PY 202, 4/10/17

John M. Lynch*

April 10, 2017

Topics for Exam

1. LC Circuits
2. EM waves
3. reflection, refraction (31)
4. polarization (31)
5. mirrors, lenses (32)

HW 32

1. only one problem on WebAssign!
2. downside: quite a bit of ray-tracing on rest of HW (LaTeXwill be difficult)

Quiz Review

1. reflection & refraction: It's the angles with respect to the *normal* that matter, not the surface!

Today's Quiz

1. If you are looking at a rock on the bottom of a stream, what do you see? Does it seem closer, further away, or at the correct depth?

   (a) A (correct, 0.35): You think you see it close along your line of sight, but in reality it rests much lower, on the lake floor.

2. light is incident at 55° on a water/air interface. Is there reflection (B), refraction (C), or both (A)?

   (a) B (correct, majority): this asks if it has reached the critical angle, or angle of *total internal reflection*:

   $$\theta_c = \frac{n_2}{n_1} = 0.752 \qquad (1)$$

   where $55° > \theta_c$, so you have *only* a reflected ray. (I just figured this out by seeing that the arcsin was imaginary.)

3. Unpolarized light is incident on water/air interface. At what angle should light be incident to get 100% polarization? Use the Brewster (polarization) angle.

   (a) C (incorrect, split): at θ_p, reflected ray is polarized; refracted ray remains unpolarized. Brewster's angle eqn

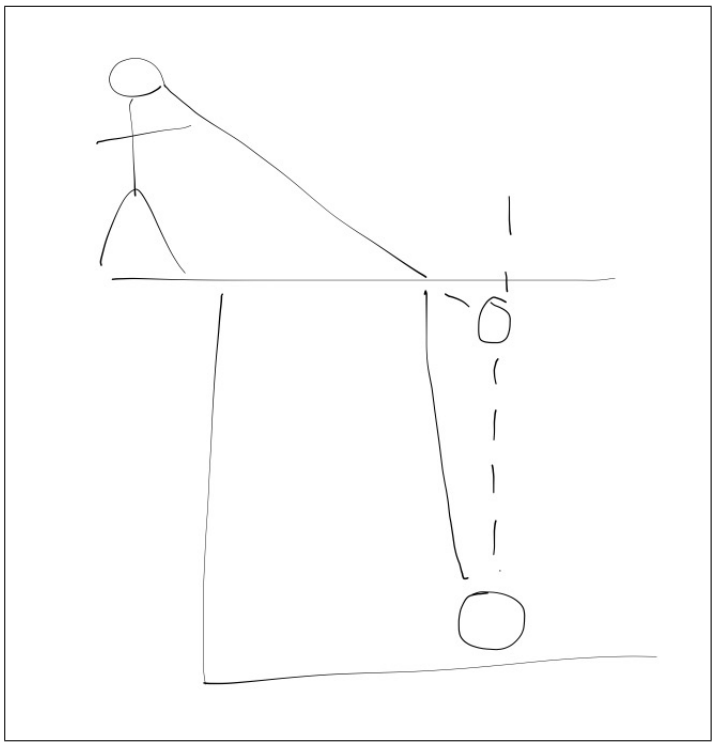


Figure 1: Quiz 1

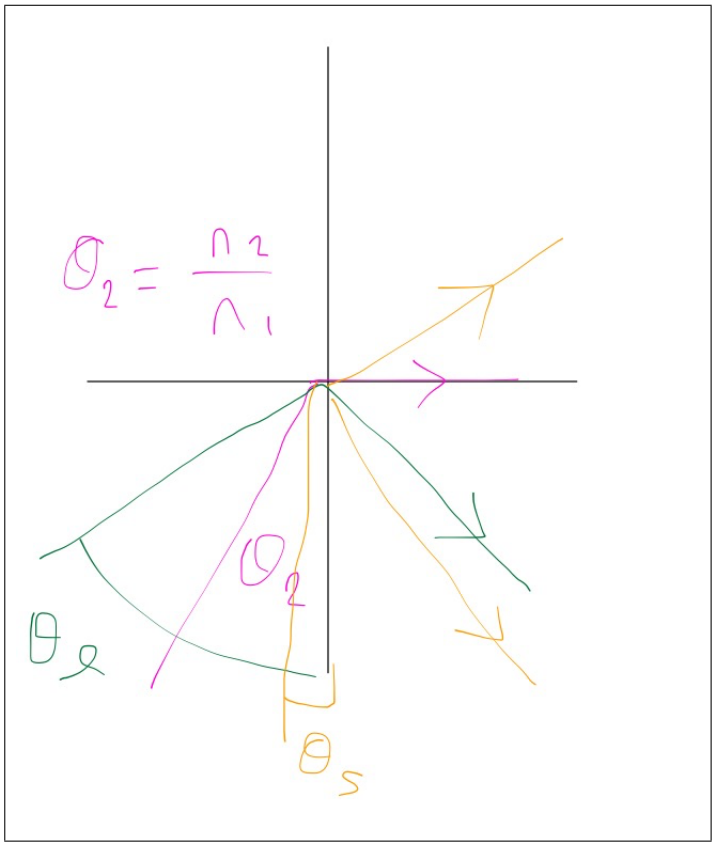


Figure 2: critical angle (Quiz 2)

