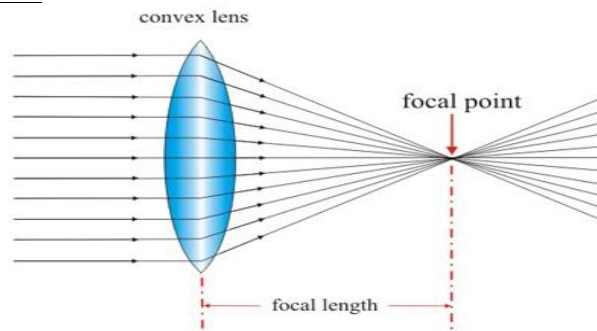


## Chapter 6 LENSES

**Lens**

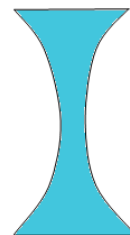
- A piece of glass or plastic which is shaped so Parallel incident rays either CONVERGE (come together) at one point or DIVERGE (move apart) from one point
- Used to REFRACT light to form images
- Examples
  - Prescription glasses
  - Contacts
  - Camera lens
  - Magnifying glass

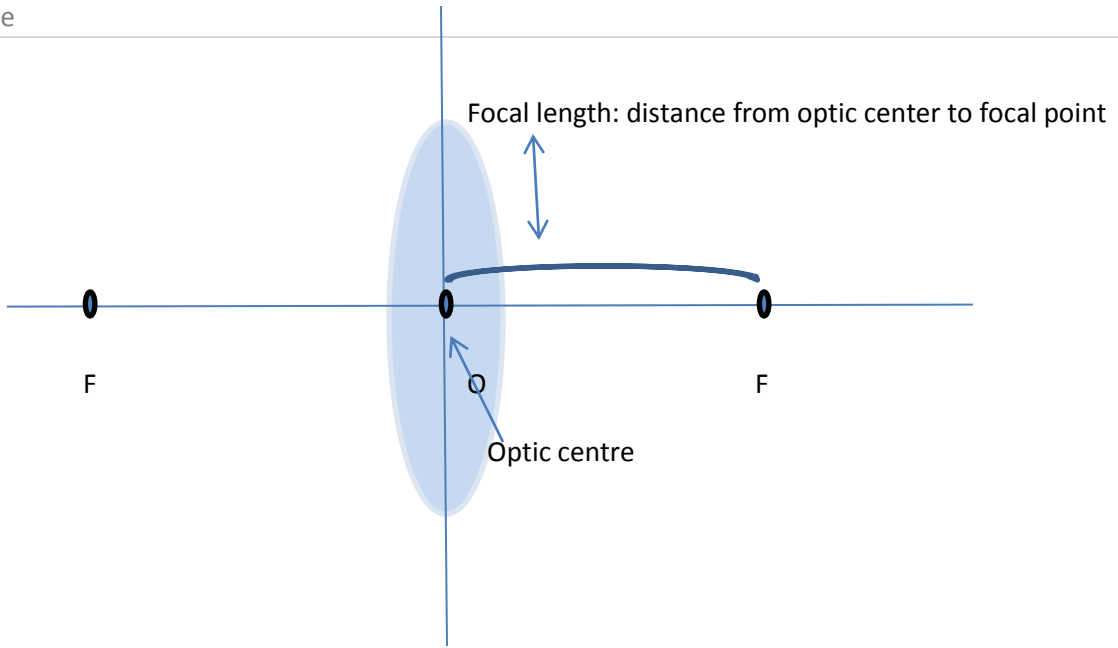
**CONVEX LENSES:**

- center of lens BULGES OUT
- causes light rays to bend TOWARDS each other (ex magnifying glass)
- used for FAR-SIGHTEDNESS

**CONCAVE LENSES**

- Center of lens is CAVED
- Causes light rays to bend AWAY From each other (diverge)
- Used for near-sightedness

