Lesson 19

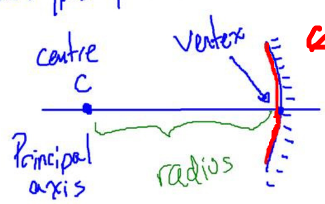
Tuesday, May 25, 2010
1:20 PM

Lesson4

lesson 7

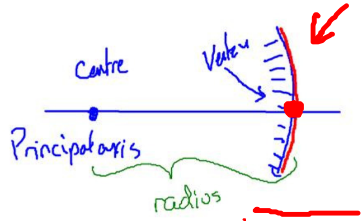
Reflection from curved mirrors

2 types of mirrors (Concave and Convex

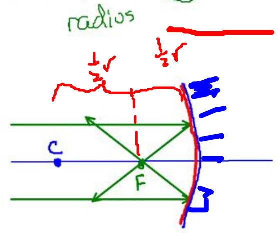


This is a concave mirror (the reflective coating is in the interior)

cornerstores



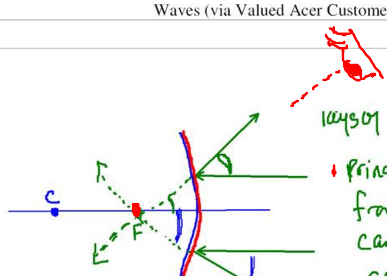
This is a convex mirror (The reflective material is on the exterior



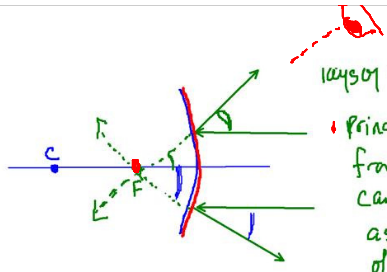
Rays of light parallel to the principal axis will reflect from a concave mirror to a single point "f" called a focal point

This focal point is $\frac{1}{2}$ the distance from the centre and the curvature

In the same way



Rays of light parallel to the principal axis will reflect from a convex mirror as if they came from a single point. as if they came from the focal pt. of the concave mirror



Rays of light parallel to the principal axis will reflect from a convex mirror as if they came from a single point. as if they come from the focal pt. of the concave mirror

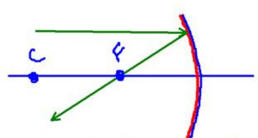
✓ Concave mirrors can be thought of as a converging mirror
✓ Convex " " " " " diverging mirror

✓ The focal pt of a concave mirror is called a real focal pt.
✓ " " " " convex " " " virtual " "

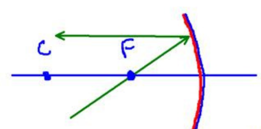
A real focal point is where rays of light actually converge
-notice the dashed lines intersecting the focal pt for convex, mirror, those rays don't actually exist.

the radius of the curvature is the distance from the centre to the mirror or vertex.

Sample Ray diagrams (Need to memorize)

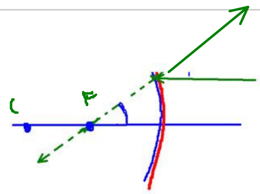


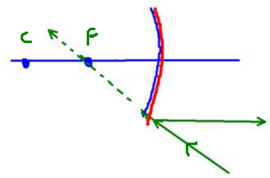
or



ray parallel to the principal axis will go through "F"

ray going through the focus will always be parallel to the principal axis

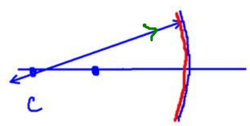


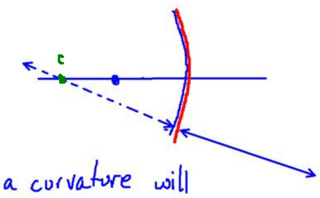


convex mirror

if a ray parallel to the principal axis will strike the mirror light diverge away with an angle as if it came from a focal point

a ray striking a convex mirror at an angle as if going through a focal pt will reflect parallel to the principal axis

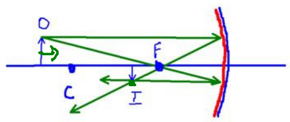




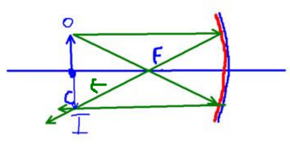
a ray through the centre of a curvature will reflect back along the same path

