1.4.26 3-collinearity. Suppose that you have an algorithm that takes as input N distinct

points in the plane and can return the number of triples that fall on the same line.

Show that you can use this algorithm to solve the 3-sum problem. Strong hint : Use

algebra to show that (a, a3), (b, b3), and (c, c3) are collinear if and only if a + b + c = 0.

Proof for (a, a3), (b, b3), and (c, c3) are collinear ⇔ a + b + c = 0

From (a, a3), (b, b3) are collinear, we can get

y = (a2 + ab + b2) x - ab(a + b)

=>

Because (c, c3) is a different point from (a, a3), (b, b3) and is also on the line...

c3 = (a2 + ab + b2)c - ab(a + b)

c3 = (a + b)2 \* c - abc - ab(a + b)

c(a + b + c)(c - a - b) = -ab(a +b + c)

(a + b + c)(c(c - a - b) + ab) = 0

(a + b + c)(b - c)(a - c) = 0

Because c != a and c ! = b

We have (a + b + c) = 0;

<=

From a + b + c = 0

y = (a2 + ab + b2) x - ab(a + b)

y = ((a+b)2 – ab)x + abc

y = (c2 – ab)x + abc

Clearly (c, c3) fulfills this formula.

So (c, c3) is also on the line.