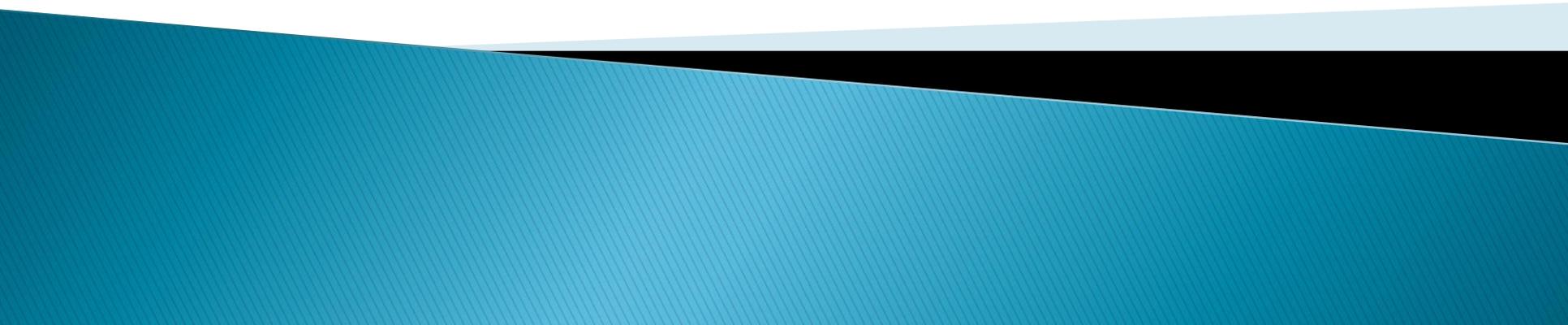


# Prism – Is it Prescribed or is it Unwanted?

Diane F. Drake, LDO, ABOM, NCLEM, FNAO



# Course Description

- ▶ Sometimes prism is prescribed and sometimes it is not prescribed. This course will present information that includes both prescribed prism as well as unwanted prism and the effect on the wearer. The information will include basic prism as well as advanced prism. An understanding of basic prism would be helpful for the learner to comprehend the more advanced knowledge in this course. This course will be a more advanced level regarding prism.
- 

# Learning Objectives / Learning Outcomes

- ▶ At the completion of this course, the student should:
  - Be able to identify unwanted prism
  - Describe vertical imbalance
  - Explain how to split prism and when you should not split prism.
  - Discuss compounding prism
  - Have an understanding of prism notation
  - Be able to explain resultant prism and resolving prism

# Introduction

- ▶ Prescribed prism
  - ▶ Unwanted prism
  - ▶ Prismatic effect
  - ▶ Vertical imbalance
  - ▶ Prism notation
  - ▶ Canceling and Compounding prism
  - ▶ Compound prism and prism prescribed at degree meridians
  - ▶ Resultant prism
  - ▶ Resolving prism
  - ▶ Exercises – You make the call
  - ▶ Questions and answers
- 

# Prescribed Prism

- ▶ Yoked prism
  - ▶ Diplopia and/or Confusion
    - Phorias/tropias
    - Anisometropia
    - Testing with prism and/or slab-off
  - ▶ Post Trauma
  - ▶ Compromises in Visual Field
  - ▶ Posture and Mobility
    - Head/neck position problems
  - ▶ Reading – Bed Specs
  - ▶ Others
- 

# Esophoria or esotropia

- ▶ Base-out prism
  - All in one eye or split between the two eyes.
  - If split between both eyes, the orientation for the prism will still be base-out for both eyes. An example of “eso” correction in a prescription is:
- ▶ OD:  $-2.00 - 0.25 \times 180 \quad \Delta 1.50 \text{ BO}$   
OS:  $-2.25 - 0.50 \times 175 \quad \Delta 1.50 \text{ BO}$

# Exophoria or exotropia

- ▶ Base-in prism
  - All in one eye or split between the two eyes.
  - If split between both eyes, the orientation for the prism will still be base-in for both eyes. An example of “exo” correction in a prescription is:
- ▶ OD:  $-2.00 - 0.25 \times 180 \quad \Delta 1.50 \text{ BI}$
- ▶ OS:  $-2.25 - 0.50 \times 175 \quad \Delta 1.50 \text{ BI}$

# Slab-off

- ▶ Vertical imbalance caused by unequal refractive errors at the reading level
  - ▶ Slab-off is base-up prism placed in the lower portion of the most minus lens or the least plus lens
  - ▶ Reverse slab-off is base-down prism in the lower portion of the most plus or least minus lens
- 

# Visual field loss

- ▶ Treating visual field loss
  - Shifts an image from blind area into an area of vision.
  - The base is positioned in the blind area, which shifts the image toward the apex and into the seeing area.
- ▶ A 2.0 diopter prism shifts an image approximately 1.0 degree.

# Yoked prism

- ▶ Prism thinning
- ▶ Visual Midline Shift
  - Patient misperceives their position in their spatial environment
    - Patient may lean forward, backward or sideways
- ▶ Nystagmus
  - Brings the null point to more comfortable position
- ▶ Yoked prism is used in both lenses, not just one

# Yoked prism

- ▶ Horizontally yoked prism:

OD:  $-2.00 - 0.25 \times 180$   $\Delta 5.00$  BI

OS:  $-2.25 - 0.50 \times 175$   $\Delta 5.00$  BO

- ▶ Vertically yoked prism:

OD:  $+2.00 - 0.25 \times 180$   $\Delta 2.50$  BU

OS:  $+2.25 - 0.50 \times 175$   $\Delta 2.50$  BU

# Cosmesis or alignment of appearance

- ▶ Usually opposite of what would seem normal
- ▶ BO prism for eye that is deviated outward
- ▶ Eye would not have correctable vision

# Prismatic Effect

- ▶ Unwanted prism is one of the most common reasons for difficulty with spectacles
  - ▶ Looking outside of Optical Centers creates prismatic effect
  - ▶ Creates viewing discomfort
  - ▶ Troubleshoot
- 

# Prismatic Effect

- ▶ Principles of Optics
  - ▶ Prescribed Prism
  - ▶ Unwanted Prism
- 

# Prism Basics

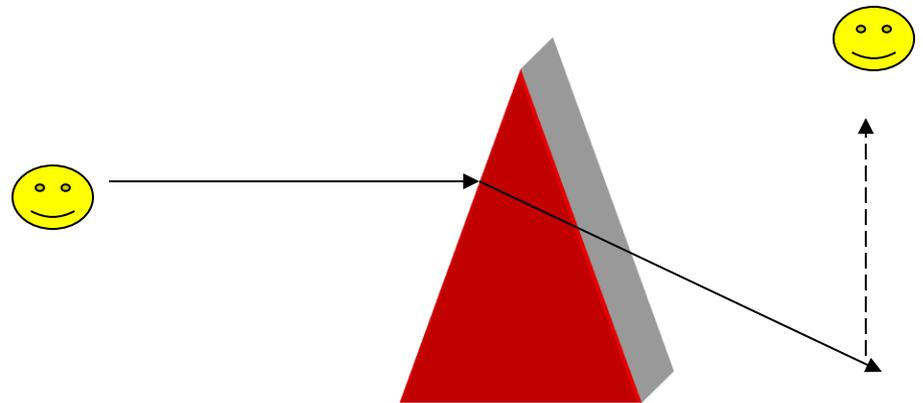
- ▶ When inspecting a pair of mounted lenses
  - OC's should be located and measured
  - Is prism prescribed?
    - Prescribed vs unwanted
  - Is prism present?
  - Acceptable or unacceptable

# Prismatic Effect

- ▶ If the patient is uncomfortable with the presence of unprescribed prism then fixing it in the new lenses will bring welcome relief.
- ▶
- ▶ If on the other hand the patient has gotten used to and is seemingly not bothered by the unprescribed prism then fixing the problem may make it appear that we have done something wrong. This is when the dispenser must use their best call to remove, reduce, or maintain the unprescribed prism.
- ▶
- ▶ In order to make the proper decision it is often necessary for the dispenser to discuss their findings with the refractionist.

