Phys 2120-4 11/19/12

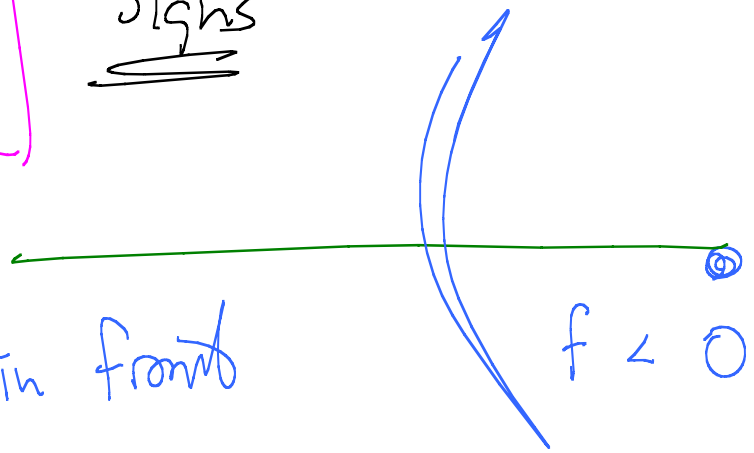
Note Title 11/19/2012

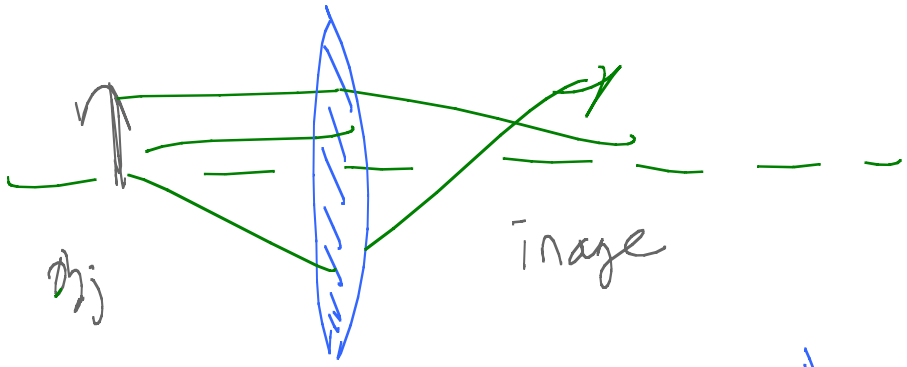
Mirrors: $\frac{1}{s} + \frac{1}{s'} = \frac{1}{f}$

Signs

s is pos, obj. in fm

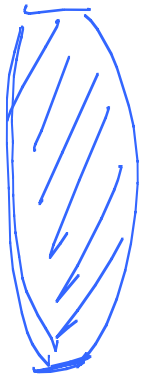
s' is pos if img is in front






Lens is thin

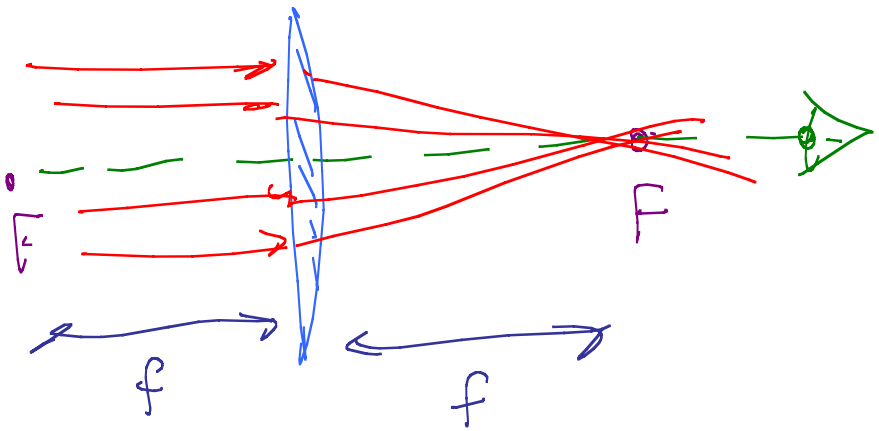
Generally
Fat have
diff curvatures
on surfaces



