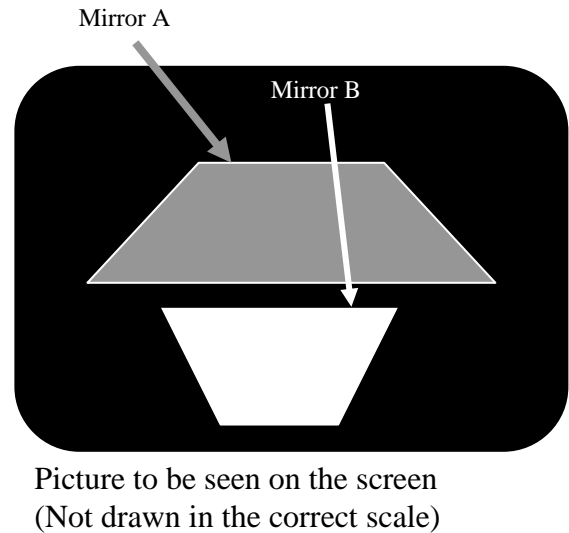
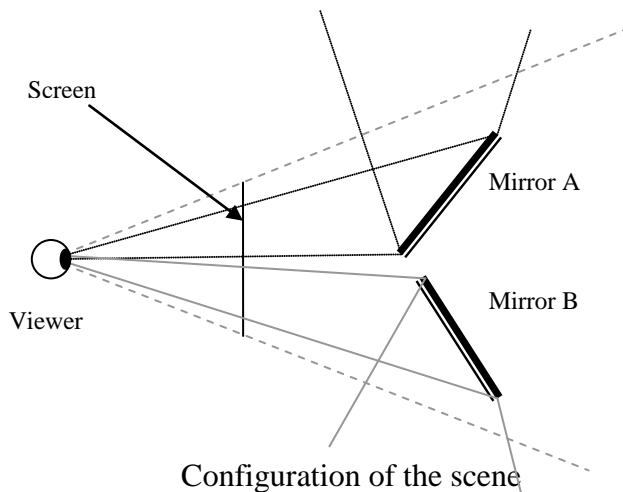


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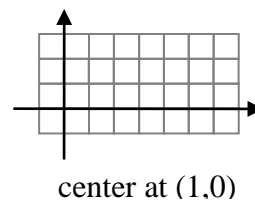
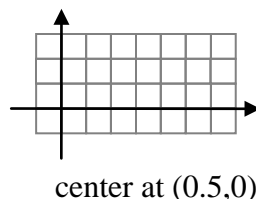
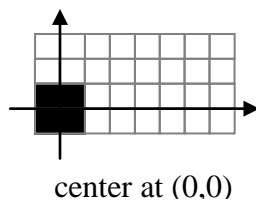
Please attempt all the 4 questions before attending tutorial.

1. Given an object represented in polygons, how to find its bounding sphere?
2. There are two mirrors in the space and a viewer as the following configuration on the left. Assuming there is no light source nearby but only some ambient lighting. The viewer should see the picture in the screen as in the right picture.



If we render the picture with ray tracing, **how many times do we need to test if a ray intersects an object?** Assuming the screen dimension is 1024x768 pixels. The grey area in the picture has 100000 pixels (excluding the white area) and the white area has 70000 pixels. Assuming this is the most basic ray tracing without any other techniques to reduce the number of ray-object intersection test. However, you can assume that a ray does not intersect the object which the ray just comes out from. (Note that the viewer is NOT an object in the scene.) **List the steps and explain your answers also.**

3. Imagine a 2 pixels by 2 pixels square, has its center at the origin (see the left figure). The square moves linearly to a new position with its center at (1,0). If the pixels on the display are shaded as long as they are covered by the square, please draw the shaded pixels when the center of the square is at (0.5,0) and (1,0). Is the “square” a square all the time?



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4. In ordered-dithering, we light up a pixel if $S(x,y) > D_{ij}$. Given the dithering matrix:

0	2
3	1

and the pixel intensities of a picture:

4	4	3	3	2	2	1	1	0	0
0	0	0	0	0	0	0	0	0	0
4	4	3	3	2	2	1	1	0	0
0	0	0	0	0	0	0	0	0	0
4	4	3	3	2	2	1	1	0	0

Please compute the image with ordered dither (without error diffusion). Shade the pixels which are supposed to be turned on.

What is the average difference of pixel intensity between two pictures? Assume the intensity of the pixel is 4 when it is turned on, 0 when it is turned off.