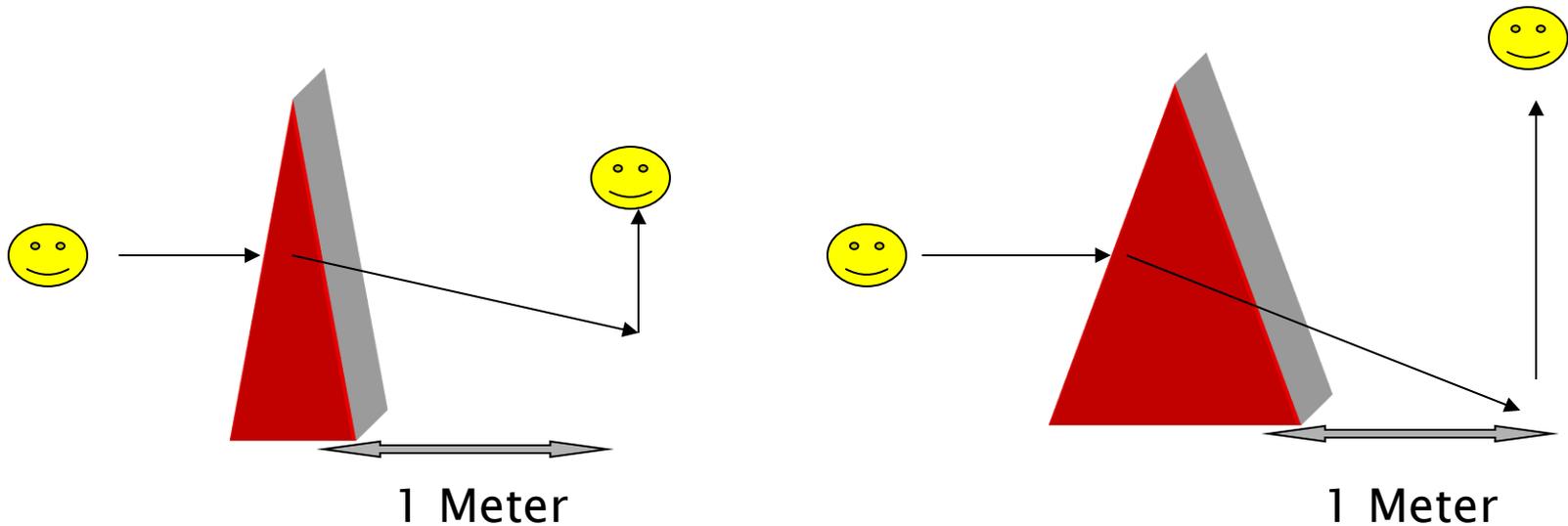
# Prism

- ▶ Light strikes a prism
  - light ray is bent (deviated) toward the base
  - image is displaced toward the apex.



# Prism

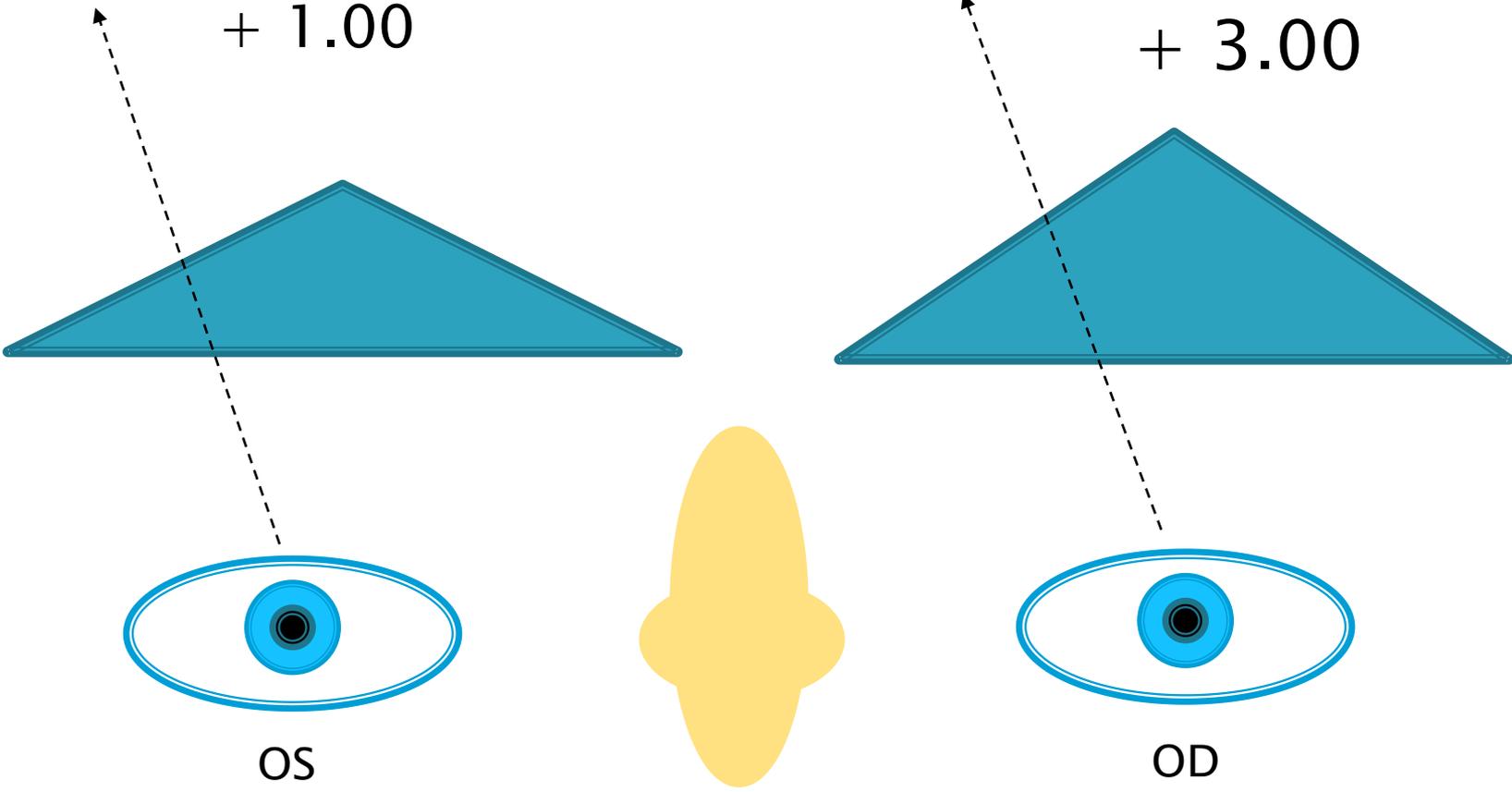
- ▶ The greater the difference in thickness between the base and the apex
  - Stronger the power of the prism



# Prism

- ▶ Power of prism is referred to as prism diopter
  - 1  $\Delta$  will deviate light 1 cm at 1 M
  - 2  $\Delta$  will deviate light 2 cm at 1 M
  - 3  $\Delta$  will deviate light 3 cm at 1 M

# Single Vision Displacement

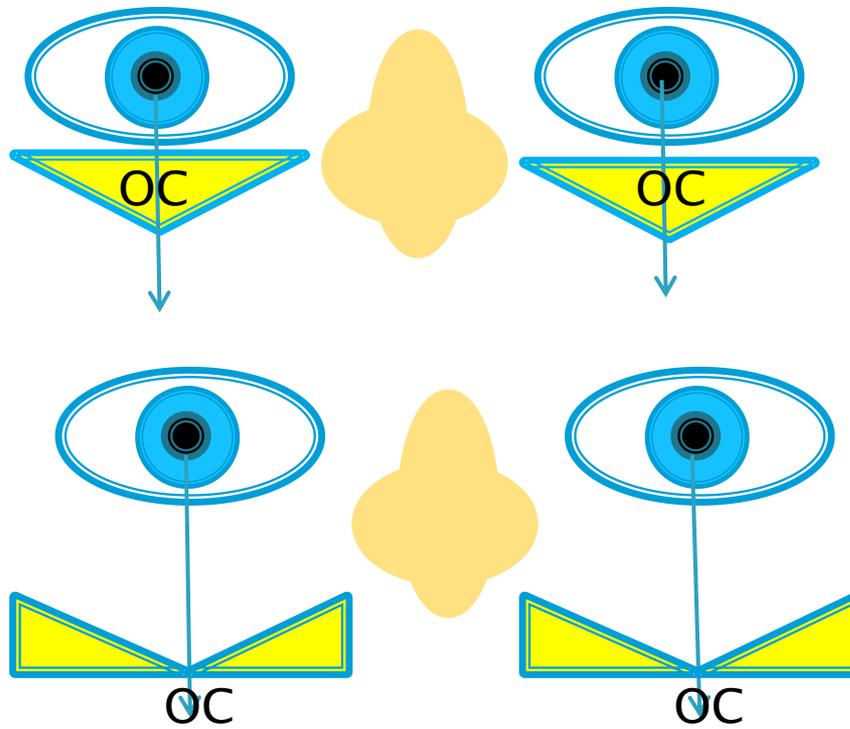


# Prism Notation

- ▶ The symbol used to designate prism is the triangle (Greek Delta symbol  $\Delta$ )
- ▶ The base of the prism is indicated by the  $\Delta$  combined with the direction:
  - Base in would be BI
  - Base out would be BO
  - Base up would be BU
  - Base down would be BD

