

## MA 341 — Homework #1

Due Friday, September 5, in class

We saw in class that an equation of a line containing the distinct points  $(x_1, y_1)$  and  $(x_2, y_2)$  is given by

$$(y_1 - y_2)x + (x_2 - x_1)y = x_2y_1 - x_1y_2.$$

Knowing this, now assume that  $(x_1, y_1)$ ,  $(x_2, y_2)$ , and  $(x_3, y_3)$  are three distinct points and consider the expression

$$A = x_1y_2 + x_2y_3 + x_3y_1 - x_1y_3 - x_2y_1 - x_3y_2.$$

1. Prove that if the three points all lie on a common line then  $A = 0$ .
2. Conversely, prove that if  $A = 0$  then the three points all lie on a common line.
3. Do a lot of experiments with actual points to try to figure out what geometric meaning the quantity  $A$  has. That is to say, if you plot the three points, make a good guess backed by your evidence as to what  $A$  measuring. It is not necessary (yet) to prove your conjecture.