

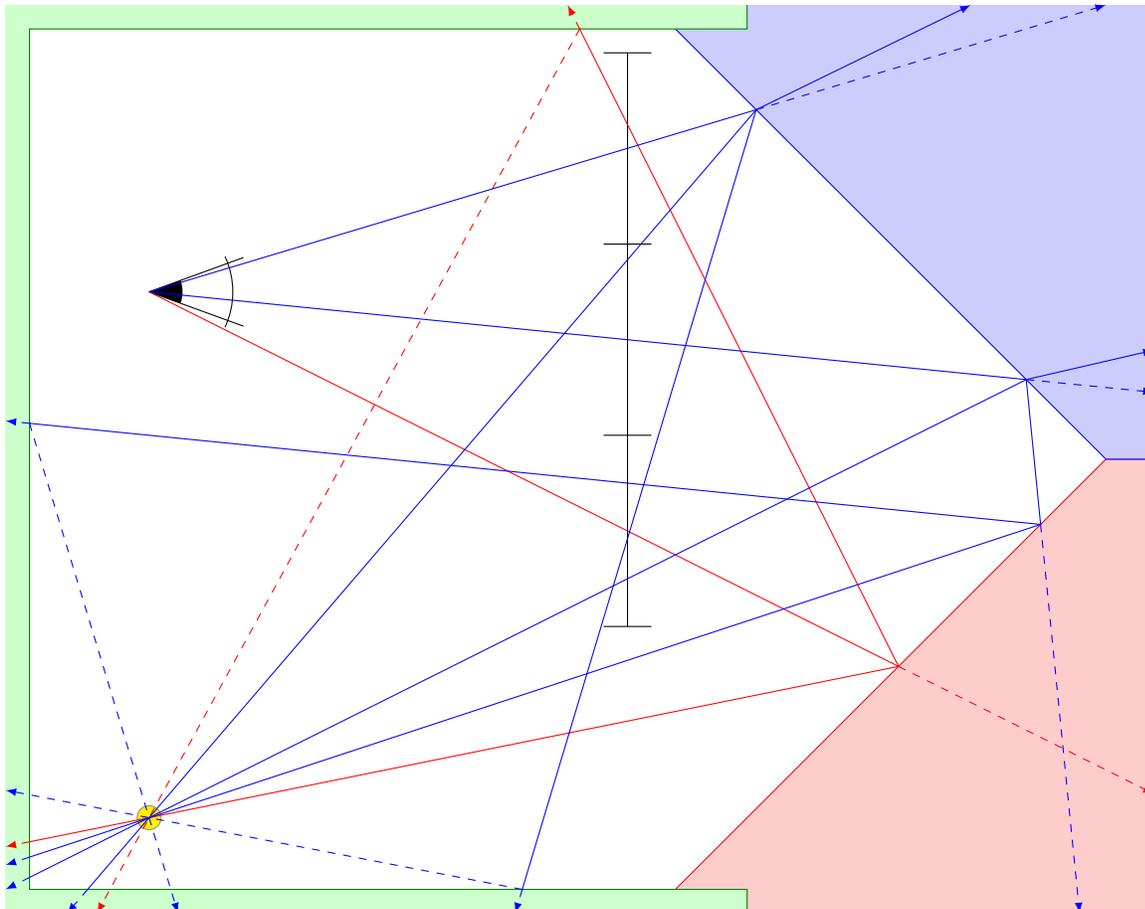
# CS 230, Quiz 2

## Solutions

There is one question. No books, notes, or other aids are permitted.

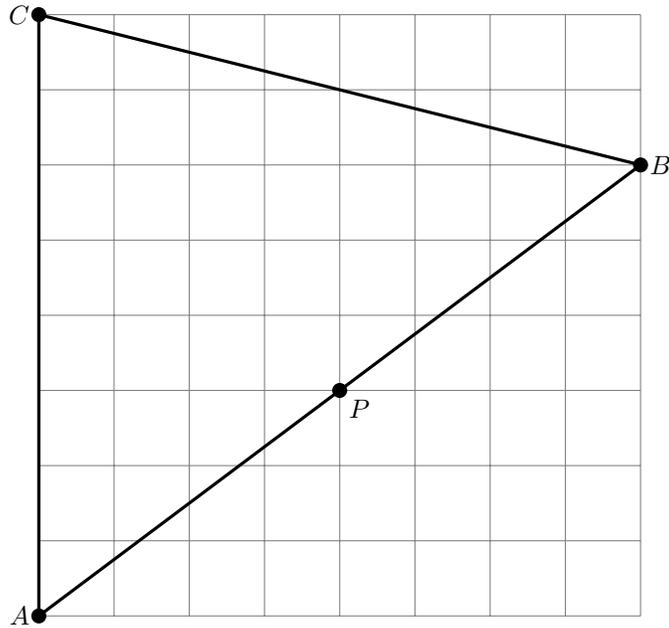
In the raytracing problems below, **green** objects are wood, **red** objects are reflective, and **blue** objects are transparent. The scenes are in 2D with a 1D image. **yellow** circles are point lights; the ray tracer supports shadows. Draw all of the rays that would be cast while raytracing each scene. Use a maximum recursion depth of 3. (Don't worry about precisely what counts as depth 3; I just care that recursion is being performed correctly when necessary and that important rays are not missing. There are no more than 20 rays in the "exact" solution.)

### Problem 1 (4 points)



## Problem 2 (4 points)

Compute the barycentric weights of the point  $P$ .



$P$  is at the midpoint of one of the edges, which makes the barycentric weights easy:  $\alpha = \beta = \frac{1}{2}$ ,  $\gamma = 0$ .

## Problem 3 (4 points)

Let  $R$  be the ray with endpoint  $(2, -3, 1)$  and direction  $(0, 1, 0)$ . Let  $S$  be the sphere centered at the origin with radius 3. Find all intersection *locations* between the sphere and the ray.

The ray is given by  $x = 2$ ,  $y = -3 + t$ ,  $z = 1$ . The sphere is given by  $x^2 + y^2 + z^2 = 9$ . Substituting in gives  $4 + (t - 3)^2 + 1 = 9$  or  $(t - 3)^2 = 4$  so that  $t - 3 = \pm 2$ . This gives two solutions  $t = 1$  and  $t = 5$ . These correspond to the locations  $(2, -2, 1)$  and  $(2, 2, 1)$ .