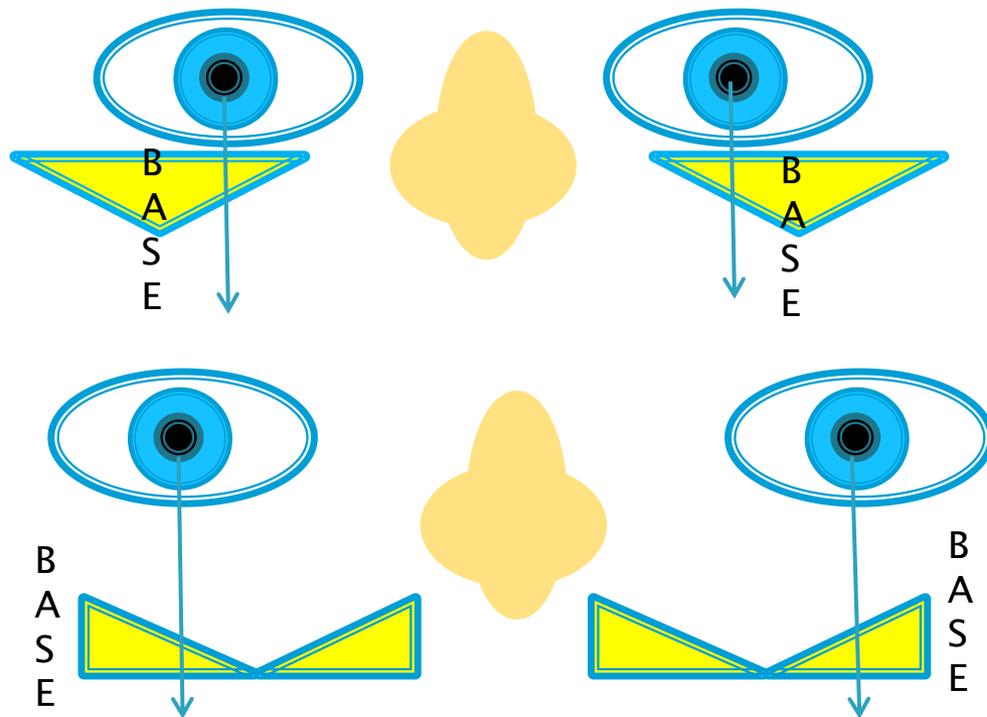
# Prismatic Effect

## Ideal Viewing Situation



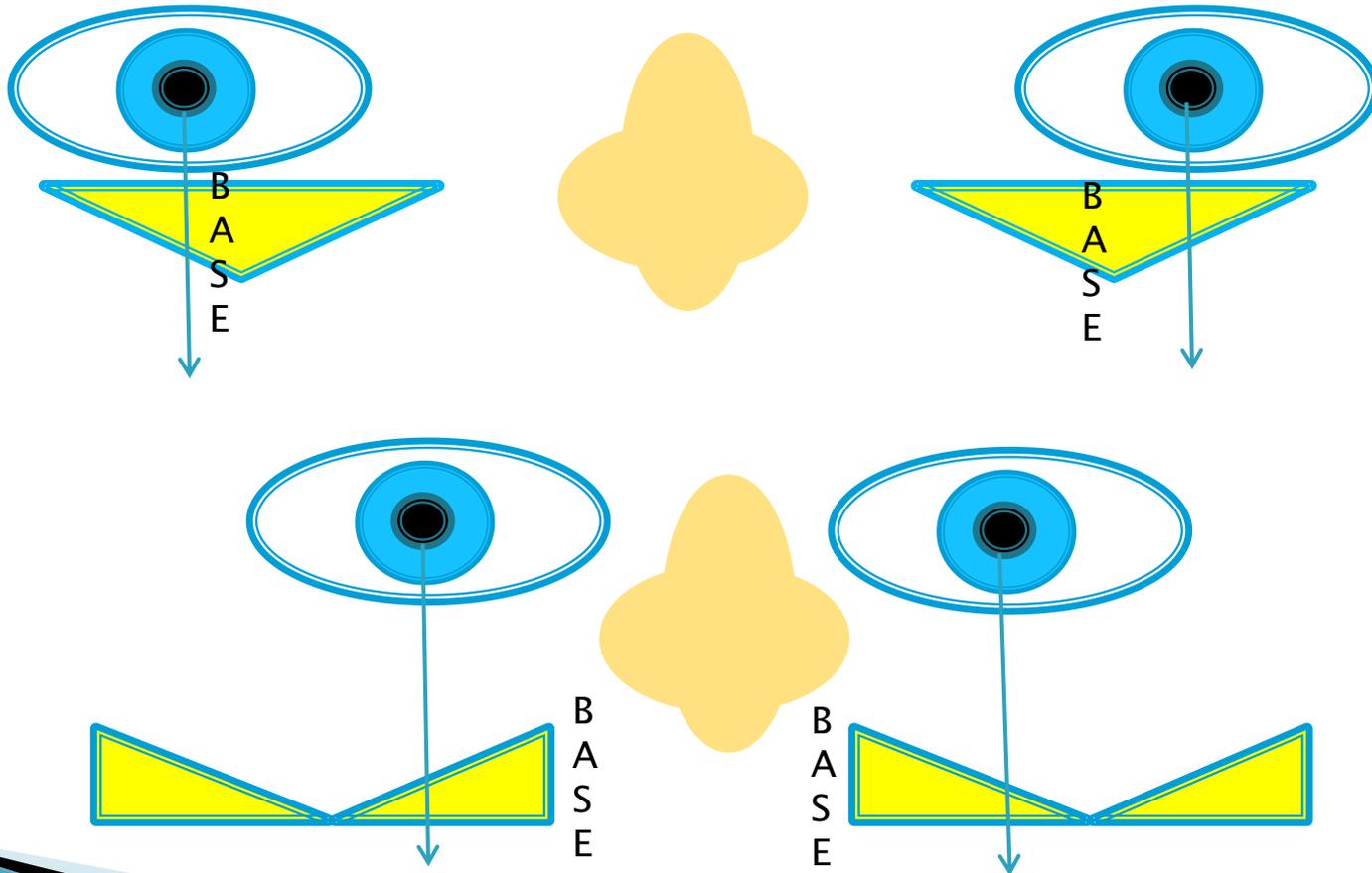
# Prismatic Effect

## Prism Base Out



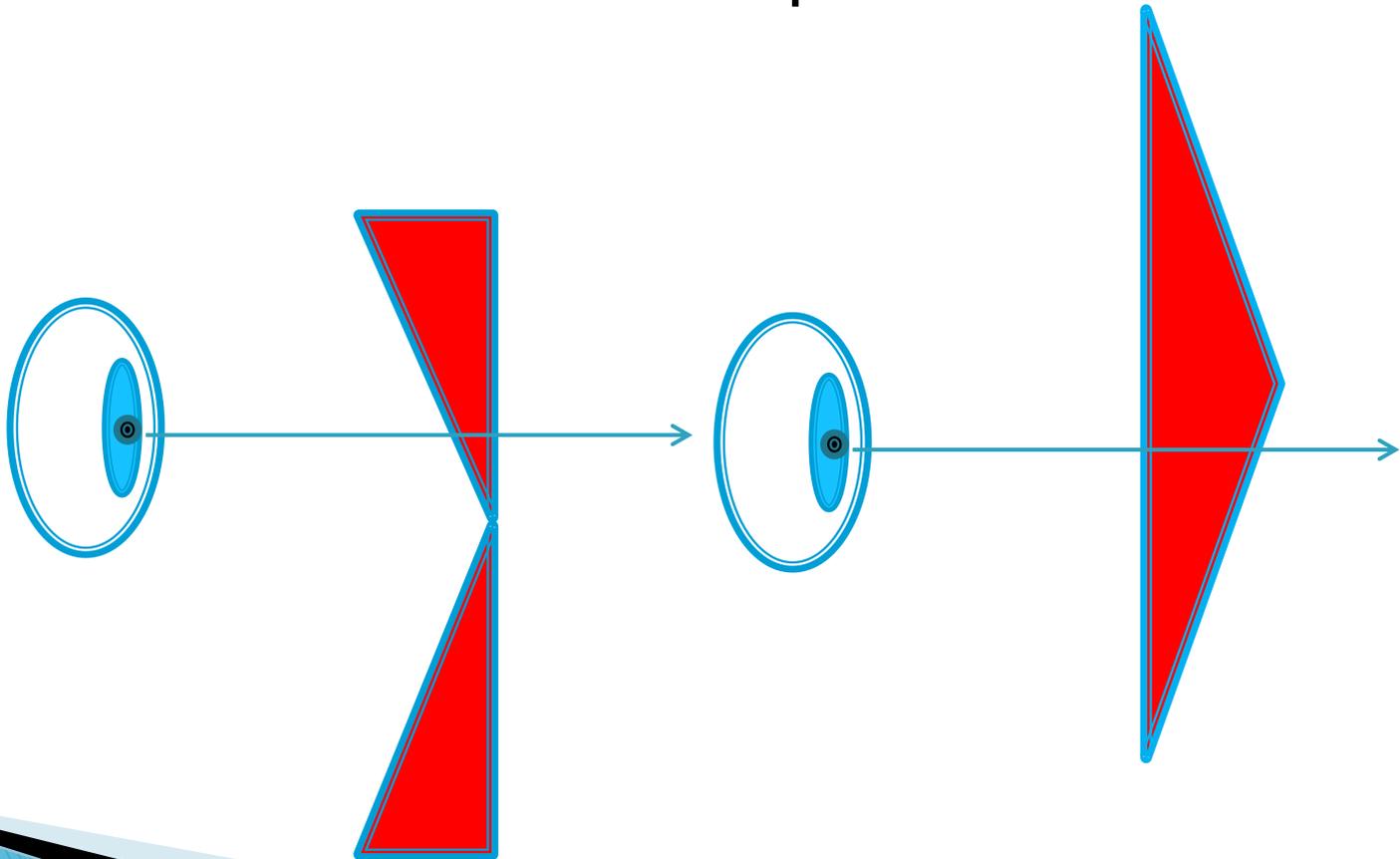
# Prismatic Effect

## Prism Base In



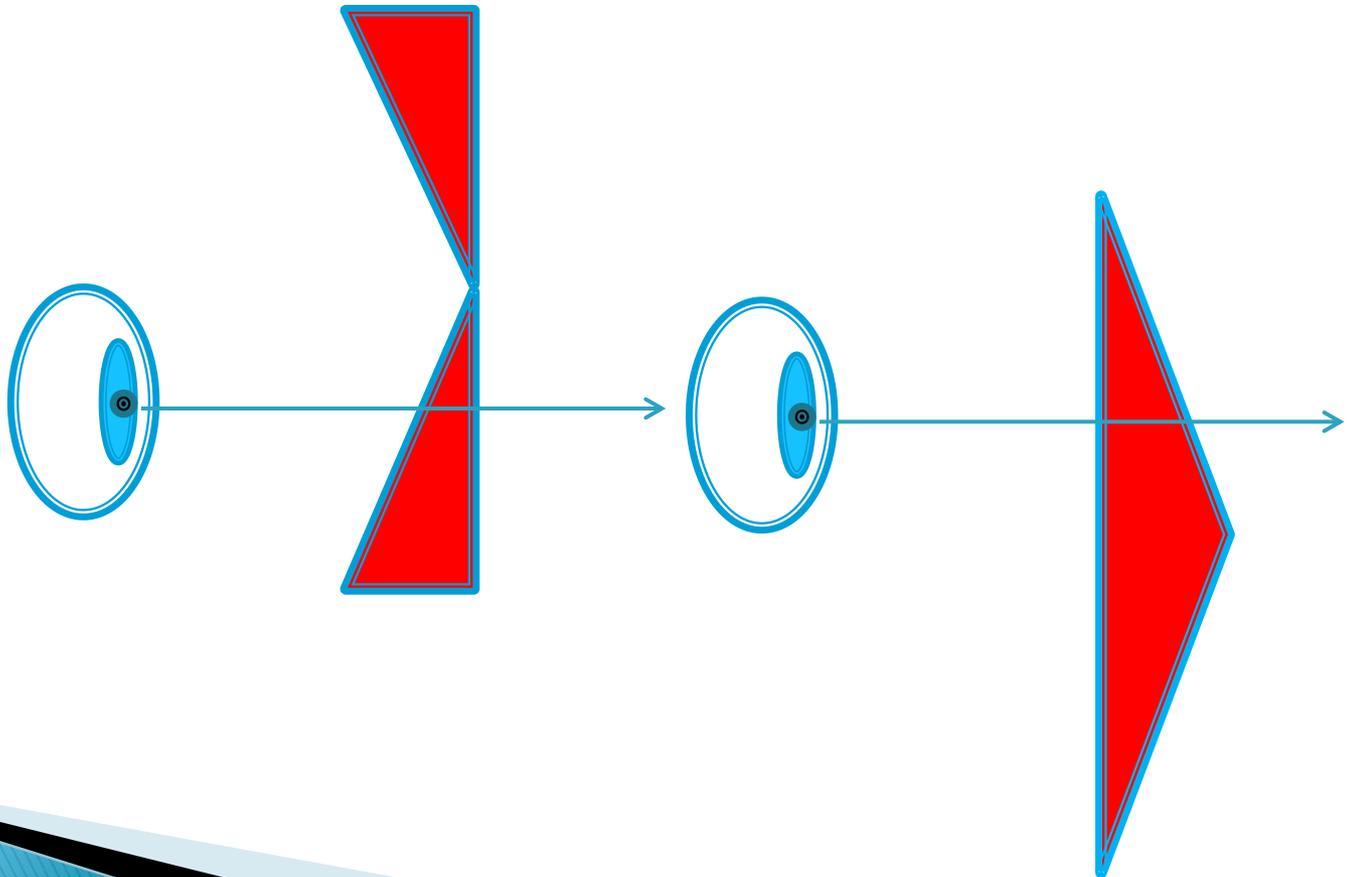
# Prismatic Effect

Prism Base Up

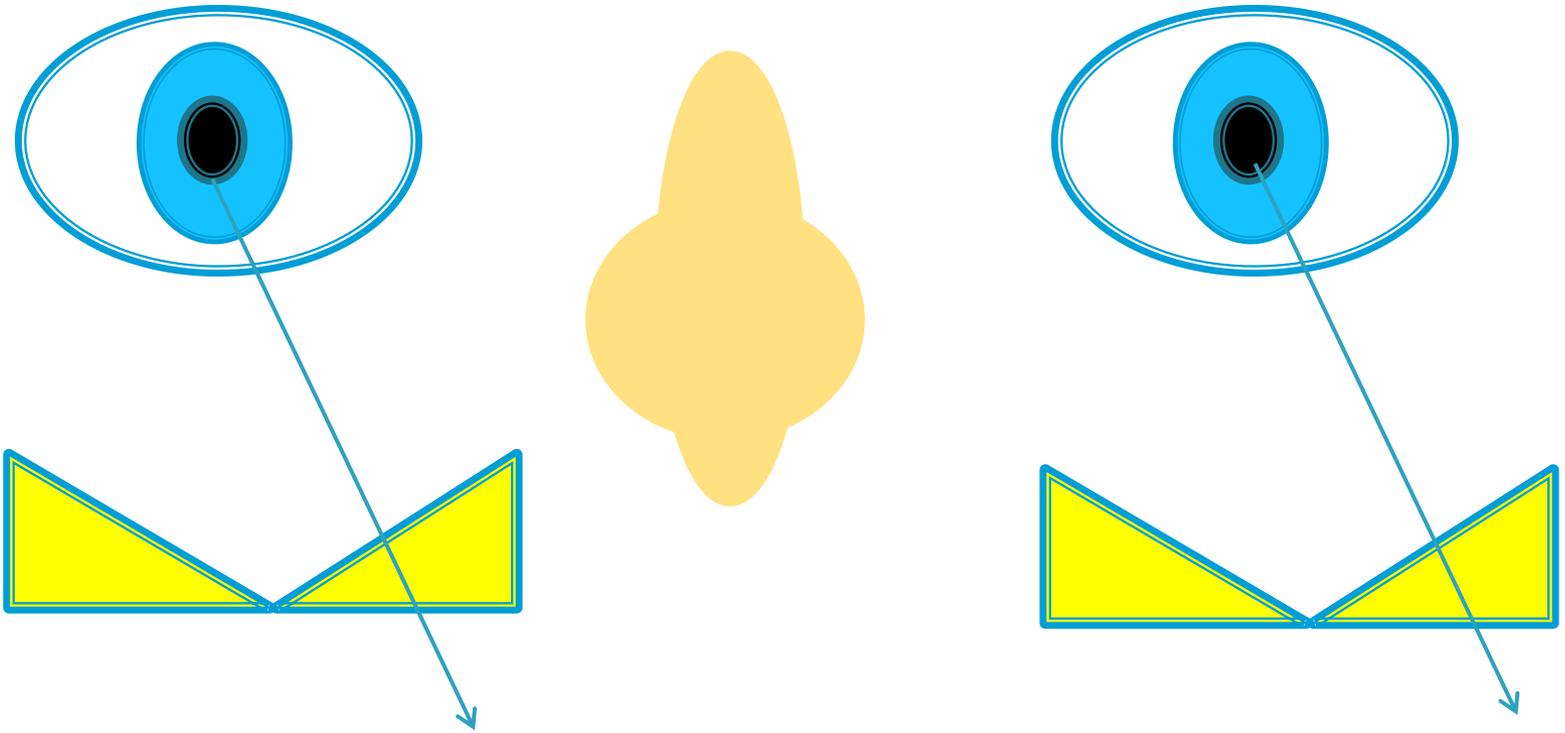