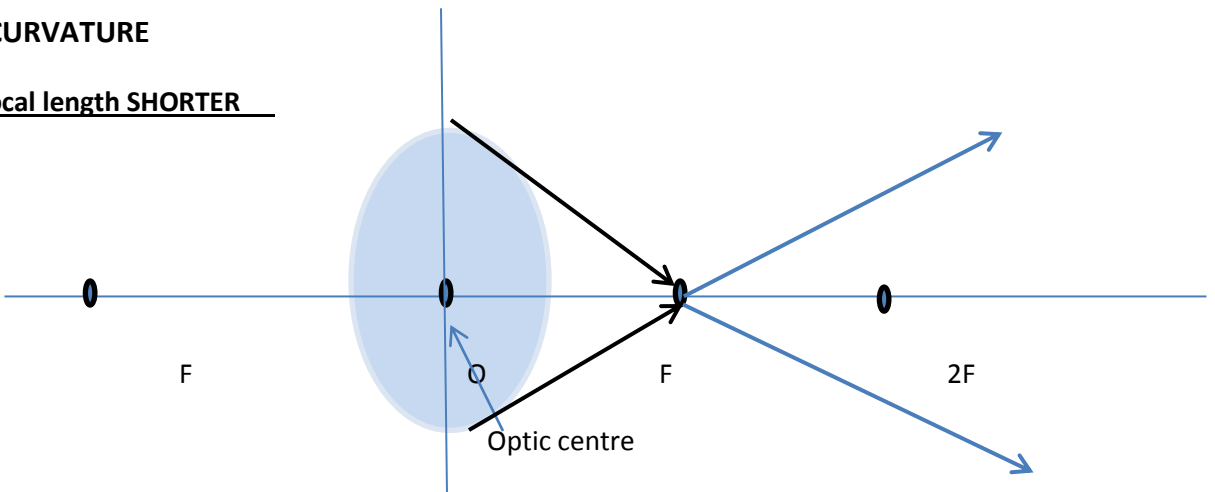
Plano-Concave  
LensDouble-Concave  
LensConvexo-Concave  
Lens



NOTE: **LIGHT can go through lens BOTH WAYS**  
**SO there are TWO focal points!**