*Undergraduate ECE/Physics, NCSU, Raleigh, NC 27705. E-Mail: jmlynch3@ncsu.edu

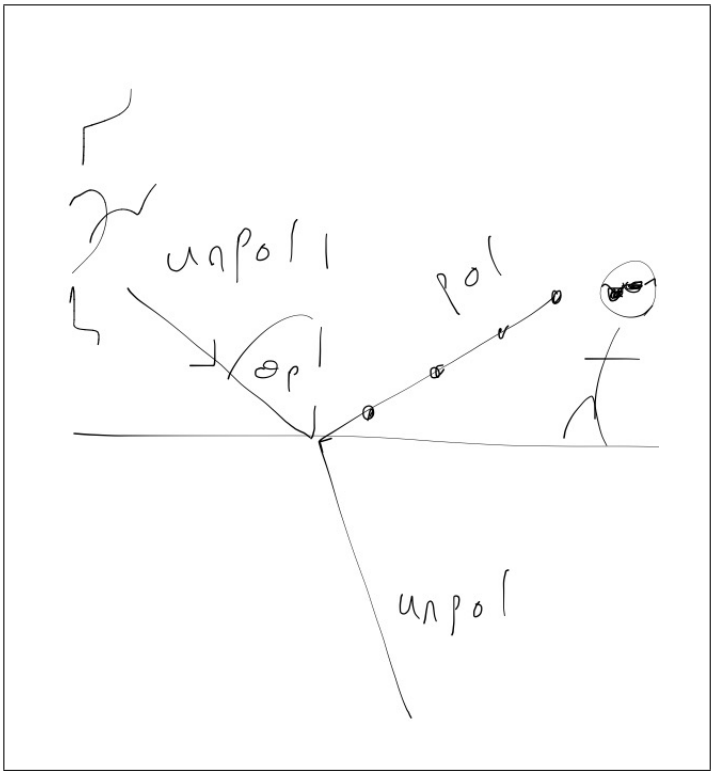


Figure 3: polarized reflected ray (Brewster's angle, Quiz 3)