# Prismatic Effect

Prism Base Down



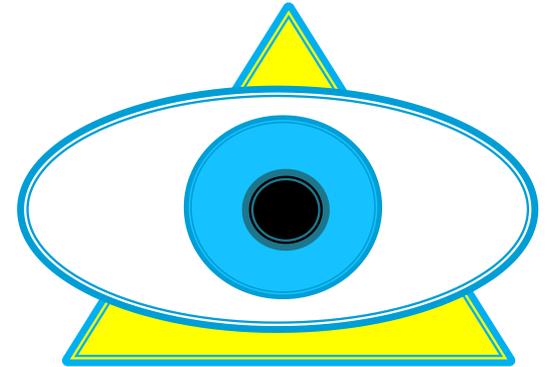
Viewing left - OD = BI, OS = BO



# Prismatic Effect

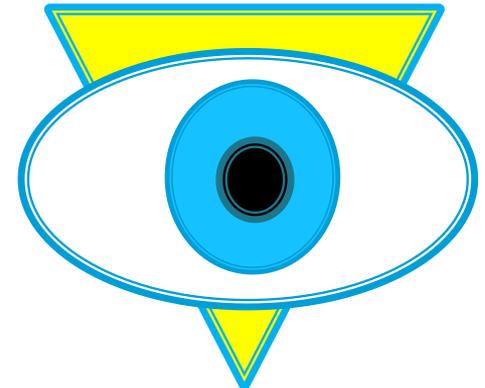
## #1 EXCESSIVE BASE DOWN :

- Floor ( Horizontal ) seems concave.  
Standing in bottom of a bowl.
  - Vertical objects seem taller.
    - Walking Uphill.