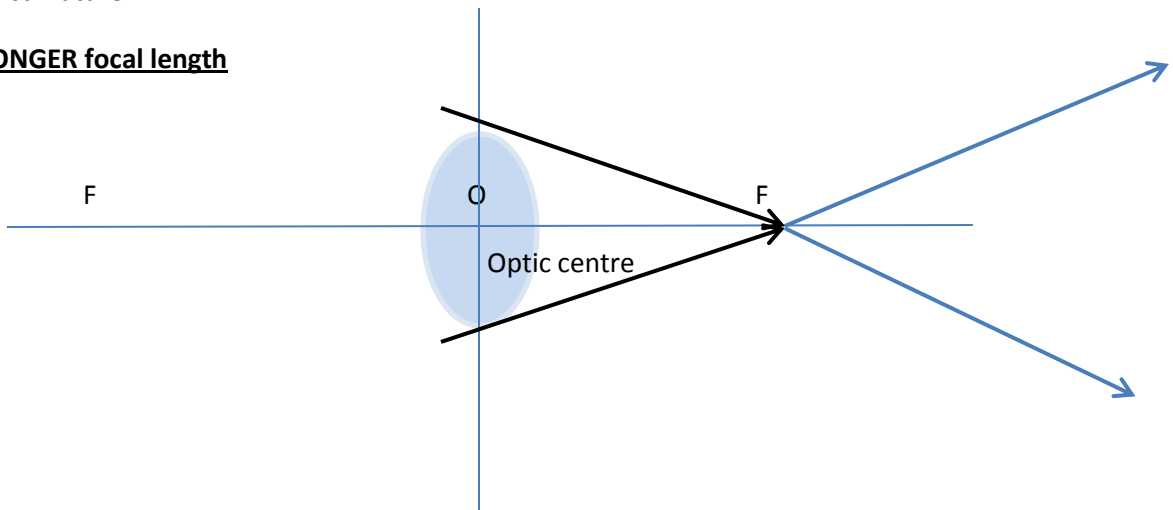
**LARGE CURVATURE**

means focal length SHORTER



**SMALLER curvature**

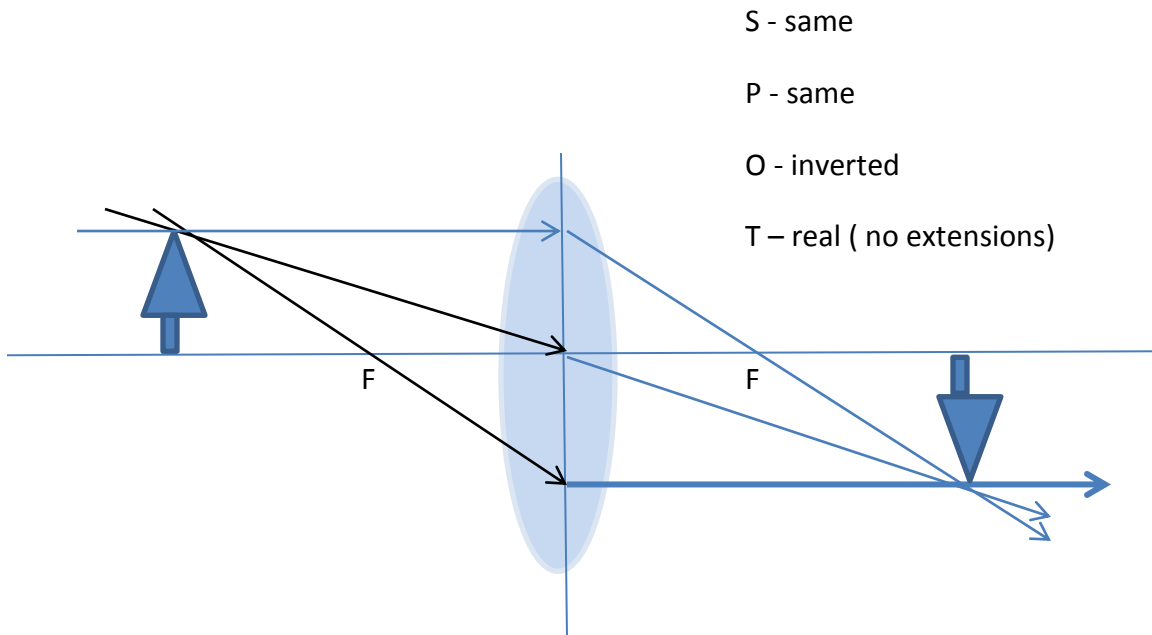
means LONGER focal length



See chart on page 220

CONVEX LENSES *see page 216*

- Ray diagrams are **approximations** of what actually occurs
- A virtual image is located on the SAME SIDE of the lens as the object is on
- WHY? The refracted rays do NOT actually meet...i.e reflection not extended