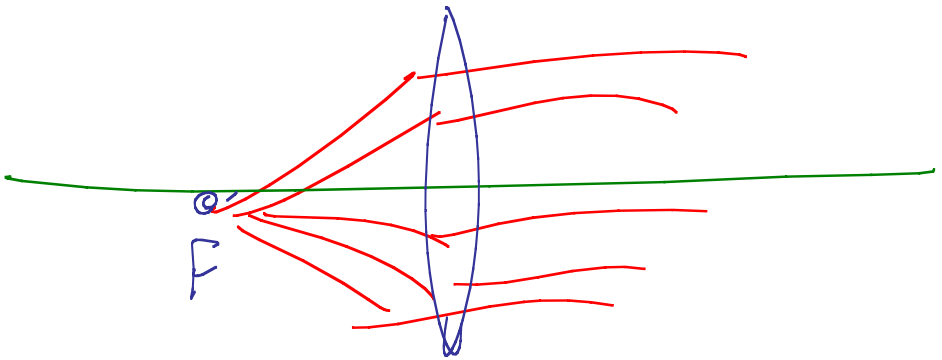
Can use effective or avg
radius of curvature
Avg focal length $f = \frac{1}{2}R$

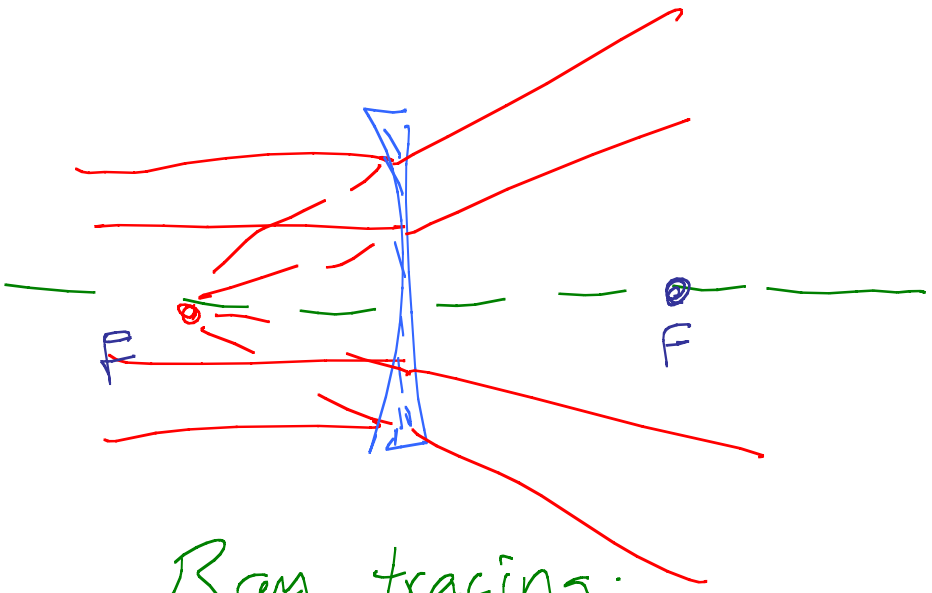
Two kinds of lenses

a) Converging lens. ($f > 0$)




Parallel rays collapse down to a point F






b) Diverging lens

Parallel rays come in "diverge from" the focal point

Ray tracing:

1) Ray comes in parallel goes out on line thru focal point
2) Ray coming from focal point goes out parallel
3) Ray thru center of lens keep going!

# Converging Lens

a) Object near lens

Image is:

Upright, Virtual

Bigger

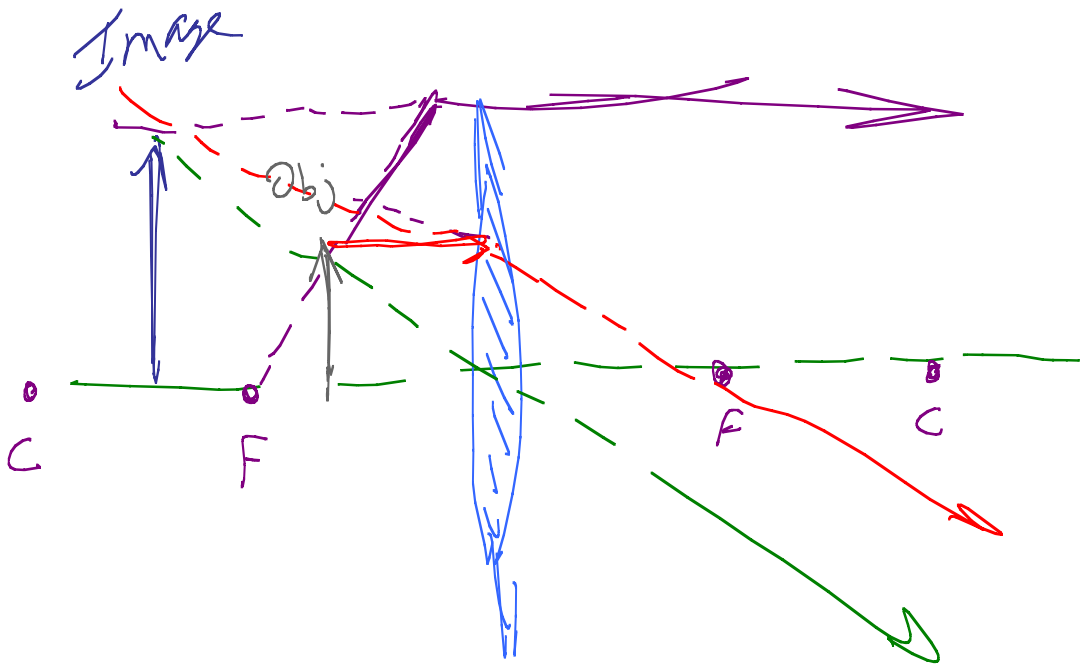


Image is

Real smaller, inverted

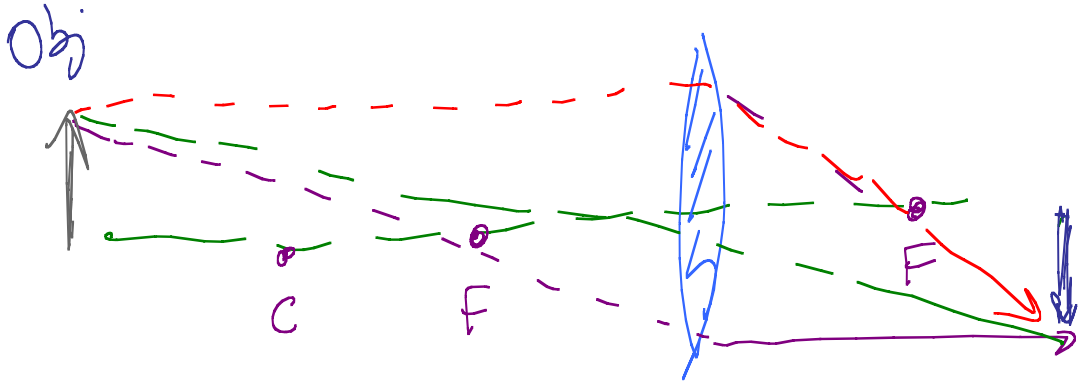
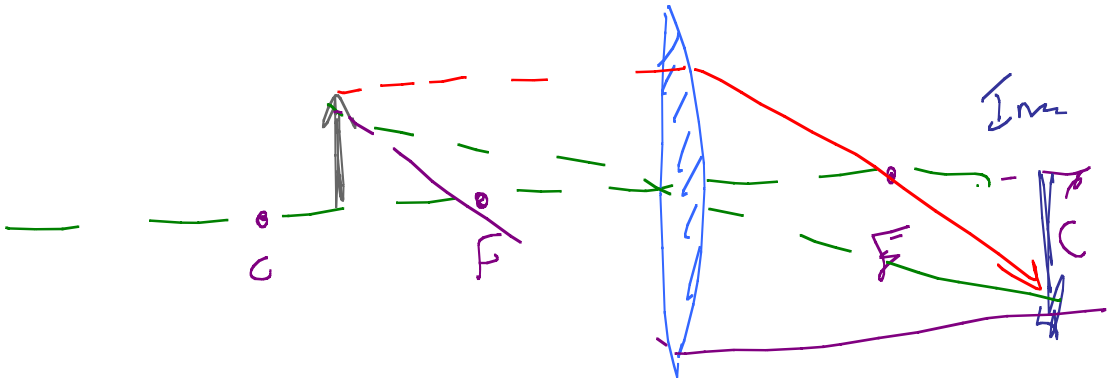



