

MA 330 HOMEWORK
DUE FRIDAY, JAN 30

Part I: In modern mathematics, we often do not begin geometry courses with the Euclidean plane. We instead use the Cartesian plane, which we define as follows:

Assume all the axioms¹ for the real numbers, denoted $\mathbb{R}$. The Cartesian plane, denoted $\mathbb{R} \times \mathbb{R}$ or $\mathbb{R}^2$, consists of all ordered pairs (x, y) where x and y are real numbers. We then define the distance between two points (x_1, y_1) and (x_2, y_2) to be

$$\text{dist}((x_1, y_1), (x_2, y_2)) := \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$

We further define a triangle with corners at the points

$$(0, 0), (x_1, y_1), (x_2, y_2)$$

to be a *right triangle* if $x_1x_2 + y_1y_2 = 0$. Prove that the Pythagorean theorem holds for any right triangle in the Cartesian plane.

This part may be handwritten, but should be in essay form (i.e. use complete sentences and explain any computations you write down).

Part II: Which approach to the Pythagorean theorem do you prefer: the one above or Euclid's? Why? Which one makes more sense to you? Why?

This part should be: typed, one page long, double spaced, 12 point Times New Roman font.

¹These may be found, among other places, at <http://www-history.mcs.st-and.ac.uk/~john/analysis/L5.html>.