## #2 EXCESSIVE BASE UP :

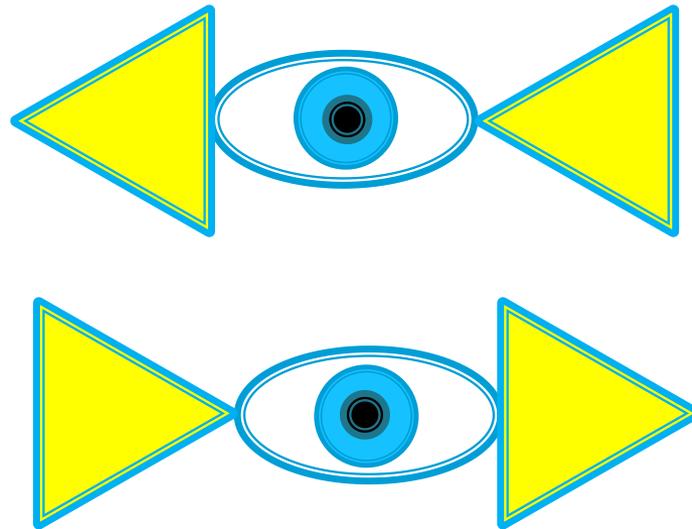
- Floor ( Horizontal ) seems convex.  
Standing on top of a hill.
  - Vertical objects seem shorter
    - Walking Downhill.



# Prismatic Effect

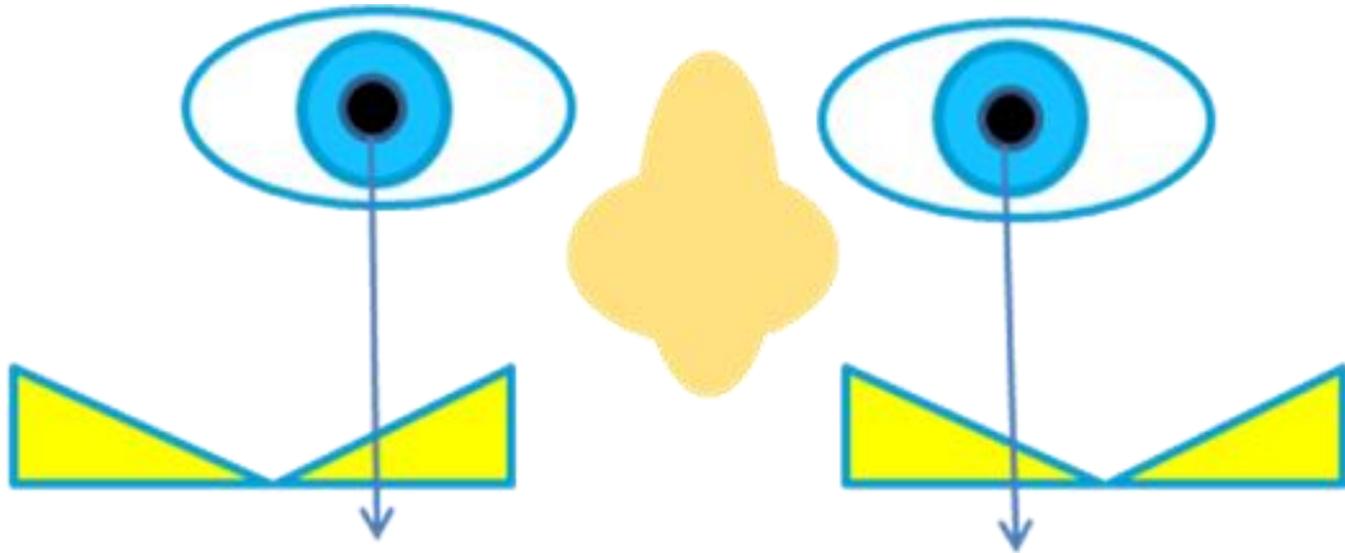
## #3 EXCESSIVE BASE IN OR OUT:

- Horizontal seems high towards base or / low towards apex.