Sample diagrams need to memorize

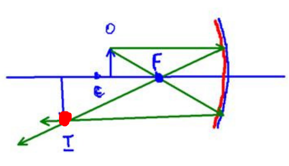
object "O" Pg 298
Image "I"



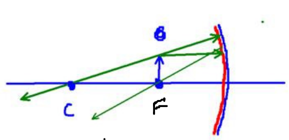
This is a case where the object is beyond the centre
The result is an inverted image that is real but smaller



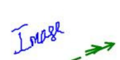
If the object is on the centre
The result is an inverted and real and exactly the same



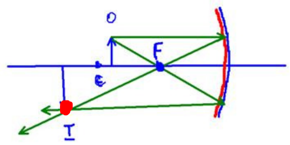
If the object is between the centre and the focus, the result is an inverted image that is real and larger than the original



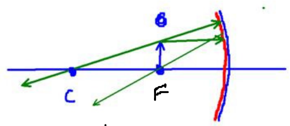
If the object is on the focal pt there will be no image, the rays do not intersect.



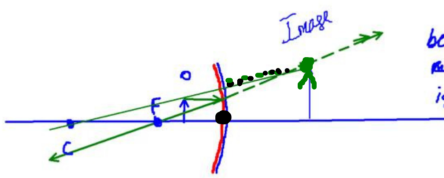
when the object is between the focus and the



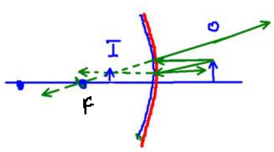
If the object is between the centre and the focus, the result is an inverted image that is real and larger than the original



If the object is on the focal pt there will be no image, the rays do not intersect.



When the object is between the focus and the concave mirror the image is erect, larger than the object and virtual



Just the opposit of the previous case

The image is erect and virtual and smaller

Mirror equations we play with

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

and magnification = $\frac{\text{height of image}}{\text{height of object}} = \frac{h_i}{h_o}$

or $\frac{\text{distance of image from mirror}}{\text{distance of object from mirror}}$ = [redacted] $= \frac{-d_i}{d_o}$

[illegible] [redacted]

magnification $\Rightarrow \frac{h_i}{h_o}$

[redacted]

magnification $= -\frac{d_i}{d_o}$

or $\frac{h_i}{h_o} = -\frac{d_i}{d_o}$

ex) an object 3.00 cm tall is placed 10.0 cm in front of a concave mirror that has focal length of 3.0 cm

find d_i and magnification

$d_o = 10.0\text{ cm}$ $\quad h_o = 3.00$ $\quad f = 3.0\text{ cm}$ $\quad d_i = ?$

$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i} \Rightarrow \frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o}$

$= \frac{1}{3.0\text{ cm}} - \frac{1}{10.0\text{ cm}}$

$d_i = \frac{1}{.23}$ $\qquad \frac{1}{d_i} = \frac{10}{30} - \frac{3}{30}$

$= 4.28$ $\qquad \frac{1}{d_i} = 7/30$

$d_i = 30/7\text{ cm}$ } (+)'ve value indicates real image

find h_i $\quad \boxed{\frac{h_i}{h_o} = \frac{-d_i}{d_o}}$

$= h_i = \frac{-d_i h_o}{d_o}$

$= \frac{\left(-\frac{30}{7}\right)(3.0)}{10\text{ cm}}$

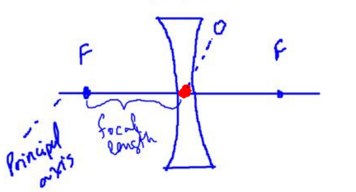
$h_i = -1.3\text{ cm}$ } (−)'ve value indicates inverted.

Pg 303 #1 – 11 odd (2 - 11 odd)

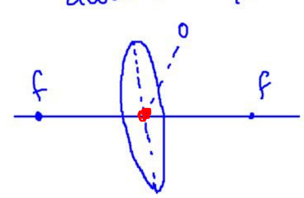
Refraction from lenses

Terms

double concave lense



double convex lense



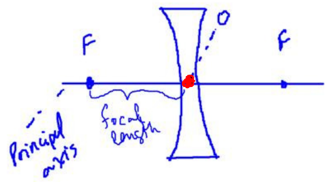
"O" optical centre

"F" f...

