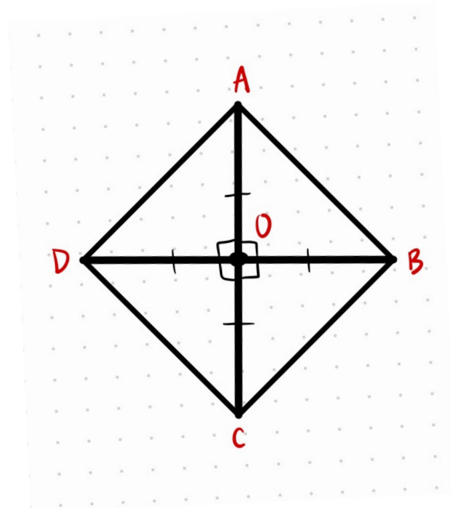
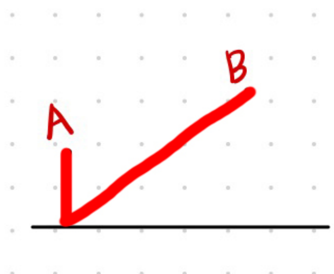
CHALLENGE PROBLEMS: (Attempt on a separate piece of paper)

1.) Notice that the quadrilateral below is such that *AO, BO, CO*, and *DO* all have equal length and moreover *AC* and *BD* are perpendicular (meaning they form right angles). Prove that the quadrilateral must be a square.



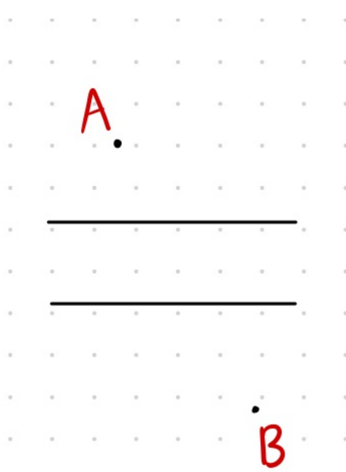
Hint: a square is defined to be a quadrilateral where all four sides have equal length and all four corners form right angles.

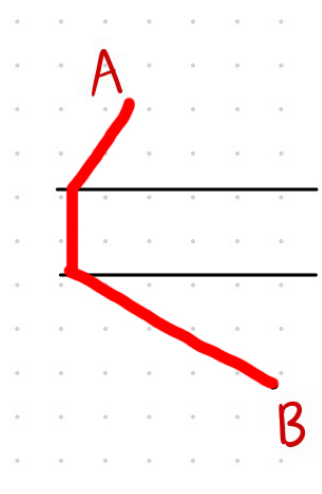
2.) What is the shortest path that starts at *A*, goes straight to the line, and then goes straight to *B* in the diagram below to the left? An example of such a path (not the shortest) is on the right.



Hint: use triangle congruence.

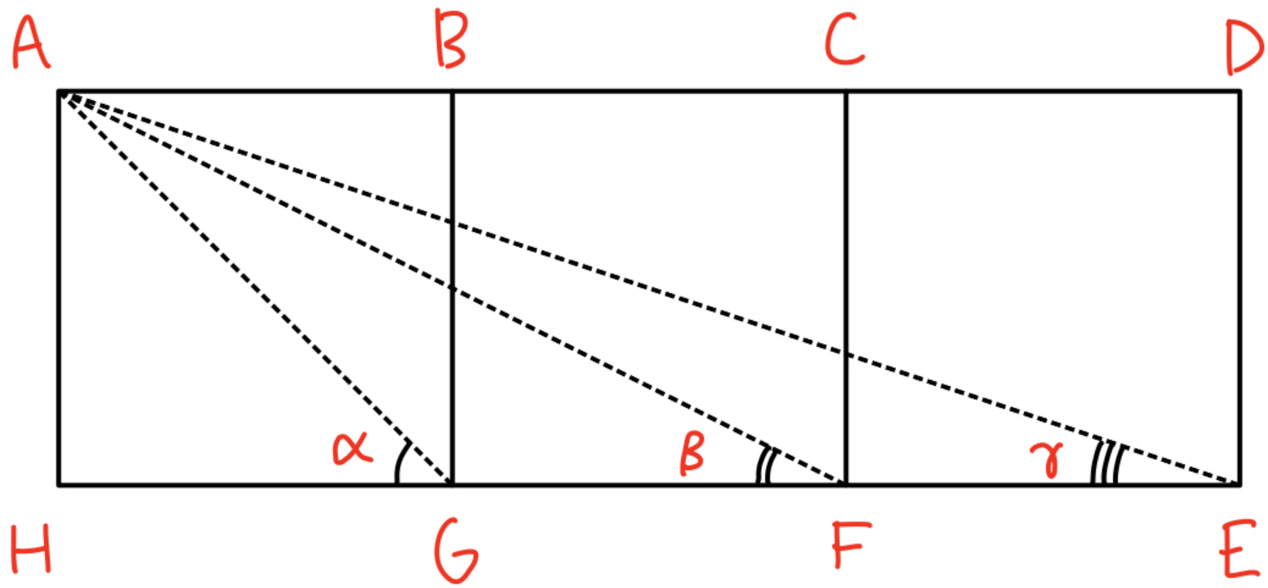
3.) What is the shortest path that starts at *A*, goes straight to the top line, drops down perpendicular to the bottom line, and then goes straight to *B* in the diagram below to the left? An example of such a path (not the shortest) is on the right.



