

MA 330 HOMEWORK
DUE WEDNESDAY, JAN 30

Part I: In modern mathematics, we do not begin 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 (a, b) where a and b 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 and the equivalent of one page in 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/Lectures/L5.html>.