- Exam 3 will take place on Wednesday 11/28/12, from 6-9pm. and will cover through Problem Set 12 (which I'm just including at the beginning of this study guide, rather than having it be separate) – that is, it will cover from finding the ideal viewing position of a drawing done in one-point perspective (again!) and the rules of perspective through introductory ideas of Other Dimensions.

- If you can not take the exam Wednesday 11/28 from 6-9pm, contact me no later than Monday 11/19.

- As with the first two exams, I am not *designing* the exam to take 3 hours, but if you used 3 hours on one or both of them, it's reasonable to assume this exam will take that long as well.

- The exam will cover *from* the end of PS 10 *through* PS 12. Unlike the first two exams, there is no problem set included at the beginning of this study guide (and there will be no problem set due November 28).

- The solutions to Problem Sets 11 and 12 will soon be on 2-hour reserve at the circulation desk in the library (along with Problem Sets 1-10). Solutions to this study guide should become available on reserve no later than the Monday after Thanksgiving; hopefully sooner.

- I will **not** be giving you a formula sheet along with your exam this time. You should know: the formula used in determining whether a point is in the Mandelbrot set.

- Advice:

  - As usual, spread studying for this exam out over several days, for all the reasons listed on the first two study guides.

  - Skim the readings and the notes from class with an aim to both reminding yourself of the big ideas and of making connections between ideas. Your main focus, however, should be to *do* (not just read through) as great a variety of problems as possible. In addition to doing the problems I've included on this study guide, you'll also want to redo as many problems as you can from the problem sets covered on this exam. (Again remember how important actually *redoing* the problems is.)

  - While you're working on problems, focus on *why* the steps are what they are. Spare some of your thoughts for how different problems are connected, and why various steps make sense.

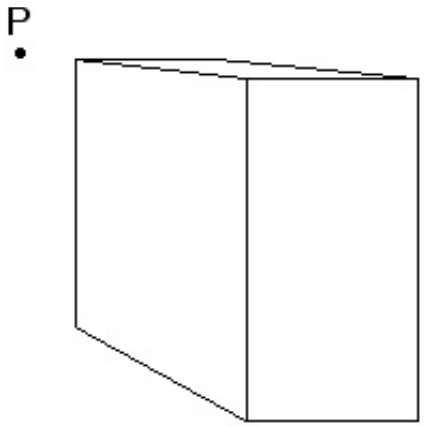
- Remember: If you can not do the problems from start to finish without getting help from friend, tutor, solutions or me, you are not ready. Please note that this does not mean you should *memorize* how to do the problems – as you know from the first two exams, the exam will involve similar but not identical ideas. If you *understand* how to do all of these problems as well as all your past homework problems, and can use that understanding to *do* all the problems with no help, then you should be prepared.

- Topics:
  - (Postponed from PS 10/StudyGuide 2) Subdividing rectangles in perspective, in thirds, fifths, sixths – any number of subdivisions that is **not** a power of 2.
  - (Postponed from PS 10/StudyGuide 2) Duplicating rectangles in perpsective, so that the two do not share a common edge, if you know where you want to put the *near* edge of the copy.
  - (Postponed from PS 10/StudyGuide 2) Duplicating rectangles in perspective, so that the two do not share a common edge, if you know where you want to put the *far* edge of the copy.
  - Be able to take a 2D-picture drawn from straight on (no perspective) and draw it in perspective, as on the 2nd exam – this time if there are two rectangles overlapping or separated (but in line with each other), or if you need to subdivide the rectangle into not just halves, but also thirds or fifths.
  - Anamorphic art.
    - Be sure you understand the ideas behind planar anamorphic art, as well as how to *do* it.
    - **I will not be including any new problems on this in this study guide, but you still need to know how to do it**.
    - Be sure you know which grid you draw the undistorted picture on, and which grid you draw the final distorted version on.
  - Understand the idea of symmetry of scale
  - Understand how to recursively construct a model of a fractal using geometry, as we did with the Koch Snowflake, the Sierpinski Triangle, the Sierpinski Carpet, and the Mitsubishi Gasket.
  - Be able to do the first several steps of creating a new fractal using similar geometric/visual recursion steps to those used to create the above-mentioned fractals.
  - Understand how we found the dimension of the Koch Snowflake, the Sierpinski Triangle, the Sierpinski Carpet, and the Mitsubishi Gasket.
  - Adding and multiplying complex numbers.
  - Representing a point (a, b) as a complex number and vice versa.