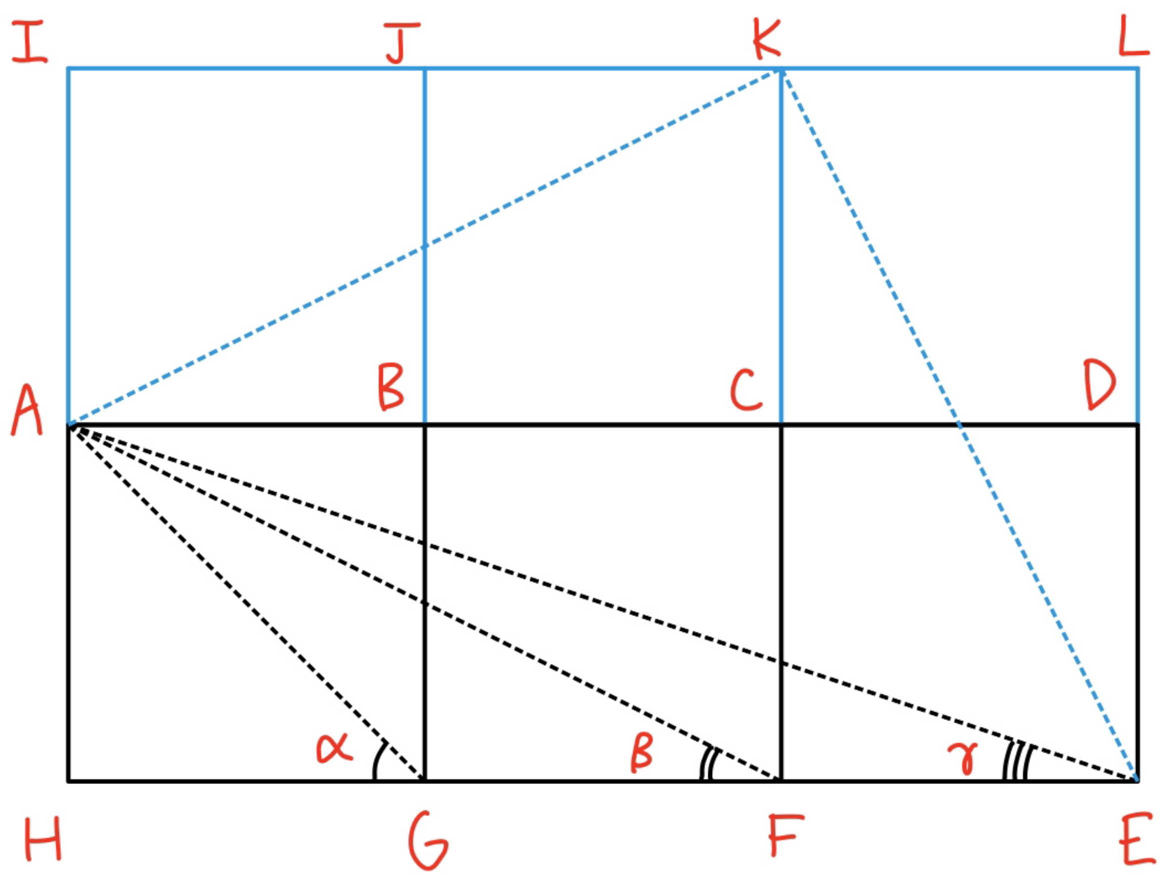


Hint: use triangle congruence.

4.) Below, *ABGH*, *BCFG*, *CDEF* are all squares with equal side lengths. Recall our definition of a square is a quadrilateral with equal side lengths and interior angles all being right angles. Prove that the angles α, β, γ are such that $\alpha° + \beta° + \gamma° = 90°$ (meaning α, β, γ sum up to a right angle).



Hint: this problem is extra difficult. Try thinking of auxiliary constructions that will allow you to use triangle congruence effectively. By auxiliary constructions, I mean try drawing in extra lines or shapes to help.



Hint 2: consider the above auxiliary construction and try to use triangle congruence. Again this is a tough problem so it is okay if you struggle on it.