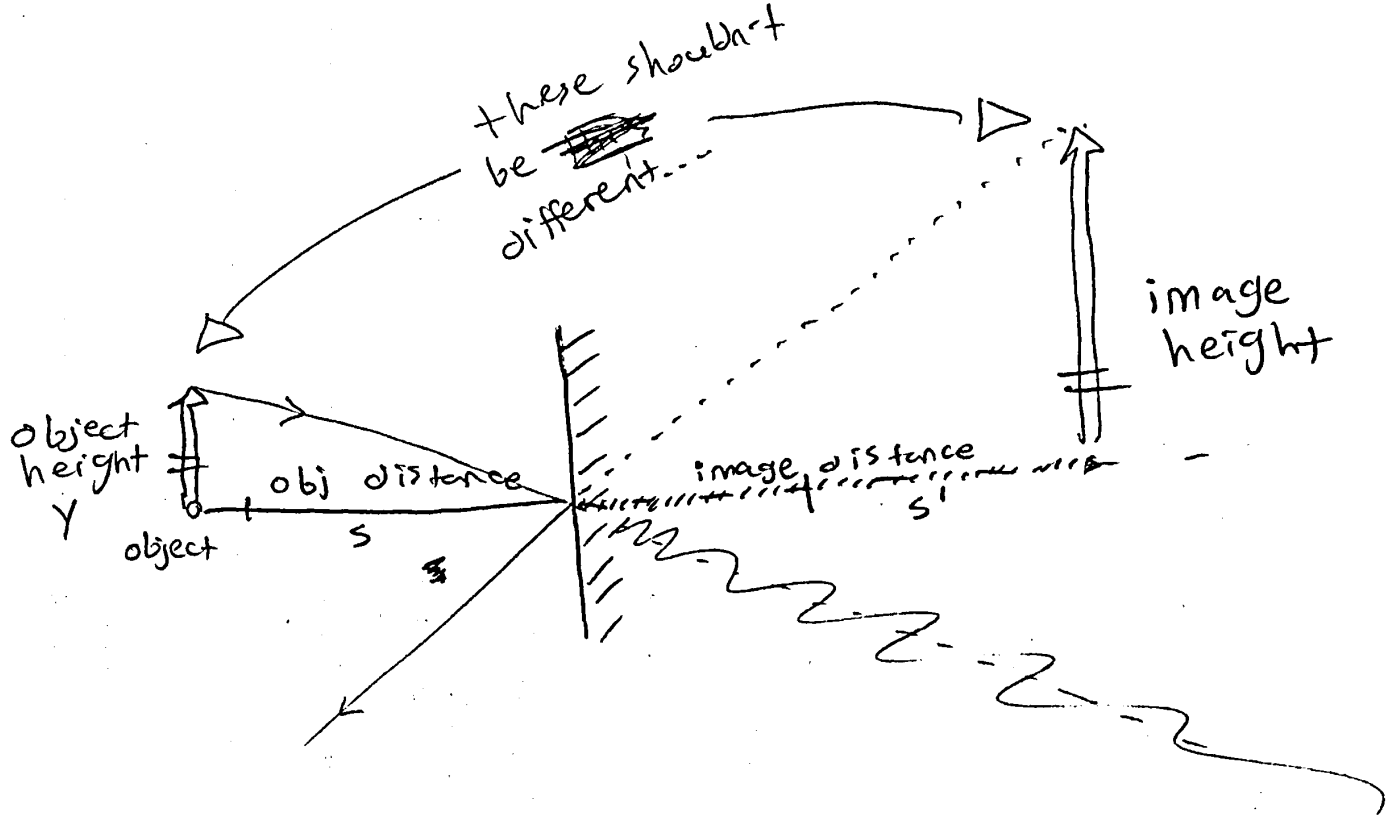
Mirrors

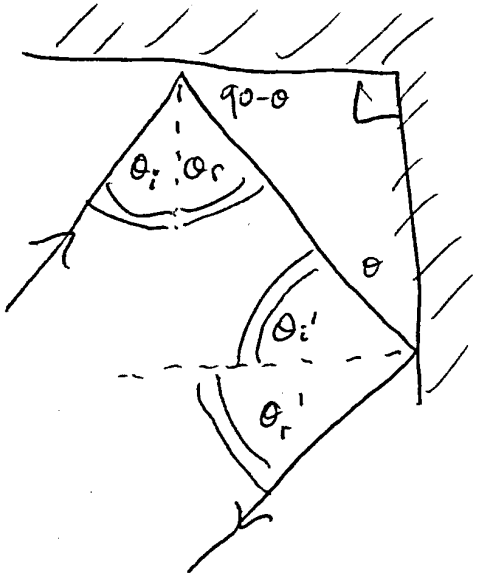
1. object: every point of object emits rays in all directions
   (a) we only consider a few
2. image: where the reflected rays converge (can be on either side of mirror)