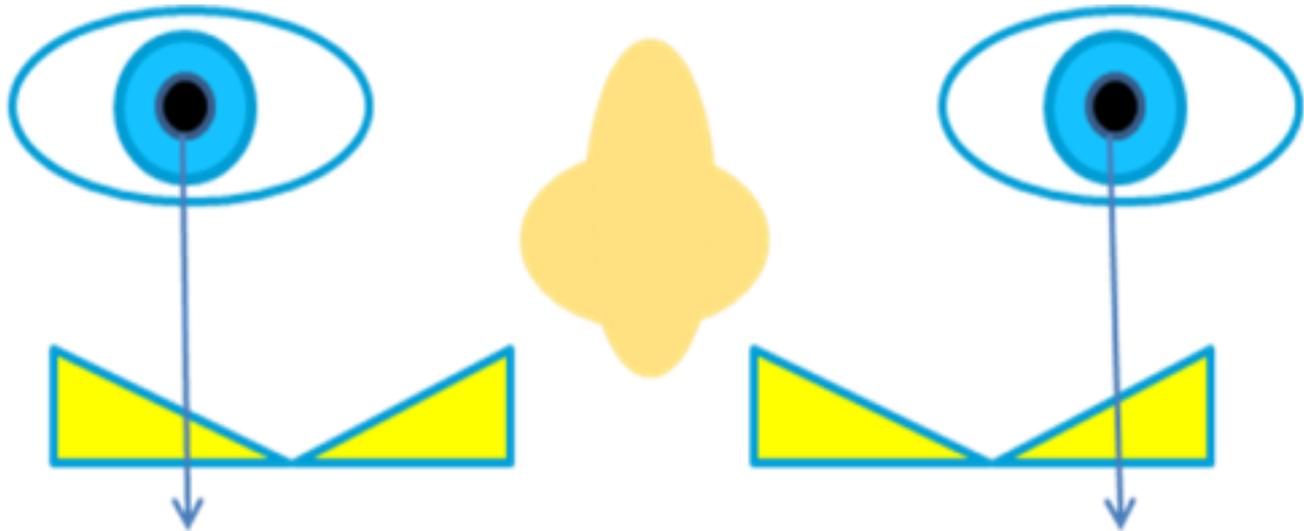
# Prismatic Effect

- ▶ Compounding Situations
  - Base In & Base In



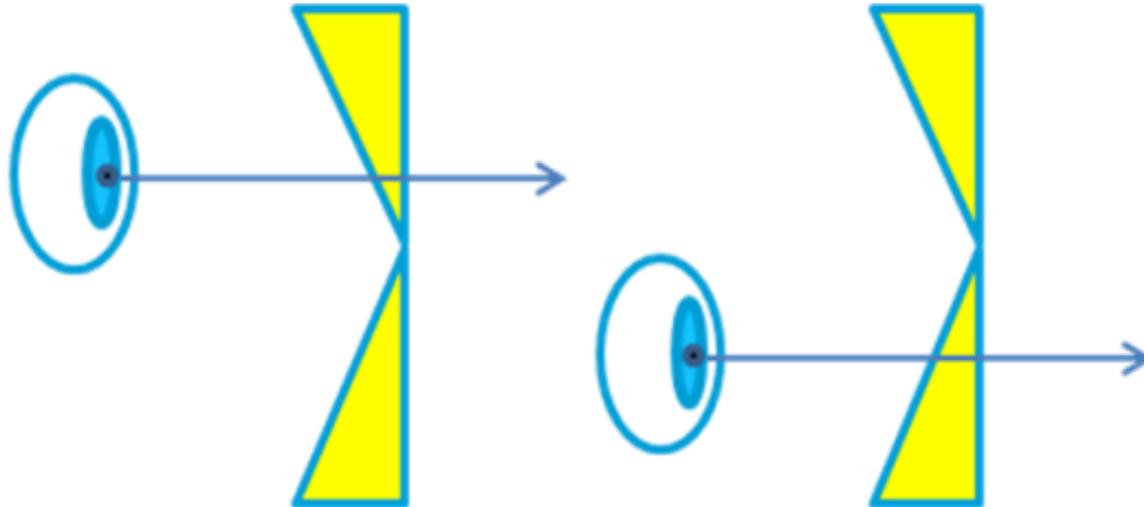
# Prismatic Effect

- ▶ Compounding Situations
  - Base Out & Base Out



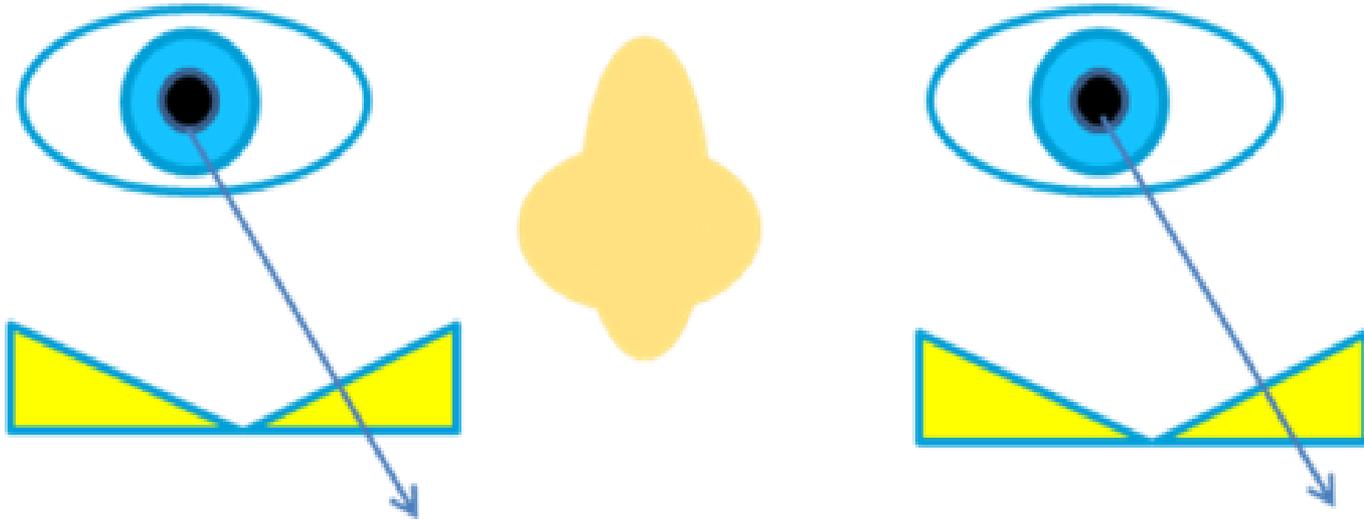
# Prismatic Effect

- ▶ Compounding Situations
  - Base Up & Base Down



