, M_B, M_C;
   (c) circumcenter, O;
   (d) circumradius, R;
   (e) orthocenter, H;
   (f) lengths of the altitudes, h_a, h_b, and h_c;
   (g) centroid, G;
   (h) lengths of the medians, m_a, m_b, and m_c;
   (i) incenter, I;
   (j) inradius, r;
   (k) center of the nine-point circle;
   (l) radius of the nine-point circle;
   (m) Gergonne point, Ge;
   (n) symmedian point, K;
   (o) lengths of the symmedians, s_a, s_b, and s_c;
   (p) centers of the excircles, I_a, I_b, and I_c;
   (q) the exradii, r_a, r_b, r_c;
   (r) the Nagel point, N;
   (s) the Spieker point, Sp;
   (t) the Napoleon point, N_a;
   (u) the Fermat, or Torricelli, point, F;
   (v) the length of the Euler segment;
   (w) the length of the Nagel segment.
2. For this triangle, verify the following with your computations.
   (a) Verify that the centroid, G, divides the Euler segment in a 2:1 ratio.
   (b) Verify that the centroid, G, divides the Nagel segment in a 2:1 ratio.
   (c) Verify that the Spieker point, Sp, is the midpoint of the Nagel segment.
   (d) Verify that the center of the nine-point circle is the midpoint of the Nagel segment.
   (e) Verify that Napoleon's triangle is an equilateral triangle.
   (f) Verify that $\dfrac{1}{r} = \dfrac{1}{r_a} + \dfrac{1}{r_b} + \dfrac{1}{r_c}$.