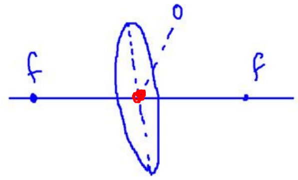
Refraction from lenses

Terms

double concave lense

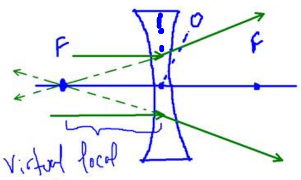


double convex lense



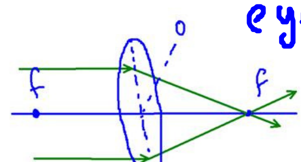
"O" optical centre
"f" focus pts

light is refracted the following ways



virtual focal pt

why?

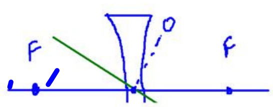


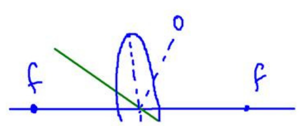
eye

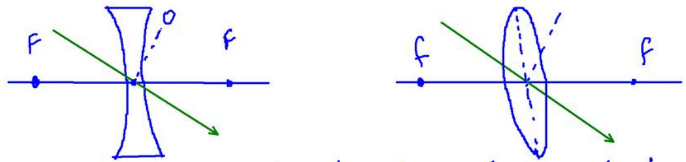
real focal pt.

why?

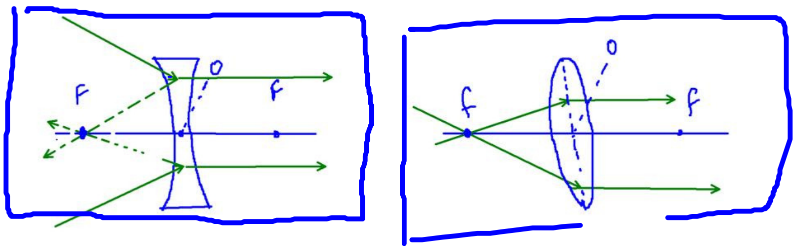
✓ rays parallel to the principle axis will be refracted by the lens s.t. the net result will be converging through a focal pt in a convex lens or diverging through a concave lens



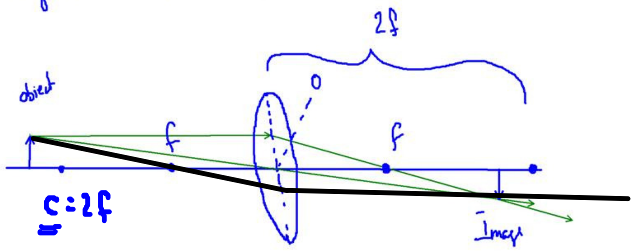




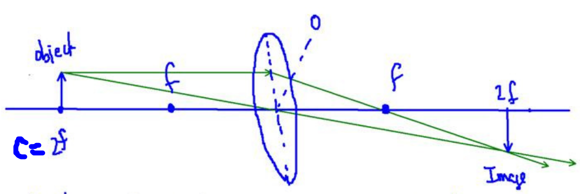
a ray through the optical centre does not change direction



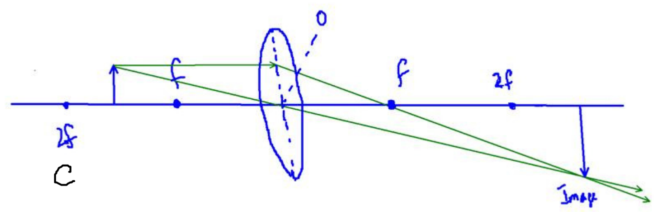
Sample diagrams for convex lenses



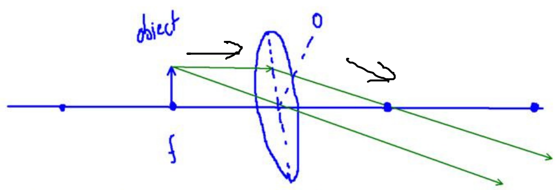
when an object is placed at a distance greater than 2f, the image is inverted and smaller than the object and is real