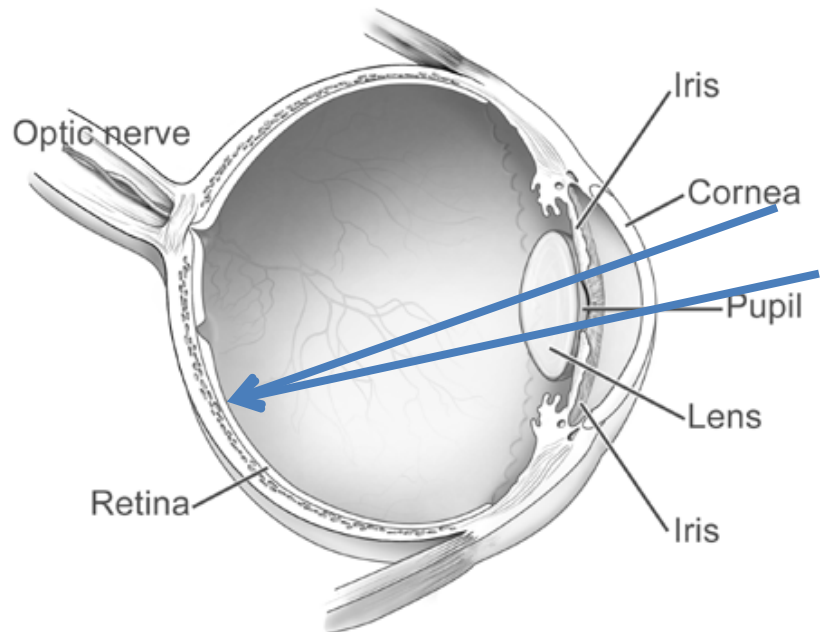
NOTE: the Image is the same size and distance as the object is but it's INVERTED!

**CORRECTING EYE PROBLEMS using**

**LENSES**

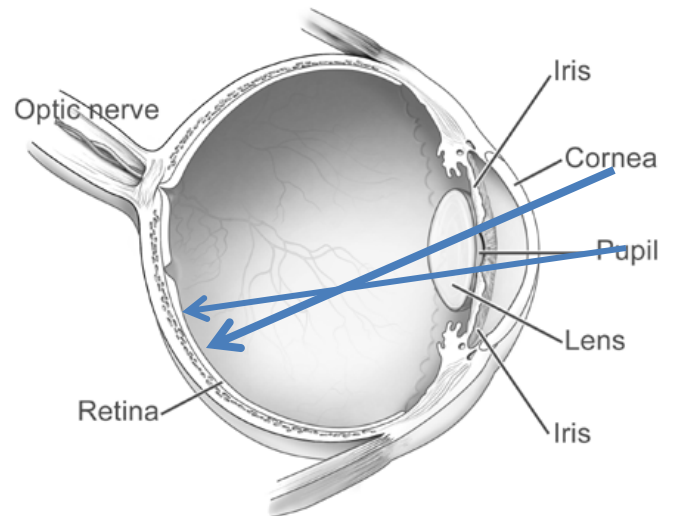
**NORMAL VISION**

Our natural lens ( behind the pupil and our cornea) REFRACTS incoming rays so they CONVERGE at the retina



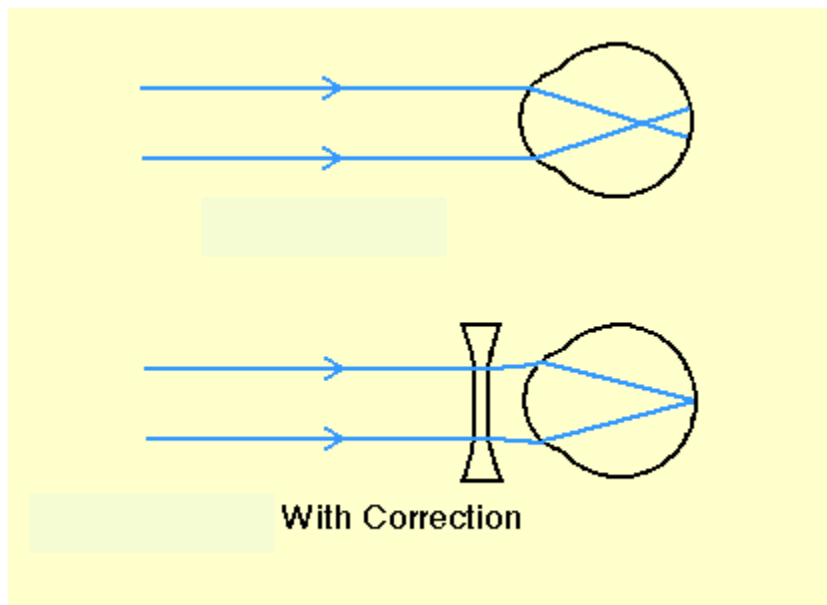
### NEAR SIGHTED

- Lens converges the light ray to form image IN FRONT of the retina ( they cross inside)
- When rays actually hit the retina, they a SPREAD OUT again and the image is BLURRY



