(This project is very similar to what we did with plotting the classroom).

You may work alone or in a group of 2, 3, or 4 people. Your group will earn a score that you will then divide up between you. For instance, if a group of 3 earns 60 points, you may choose to allot 20 points each.

Choose a room that you will draw a part of in perspective, using the Perspective Theorem. First find the 3D coordinates of important points in a room, relative to an origin. Then choose your viewer's position and use the Perspective Theorem to calculate the 2D perspective images of these points using Excel or some other spread sheet. Finally, graph your results, and connect the dots to form your room.

For extra credit, use your understanding of 3D coordinates, common sense, and basic arithmetic to add the 3D coordinates of features that are **not** in the room but that you think would be a nice addition. Then use the Perspective Theorem to find these additional points 2D perspective images and add them to your graph.

- You need to choose the artist's/viewer's position, an xy-plane, and an origin. What order you do this in will depend on you and the features of the room you've chosen.
  - If you happen to be able to find a room with a tiled floor, you could use the tiles as your graph paper. Choose one particular pair of perpendicular lines to be the x and z axes. Otherwise, it may be easiest to choose the x and z axes to meet in a corner of the room– that is, having the x axis be one edge where a wall meets the floor, and the z axis be a perpendicular edge where a wall meets the floor. That will make it easiest to measure, and hence to find the coordinates.
  - Choose where you want the viewing position (the viewer's or artist's eye) to be. This could be outside of the room (so the final picture will be as if someone was looking through a glass wall, even if the actual wall isn't glass). The viewer's eye needs to be somewhere on the negative z-axis. Your measuring may be easier if you choose to place the origin on the floor.
  - The xy-plane will be defined by your x and y axes. It doesn't have to be anything real in the room, but it does have to be between the position of the viewer's eye and the scene you want to draw. While it might be more fun and interesting if it is not parallel to any of the walls, it will also be harder, so take that into account. The final result will be look as if there was a window through the xy-plane, and as if a person looking from the artist's/viewer's position had directed some colleagues to tape the scene on the other side of the window, as we did in class.
- Figure out d, the distance from the origin to the viewer's eye along the z-axis. If you have a measuring tape that measures in centimeters rather than inches, I'd suggest using metric units. Remember the coordinates of the viewer's eye are $(0, 0, -d)$.
- Once you have clear in your mind what directions x, y, and z are and what units you're measuring in, start figuring out the real-life 3D coordinates of key features of the room by measuring how far from the origin they are in the x, y, and z direction. *Note: You are* **not** *measuring the distance from the origin to the point – you are measuring how far over, how far up, and how far out from the origin it is – 3 measurements for each point.*

- Clearly label each point you collect; otherwise putting it all together later will be nearly impossible.
- Be sure to collect enough points to draw features that are not just parallel to the picture plane.
- Key features to pay attention to: each corner of the room that lies on the positive side of the picture plane, as well as corners of windows or pieces of furniture – especially windows or furniture that is **not** parallel to the picture plane.
- Use the Perspective Theorem to find the perspective image of each of these points on the picture plane, as it would appear to a person whose eye is located at the viewing position you chose. As you calculate each image point, carefully label what it represents. (I would suggest using a spreadsheet to do this, but you're welcome to do it by hand if you'd rather.)
- Very very carefully plot each of these image points on a set of 2D axes on graph paper, and then connect those dots that should be connected, to obtain (if all went well) a pretty good perspective image of the features of the room you recorded.
- Feel free to then color in the result as you see fit!
- Please write a description of what you did and an analysis of how it turned out.

Possible points: Your score for this project will depend on how many points in the room you find the 3D coordinates of, whether you corrected your measurements for consistency and accuracy, how correct your calculations using the perspective theorem are, how careful your final graph/perspective drawing is, and whether you added any 3D points that weren't actually present for the bonus. A group which collects 40 points from features actually present in the room could earn a group score of 60 points in the room could earn a score of up to 60 (if done correctly and accurately *and* the final images shows some interesting perspective), while 20 points could earn a score of up to 30 points, and 10 points could earn a score up to 15 points. (Remember: If done in a group, that score will then be divided among the members of the group).