MA 241
Homework #9
Due Tuesday, November 24, in class

1. Page 94, #13 in *Looking for Pythagoras*.

2. Determine the length of the long inside diagonal of an \(a \times b \times c\) rectangular prism.

3. (a) Make a careful diagram by drawing a coordinate system and plotting the points \(A(1, 5)\) and \(B(-4, 2)\).
   
   (b) Use your diagram and the Pythagorean Theorem to determine the length of the segment \(\overline{AB}\).
   
   (c) Based on this experience, provide a general explanation about to use the Pythagorean Theorem to justify the distance formula \(\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\) for the distance between arbitrary points \(A(x_1, y_1)\) and \(B(x_2, y_2)\).

4. Let \(A = (0, 5)\) and \(\ell\) be the horizontal line given by \(y = 1\). Consider the set of all points \(P(x, y)\) such that the distance from \(P\) to \(A\) equals the (vertical) distance from \(P\) to \(\ell\). Write an equation to describe this set of points. Simplify it as much as possible. What kind of shape do you get?

5. (a) Let \(A = (3, -5)\) and \(P = (x, y)\). Assume that \(AP = 9\). Why does this imply that \((x - 3)^2 + (y + 5)^2 = 81\)?
   
   (b) Let \(A = (h, k)\) and \(r\) be a positive real number. Explain why \((x-h)^2 + (y-k)^2 = r^2\) is the equation of the circle centered at \(A\) with radius \(r\).
   
   (c) Consider the set of all points \((x, y)\) satisfying \(x^2 + 4x + y^2 - 6y = 87\). Show that this is a circle and determine its center and radius.

6. (a) Write \(\frac{17}{149}\) as a decimal. If there is a repeating part, clearly indicate what that part is, and explain how you know this part will repeat forever.
   
   (b) Write \(\frac{17}{300625}\) as a decimal. If there is a repeating part, clearly indicate what that part is, and explain how you know this part will repeat forever.
   
   (c) Show how to express \(17.1234563456\) as a rational number.

7. Suppose you draw a line through the point \((0, 0)\) with slope \(\sqrt{2}\). How many points of the form \((a, b)\), with \(a\) and \(b\) both integers, will be on this line? Why?