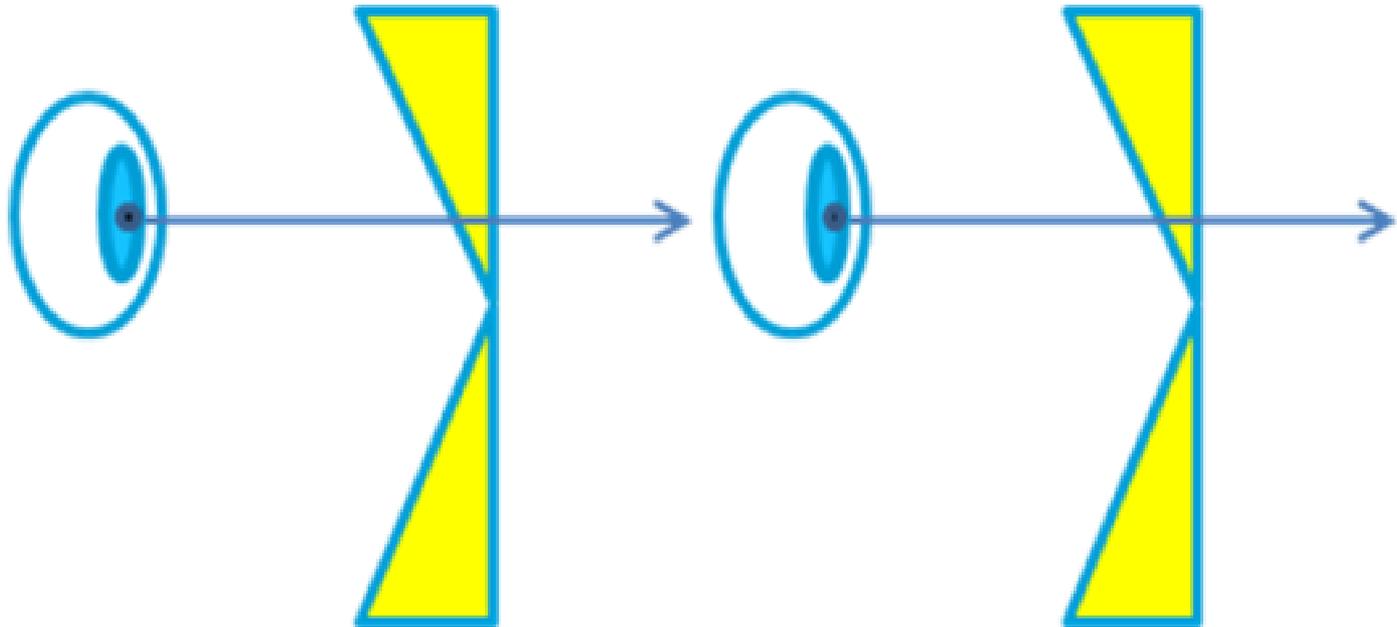
# Prismatic Effect

- ▶ Canceling Situations
  - Base in & base out



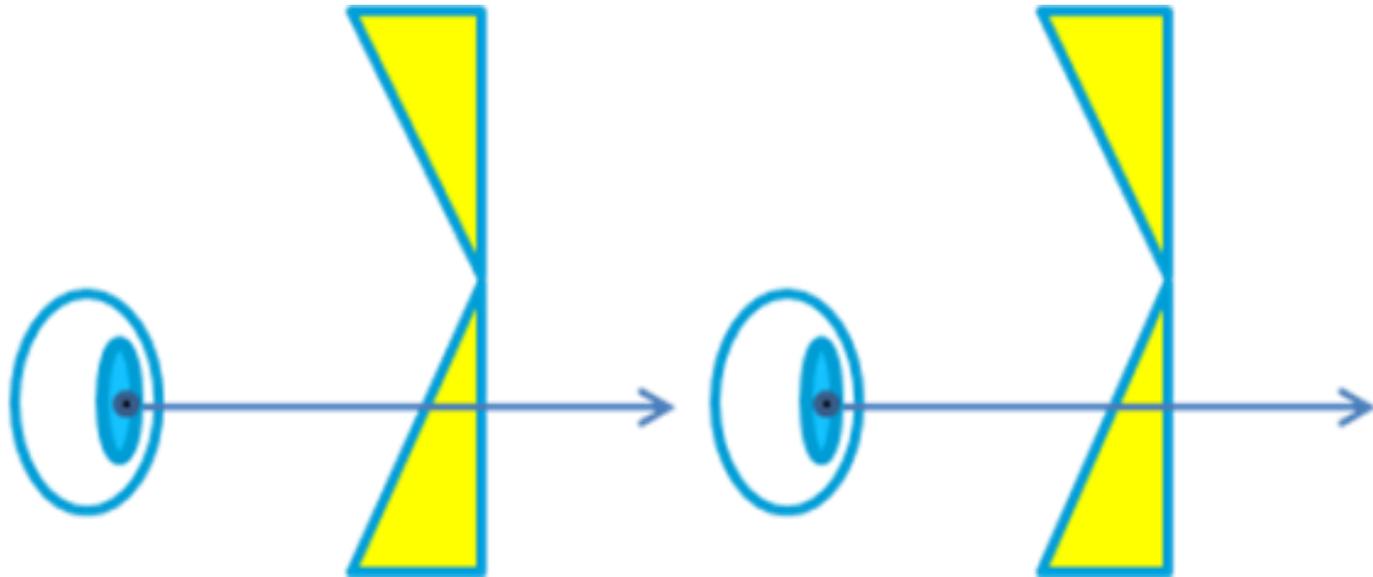
# Prismatic Effect

- ▶ Canceling Situations
  - Base up & base up

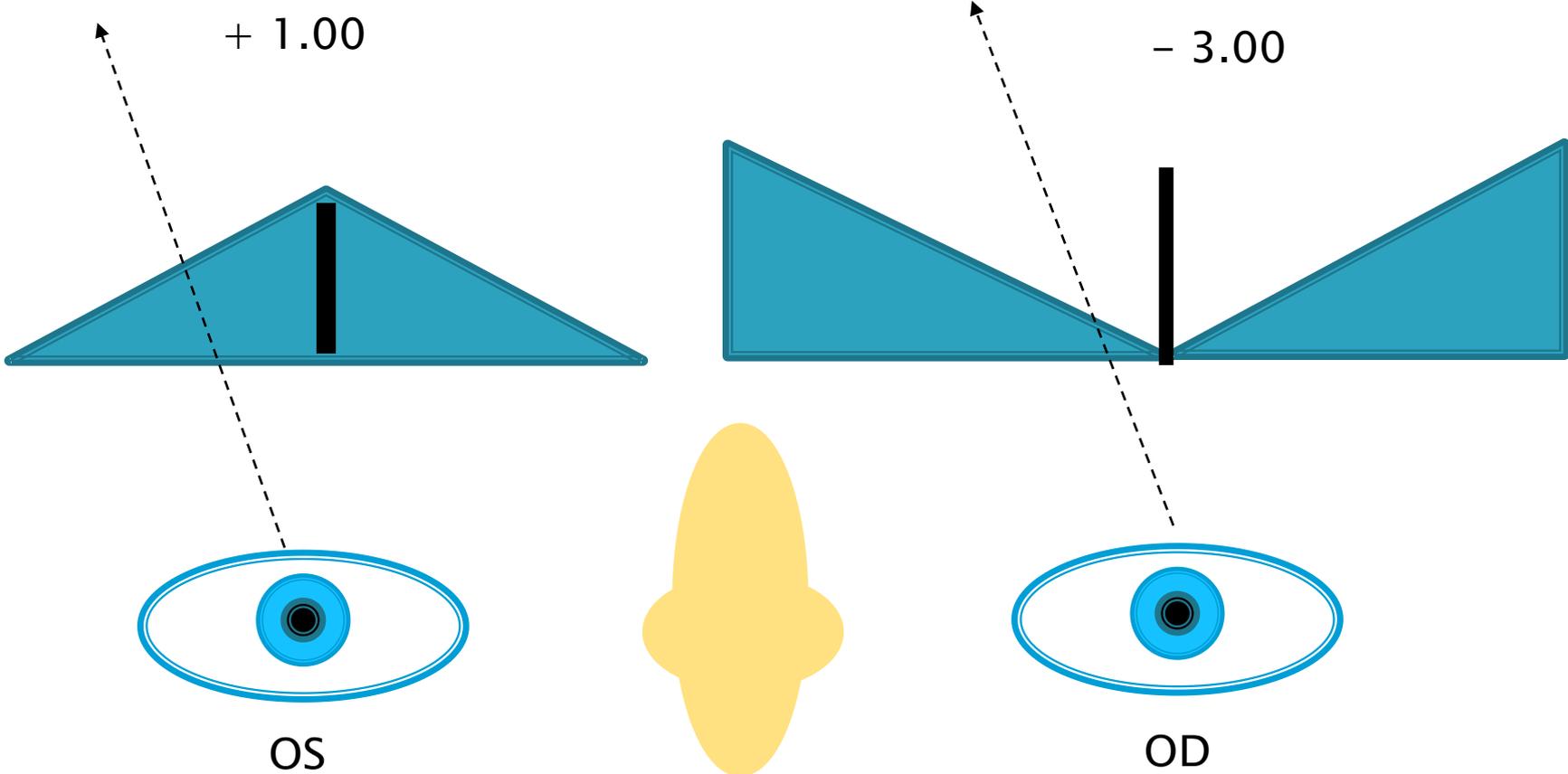


# Prismatic Effect

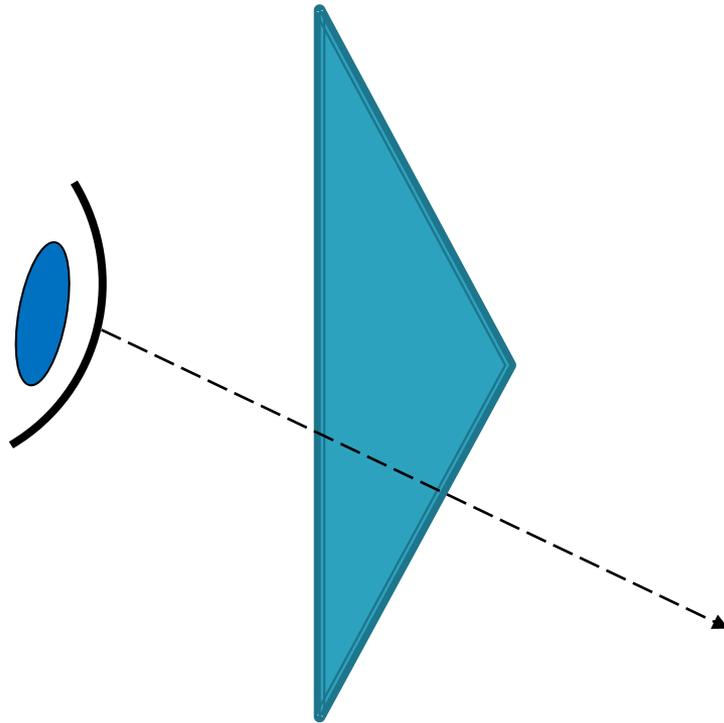
- ▶ Canceling Situations
  - Base down & base down