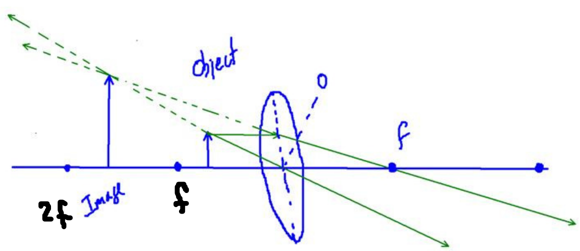
When an object is placed at 2f, the image is inverted, same size as the object and real as the object and real



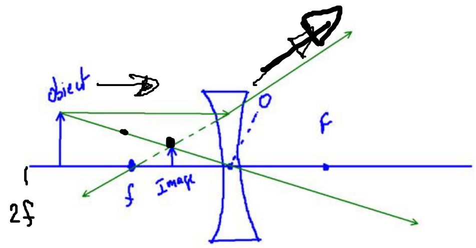
when an object is placed between 2f and f the image is inverted, larger than the object and real



when the object is placed at f no image is produced



When an object is inside f, the image is erect, larger than the object and virtual



Double concave will always have virtual image

ex) an object 2.5cm tall is placed 15cm from a convex lens if the focal length is 7.5 cm

determine d_i, h_i

h_o = height object h_i = height

a) $\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$ => $\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o}$

$\frac{1}{d_i} = \frac{1}{7.5} - \frac{1}{15}$

$\frac{1}{d_i} = \frac{1}{15}$ $d_i = 15cm$

b) $\frac{h_i}{h_o} = \frac{-d_i}{d_o}$

$h_i = \frac{-d_i h_o}{d_o} = -\frac{(15)(2.5)}{15} = -2.5cm$

Since d_i = ⊕ive image is real

h_i = ⊖ive image is inverted

$h_i = h_o$ in magnitude ∴ the same size

ex 2) pg337 $h_o = 6.0cm$ $d_o = 9.0cm$ $f = 8.0cm$

find d_i, h_i

a) $\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$ => $\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o}$

a) $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i} \Rightarrow \frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o}$

$= \frac{1}{8} - \frac{1}{9}$

$\frac{1}{d_i} = \frac{1}{72}$ $d_i = 72cm$

b) $\frac{h_i}{h_o} = \frac{-d_i}{d_o}$

$h_i = \frac{-d_i}{d_o} h_o = \frac{(-72)(6)}{9} = -48cm$

inverted, larger, real

4) $h_o = 3cm$ $d_o = 6cm$ $h_i = 1cm$

a) $\frac{h_i}{h_o} = \frac{-d_i}{d_o}$

$\frac{1}{3} = \frac{-(d_i)}{6cm}$ $d_i = -2cm$ ∴ virtual

focal length $\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$

$= \frac{1}{-2cm} + \frac{1}{6}$

$\frac{1}{f} = -.33$

$f = -3$ or 3

6) $d_o = 8.0cm$ $r = 8.0cm$ ∴ $f = 4.0cm$ Magnification?
need d_i

$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$

$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o}$ Magnification $= \frac{d_i}{d_o} =$

$= \frac{1}{4} - \frac{1}{8}$

$= \frac{1}{4} - \frac{1}{8}$ d_o

$d_i = \frac{1}{8}$

$d_i = 8cm$

w/B pg336 - 3 - 13odd

try #1 pg 335

try Additional ex pg342 - 348 all
Practice test

#3 pg337

$h_o = 5cm$ $d_o = 4.5$ $f = 4.5cm$ $d_i = ?$

$$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$$

No sol^n

$$\frac{1}{4.5} = \frac{1}{d_i} + \frac{1}{4.5}$$

Pg 332 Sign Conventions for lenses

real focal pts ⊕'ve
virtual focal pts ⊖'ve
erect images ⊕'ve
~~dist~~ inverted images ⊖'ve

Pg #324 #23

$v = 3 \times 10^8$ m/s λ

ex) An object is 32 cm to the left of a convex lens with focus 8 cm

find di

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

$\doteq 11$ cm