Flat mirror

$s = s'$

$y = y'$



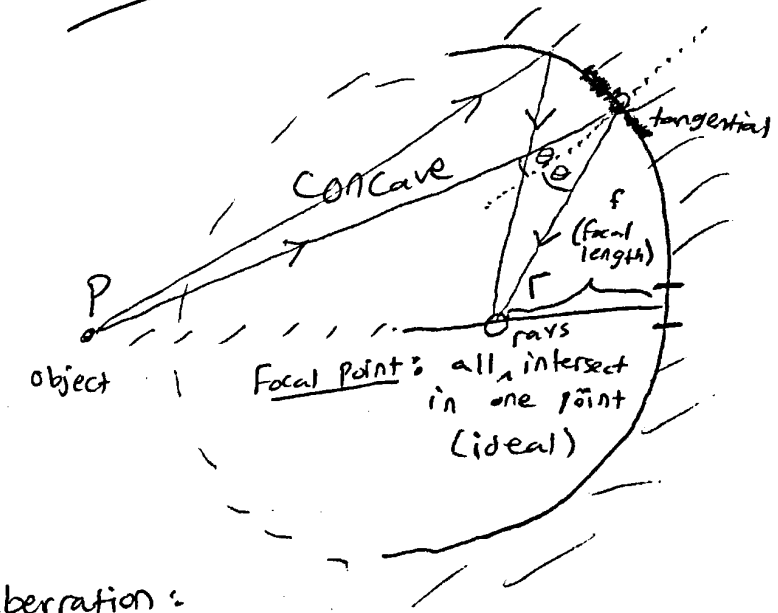


reflector

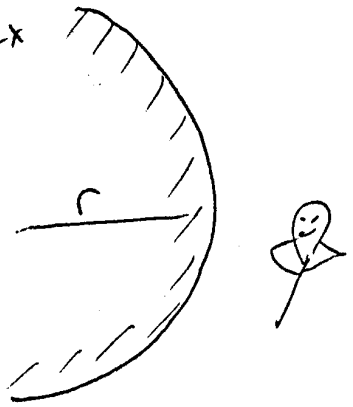
reflects back no matter the angle

Curved Mirrors

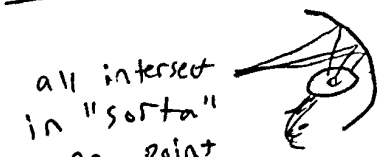
radius of curvature r

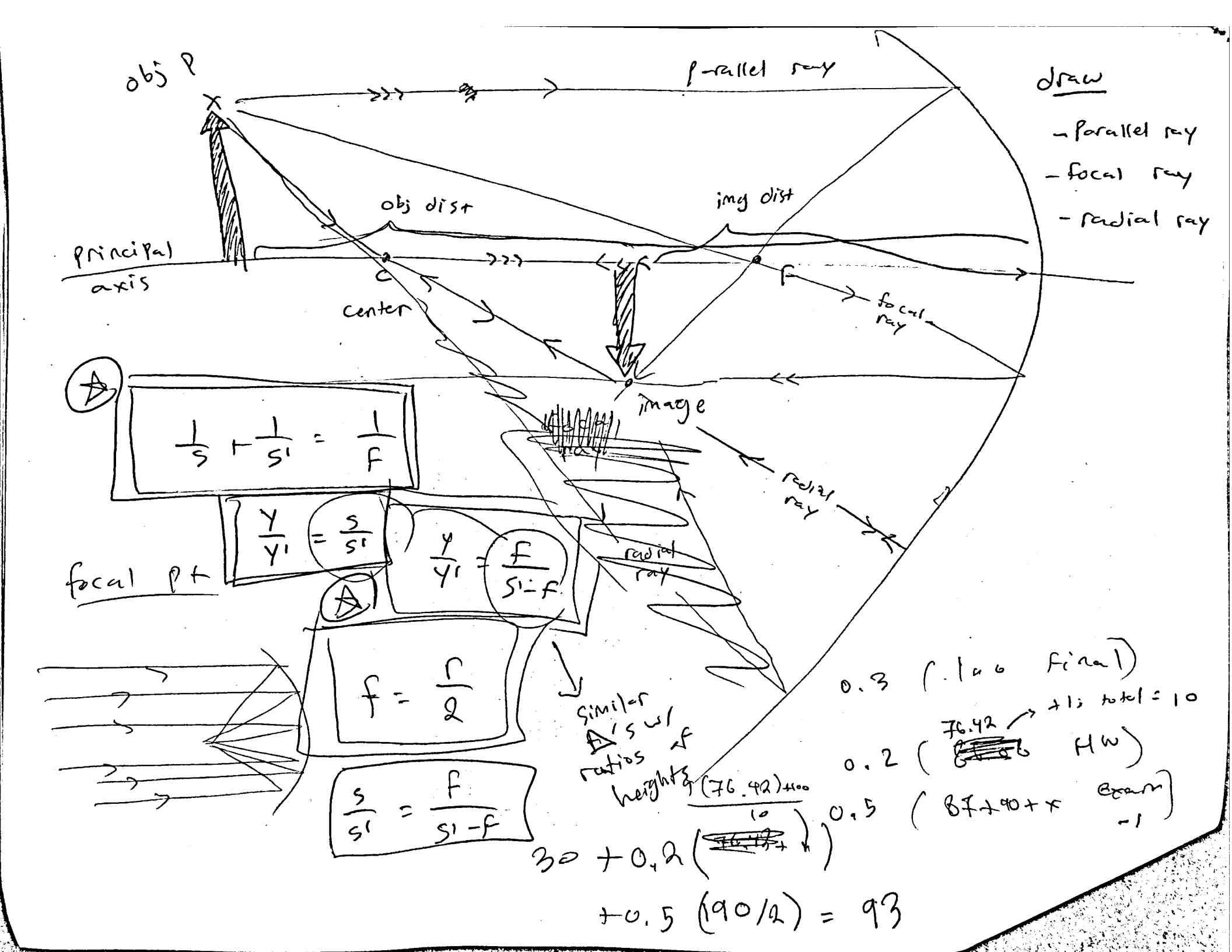


convex



aberration:




obj P
parallel ray
draw
- parallel ray
- focal ray
- radial ray
obj dist
img dist
principal axis
C
center
F
focal ray
image
radial ray
radial ray
$\frac{1}{s} + \frac{1}{s'} = \frac{1}{f}$
$\frac{y}{y'} = \frac{s}{s'}$
$\frac{y}{y'} = \frac{f}{s'-f}$
focal pt
$f = \frac{r}{2}$
$\frac{s}{s'} = \frac{f}{s'-f}$
similar △'s w/ ratios of heights
0.3 (labs final)
0.2 (76.42 → +1; total = 10 HW)
0.5 (87+90+x Exam -1)
$30 + 0.2\left(\frac{(76.42)+100}{10}\right) + 0.5\,(190/2) = 93$