### FIX Near-sightedness-

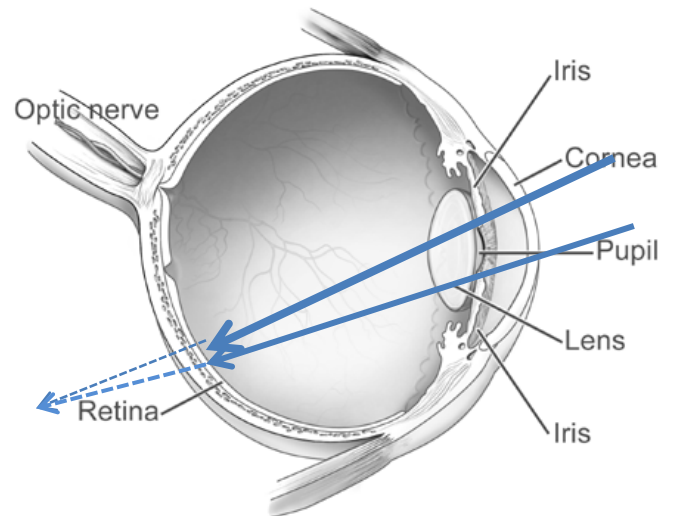
- **CONCAVE LENS** is used
- It **DIVERGES** the rays lightly so image forms on the retina



Ray slightly diverge

### FAR SIGHTED

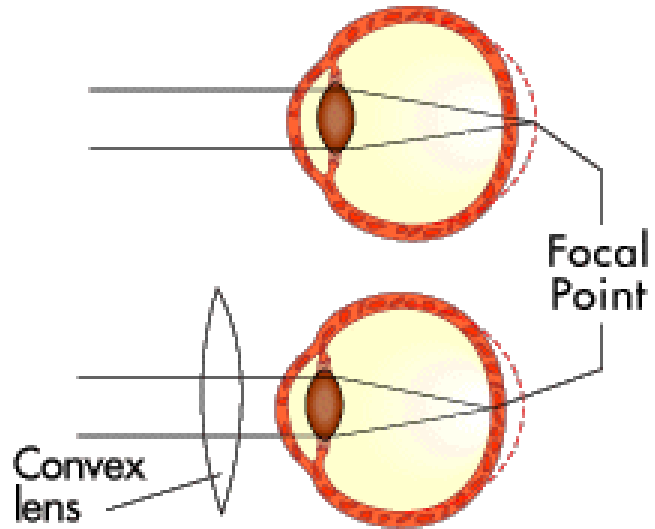
- Lens converges the light ray to form image **BEHINDT** of the retina ( they cross outside
- the image is **FUZZY**



### FIX FAR-sightedness-

- **CONVEX LENS** is used
- **image then forms on the retina**

Cross past the retina (dotted)



### ASTIGMATISM \_\_\_\_\_ see page 235

- CORNEA has a **DISTORTED SHAPE**
- SO images focus o **MORE THAN ONE** point on the retina
- Causes BLURRY VISION

## **OPTICAL TECHNOLOGY**

- **Has been developed through TRIAL AND ERROR**
- **Depends on the material that would lend itself to the specific application**
- **Ex high water content plastics need to be invented before the contact lens**

**NOTE: SCI TECH takes place individually and in groups settings**

**Ex Galileo - individual**

**Invented the refracting telescope (uses LENSES only)**

**Newton – individual**

**Invented the reflecting telescope (uses lenses and mirrors)**

**Hubble Telescope**

**Used in space to get very clear images of the universe**



Google – Hubble telescope