

Mathematics of Perspective Drawing

(Please read both activities before starting, even though you will only be doing one of them)

Activity #1:

We have 6 windows in the classroom.

Form 6 teams, one team for each window and each team with 3 students.

If we have more than 18 students, the other students will do **Activity #2**.

Each team picks one member to be “Art Director” and the other 2 students will be “Artists”.

The Art Director picks a place to stand that is 2 to 4 feet back from their window. Mark the Art Director’s position on the floor with **Blue Tape**.

The Art Director closes one eye. With one eye open the Art Director tells the team Artists how to place a few strips of **Blue Tape** on the window so that it forms an outline of a few edges of the building straight ahead and also some strips to outline some edges or other features of the parking garage. Try to keep your head in a fixed position with as little eye movement as possible.

DO NOT use too many pieces of tape — 14 to 20 should be enough.

Be aware that some students doing Activity #2 may need to put a small piece of **Green Tape** on your window. Please cooperate with them!

The Art Director should also direct one of the Artists to put a small patch of tape so that it aligns with the top of the flag pole.

Activity #2:

Students who are not on one of the 6 teams for Activity #1 should work in pairs on this activity.

Your task is to determine the distance between the wall of windows and the flag pole. You are allowed to make two “observations” — where an observation consists of one team member picking a place to stand in the room and directing the other team member to put a piece of **Green Tape** on a window so that it aligns with the top of the flag pole. You will want to stand in two different places to make the two observations.

You should also put a mark (“X”) on the ground with **Green Tape** indicating where the observer was standing (also label it so you know which one is yours).

After you mark your observations, make measurements that can be used to calculate the distance to the flag pole.

Try to figure out good approximate locations to make accurate observations **BEFORE** you make the observations. Is it good to stand near the windows or further away?

Goals:

1. Our goal is to learn how realistic drawing “works” mathematically.
 2. There are two somewhat different ways of thinking about this: **geometrically** (i.e. using lines, angles, similar triangles, etc.) and **metrically** (i.e. using coordinates and measurements).
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Questions and discussion topics:

METRIC questions:

1. The Activity #2 teams should write their data on the board and their calculation of the distance to the flag pole.
2. How accurate are the **measurements** made by the teams? That is, how much error do we expect in the data?
3. How accurately do we know the distance to the flag pole?
4. Are there ways to combine the measurements to give a better estimate?
5. What do we mean by “better”?
6. Each of the Activity #1 teams also made observations of the flag pole. If we make measurements using their markings will it make our estimate “better”?

Geometric questions:

1. Looking at the tape placed on the windows, OBSERVE which lines are parallel to one another and which lines are NOT parallel.
 2. Do edges that are parallel in the 3-D world always become parallel on the window? Why or why not?
 3. Can you develop rules about how lines in space map to lines on the windows?
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More ideas and activities:

1. Make a drawing of a cube or rectangular object. Try to do the drawing free-hand. For example, try to do a drawing of the white-boards on the walls of the room.
2. Now we’ll try to figure out how to make an improved drawing.
3. One technique that artists use is to hold a pencil out at arms length, close one eye, and note how much of the pencil is “covered” by some edge of an **object**. When one edge of an object covers twice as much of the pencil as a different edge, the ratio of the lines in the drawing should also be 2-to-1, etc.
4. Can you explain the mathematics behind the technique described in item #3?
5. Try using the technique to do an improved drawing of the white boards.