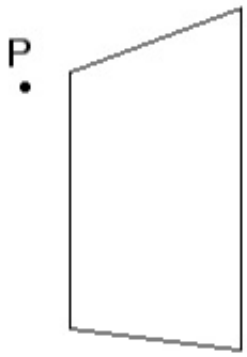
– What a seed is; using recursion/iteration to find the Mandelbrot sequence for a given seed (whether it's real or complex); what it means for a sequence to be *escaping*, *attracted*, and *periodic*; deciding whether a point belongs in the Mandelbrot set or not; and the distinction between coloring a point black or not-black.

Study Guide Problems:

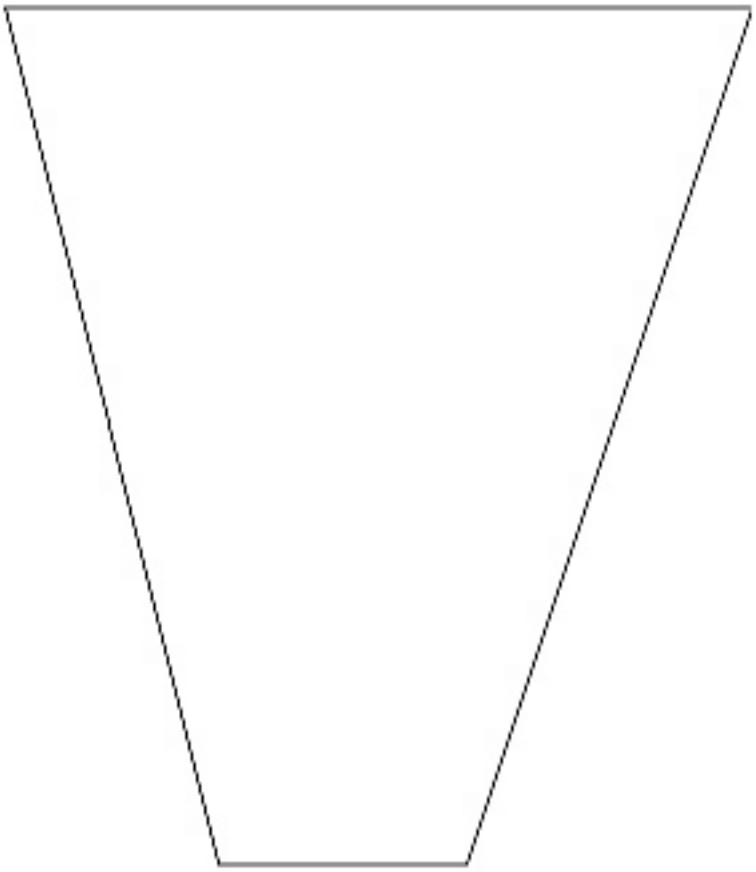
1. Below is a perspective drawing of a box, along with a point P. Draw a duplicate of the box, using the techniques we've developed. Place the duplicate so that it's front left corner (as we face it) is located at the point P, to create a picture of two boxes separated by some space.



2. Below is a perspective drawing of a window, retreating orthogonally to the picture plane. Draw a duplicate of this window, so that its upper rear corner is located at the point P, to create the appearance of a partially open sliding glass door.

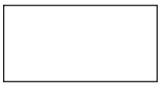

P

3. On the perspective drawing of a rectangle below, draw a horizontal line cutting the sides which no longer appear parallel into the division one-ninth/eight-ninths, without measuring. Probably the easiest way to do this is to divide the rectangle into thirds, and then one of the thirds on an end into thirds again.



4. *The Checkered Flag*

   (a) Using graph paper, carefully draw the figure that results after the first three steps, with the following recursive replacement rule:

   Start with a white rectangle  . Whenever (and wherever) you see a white rectangle  , replace it with a  .

   (b) Once again, the version you created above is actually the negative version of the actual Checkered Flag fractal, which would be black where yours is white and vice versa. Calculate the dimension of the *actual* Checkered Flag.

5. Evaluate the following, convert the results to the equivalent points, and graph them.

(a) $3 - 5i + 7 - 11i$

(b) $(4 + 7i) - (3 - 8i)$

(c) $(2 - 3i)(2 + 3i)$

(d) $(6 - 4i)^2$

6. For each of the following seeds s,

   (i) Find the first 6 terms of the Mandelbrot sequence with seed s

   (ii) Is this Mandelbrot sequence *escaping, periodic,* or *attracted*? (For some, you may not be sure; pick which you think is the most likely.)

   (iii) Will the point in the plane identified with the seed be a black point, or a non-black point?

   (a) $s = (0.75, 0)$

   (b) $s = (-0.75, 0)$

   (c) $s = (0, -2)$

   (d) $s = (-0.1, -0.1)$