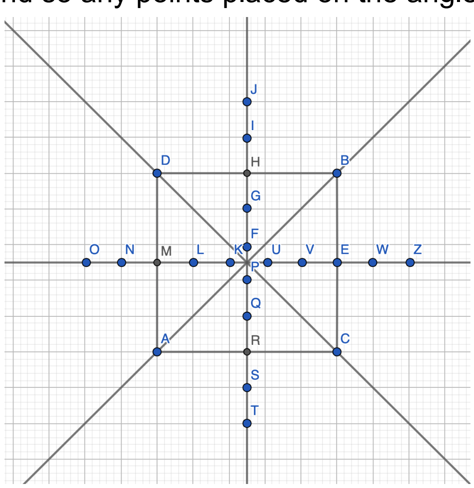
Introduction

The problem of the week is trying to find the shortest possible distance between two lines that are intersecting to form a cross and two points that need to be equidistant (the same distance from each other) from each other and the same distance to the highway. So in this problem we need to find the point where each point can lie and be equidistant from each other and the intersecting lines. Once we find where we can place our two points to where they are equidistant, can we find three points, four, maybe even five.

Process and justification of the problem

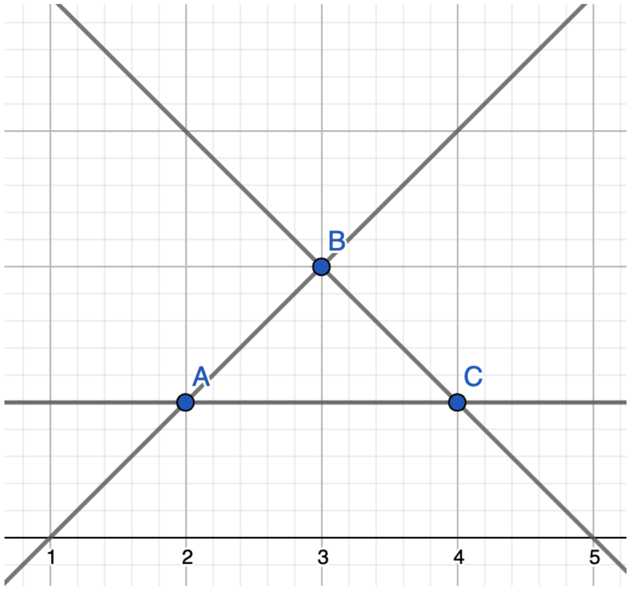
To start I will restate the problem. There are two intersecting lines that form an intersection and we need to find two points that are equal distance from each other and from the intersection. We can find the line at which the points can rest by forming an angle bisector (An angle bisector is a line that goes through or bisects an angle) that goes through the intersection, by using these angle bisectors the line at which the points rest on is given. But why is that the answer to the question, well the angle bisector is equidistant from the sides of the angle and we know this because if we call the angle bisector line D and if we form two perpendicular lines (Lines that intersects at a 90 degree angle) that touches down at the two different sides of the angle and these lines once formed make a 90 degree angle. So, now we have a right triangle formed off of the original angle bisector line, the new perpendicular line, and the sides of the angle. But now we have to prove what makes the two newly formed right triangles congruent thus proving that the angle bisector is directly in the middle of the angle and the point on that angle bisector line is directly equidesdent to the angle sides. We know that since the angle bisector goes through the angle we now have two halves of that angle so we have that angle, we also formed right angles with the perpendicular lines that are formed off of the bisecting line, so now we have two angles. Since this is a right triangle we can use pythagoras theorem (A^2 + B^2 = C^2) to find the missing angle, now we have two right triangles that share a longest side and that longest side is the angle bisector. So by having two equal right triangles on both sides of the angle bisector, we can prove that the angle bisector is equidistant from the sides of the angle and so any points placed on the angle bisector line is equidistant to the sides of the angle.



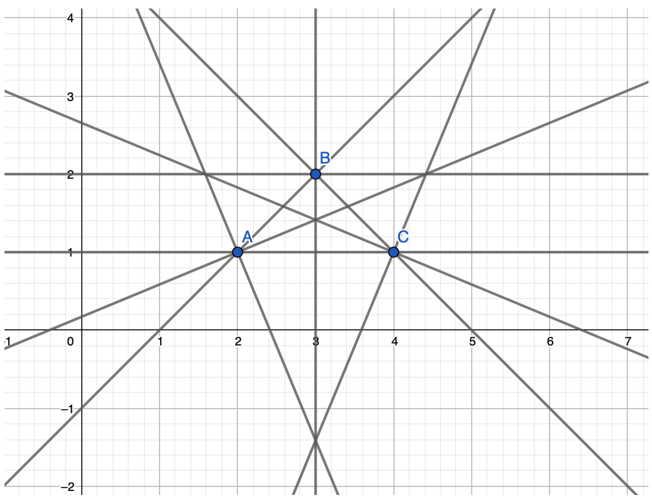
Example of the angles in the two lines problem.