Image is real, inverted

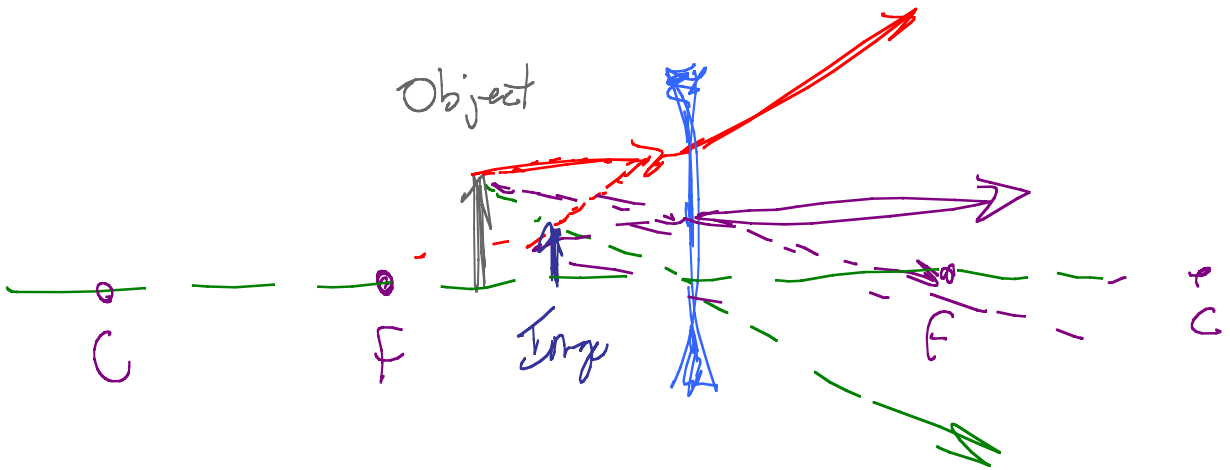


Diverging Lens

Image:

Virtual,

Upright, smaller




Lens Equation

s = obj distance

+ if on left − if on right


s′ = image distance

+ if on right − if on left

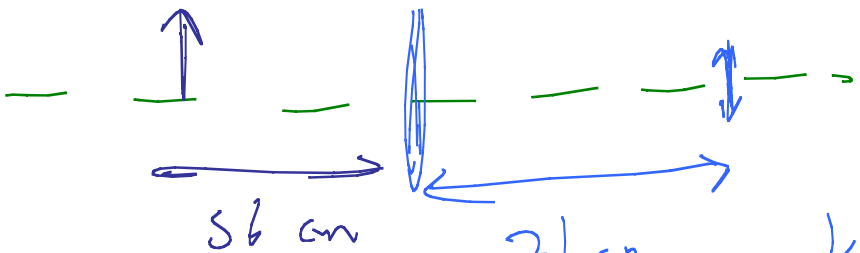
$f$ is $+$ if convex — converging

$f-$ if concave — diverging

Always draw a picture

$$\frac{1}{s} + \frac{1}{s'} = \frac{1}{f}$$

31.22 A lightbulb 56 cm from convex lens. Its image appears on a screen 31 cm from the lens and on other side. Find a) Len's focal length b) magnification.




f should be pos

$s = 56$ cm $\quad s' = 31$ cm

$\frac{1}{s} + \frac{1}{s'} = \frac{1}{f}$ $\quad f = 20.0$ cm

Magnification $m = \frac{h'}{h} = -\frac{s'}{s}$

$$m = -\frac{s'}{s} = -\frac{31\text{cm}}{56\text{cm}} = -0.55$$

31.23 By what factor is the image magnified for an object 1.5 focal lengths from converging lens? Is image upright or inverted?

$$\frac{1}{s} + \frac{1}{s'} = \frac{1}{f} \qquad \frac{1}{1.5f} + \frac{1}{s'} = \frac{1}{f}$$

$\xrightarrow{\text{math}}$ $s' = 3f$ $\qquad m = -\frac{s'}{s} = \frac{-3f}{\frac{3}{2}f} = -2$

Larger, inverted

Human eyeball

Muscles change focal length of lens.