Three lines problem

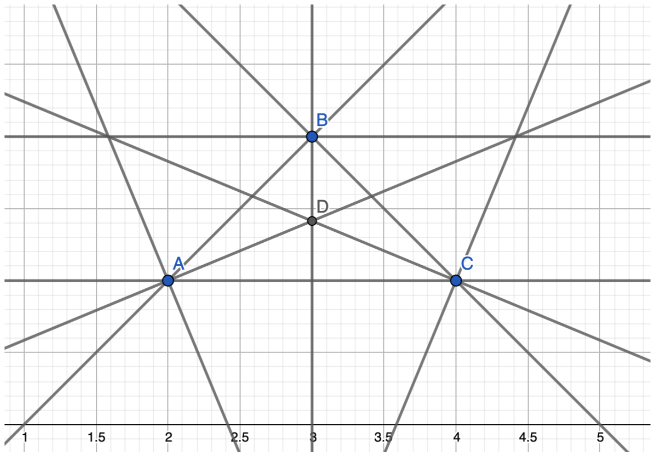
This one is easiest to explain through pictures.



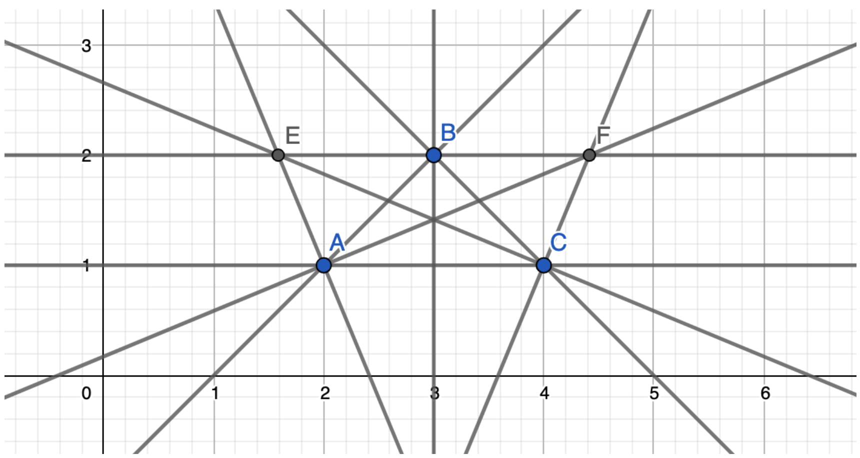
Part one: the three lines intersect and form a triangle.



Part two: We add angle bisectors through angle BAC, ABC, and ACB. We also know that these lines are equidistant from the lines of the angle because of the proof done in two lines problems.



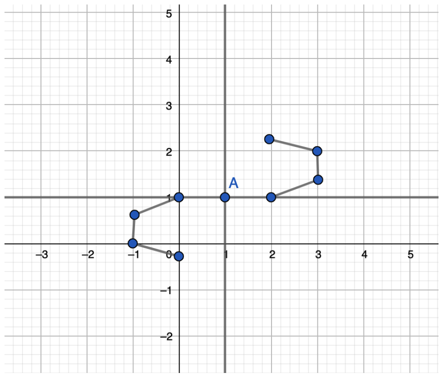
Part three: It seems like the obvious answer would be to place the point in the middle because it is equidistant from the lines around it, but that answer does not satisfy the problem of finding two points that are the same distance away from the lines.



Part four: So the answer I found is the intersection of lines which point E and F lay on because this is the point that they are both equidistant from the lines.

Extension Question

The question is similar but applies real world principles when entering onto the highway, on and off ramps. So in this question you have to find the spot for each point to be equidistant from the highway as well as allowing the fastest travel time to get on and off the highway, the question could be drawn as two lines crossing each other and two curvatures protruding off the intersecting lines. Though this is an extension to the two line problem and would be harder with the three line problem with where the placement of the on and off ramps would be.



Reflection

This Problem of the Week was harder to me than the last one, due to the more open ended nature that it brought in with the 3 line problems and I had a harder time figuring it out and really had to put in some brain power to find something that I thought could be an answer. I also had to focus on what was going on in the explanations of proofs for the 2 line problem, but after putting in some thought it helped a lot by writing the problem out and explaining the proof in my justification process. So in conclusion, the problem was difficult and I am still confused about it but I think I am getting better at the writing process of POWs and I am trying to work better at the project based learning set up at Animas.