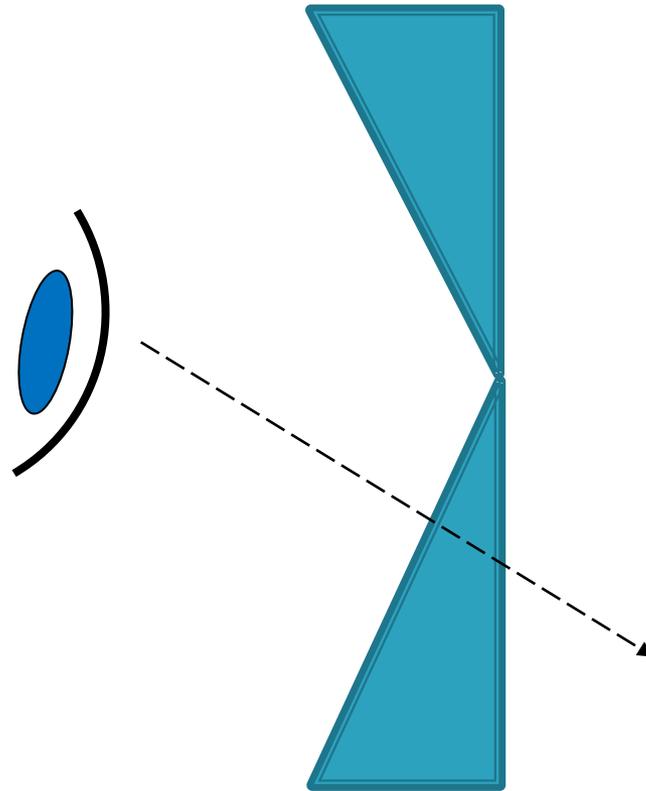
# Single Vision Displacement



# Base Directions – Plus Lens



# Base Direction – Minus Lens



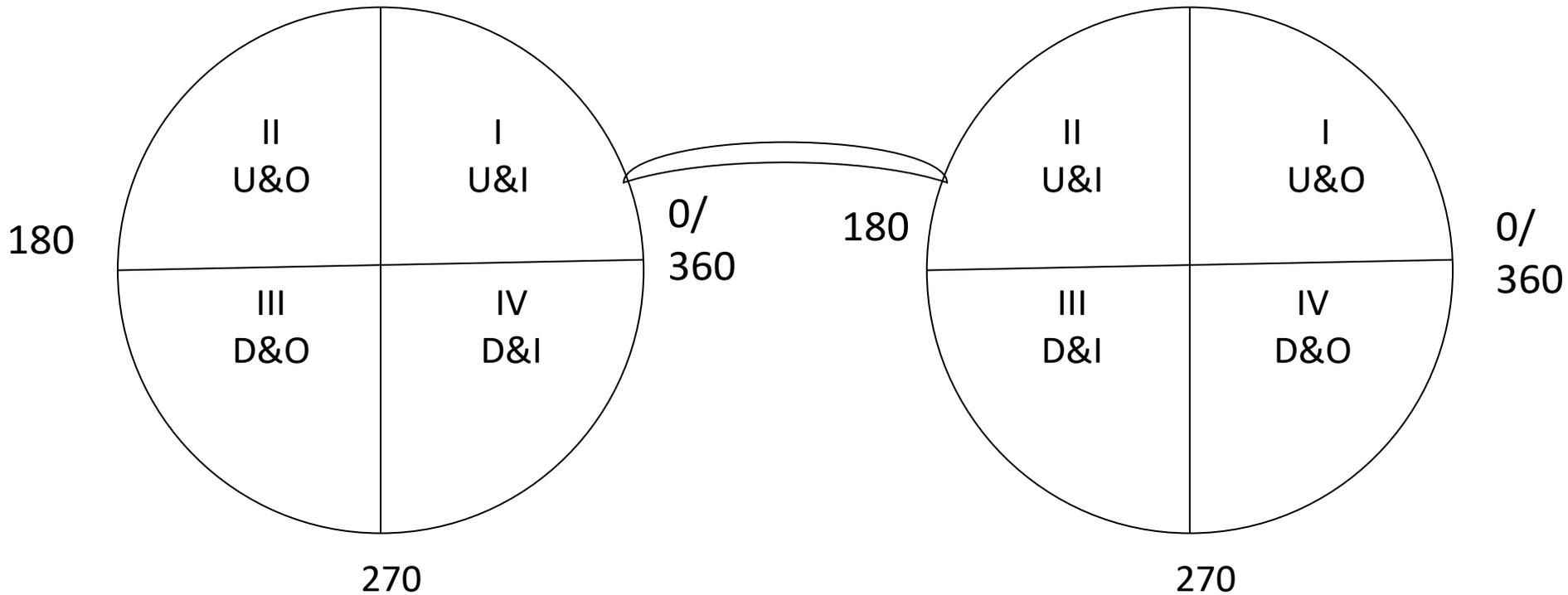
# Compound Prism



# Prism Designation

OD  
90

OS  
90

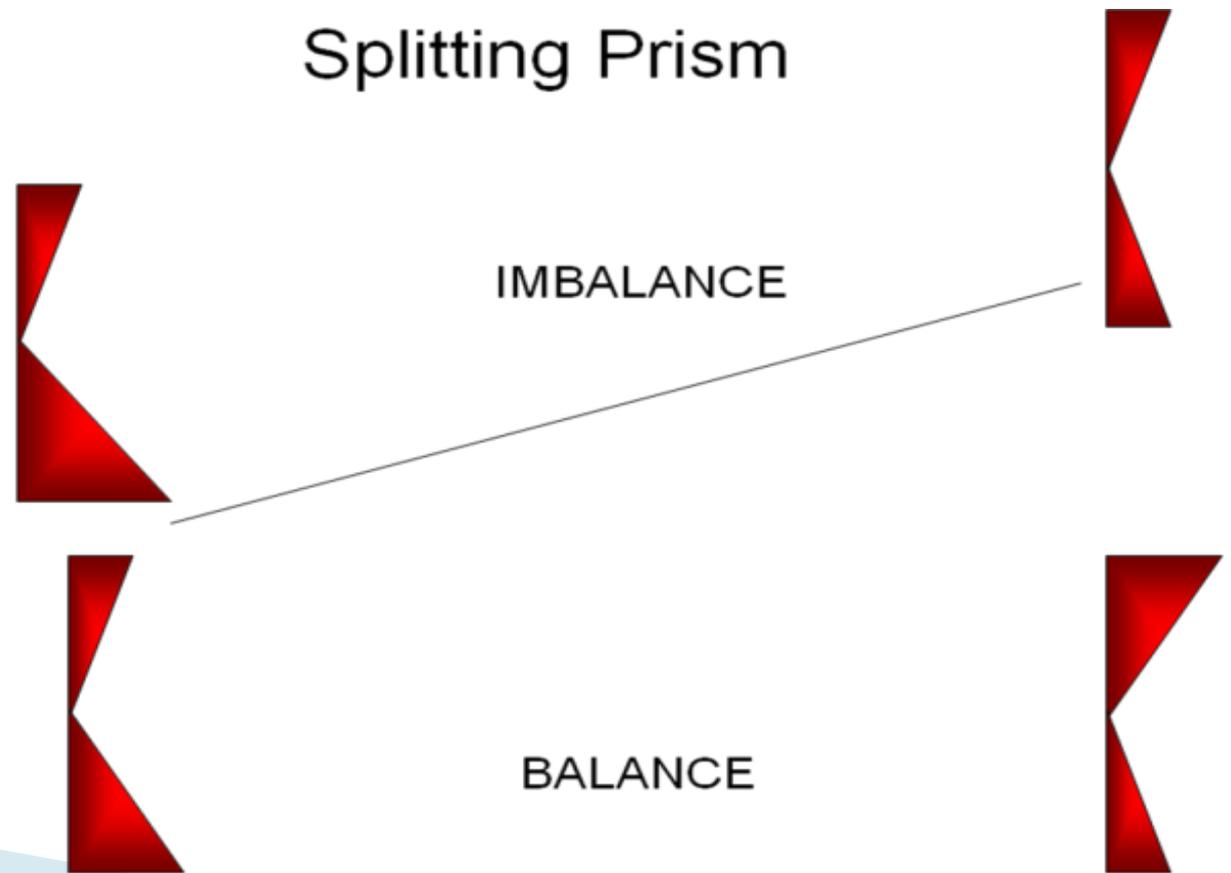


# Splitting Prism – Vertical

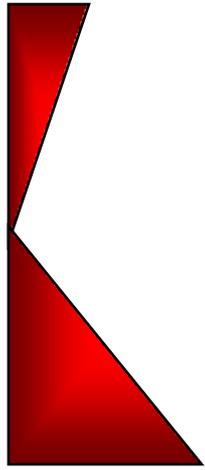
- ▶ When vertical prism is prescribed in one eye only, the dispenser can split the amount in order to balance lens weight and thickness as long as the half that remains in the originally prescribed eye remains in the prescribed direction in that eye.
  - ▶ Be sure to check with the doctor/refractionist before doing this.
- 

# Splitting Prism – Vertical

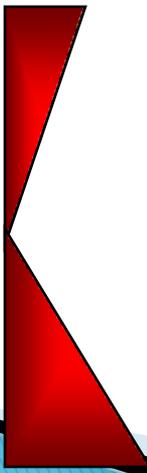
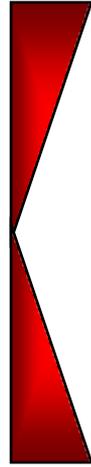
O.D.      -1.00 -0.25 X 180      10 Δ BD  
O.S.      -1.00



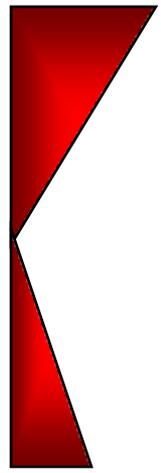
# Splitting Prism



IMBALANCE



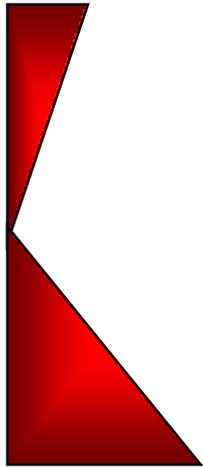
BALANCE



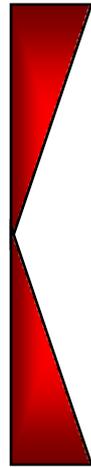
# Splitting Prism

O.D. -1.00 -0.25 X 180 10 Diopters Base Down

O.S. -1.00



OD



OS

The optical alignment of the patient's eyes are not matched and therefore the prescribed prism enables fusion for good binocular vision.

The weight and look of the finished lenses are not balanced.

# Splitting Prism

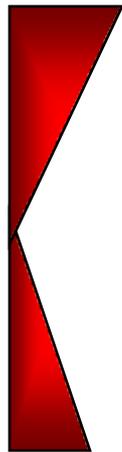
O.D.    -1.00 -0.25 X 180        5 Diopters Base Down

O.S.    -1.00                                5 Diopters Base

Up



OD



OS

The weight and look of the finished lenses are balanced by splitting the amount of the prism and ordering the lenses with the base direction the same in the originally prescribed eye and opposite in the other.

# Splitting Prism – Horizontal

- ▶ Prism that is prescribed horizontally for one eye can be split to achieve balance as long as the other eye carries half of the prism in the same direction as in the prescribed eye.
- ▶ Be sure to check with the doctor/refractionist before doing this.

# Splitting Prism – Horizontal

## Example

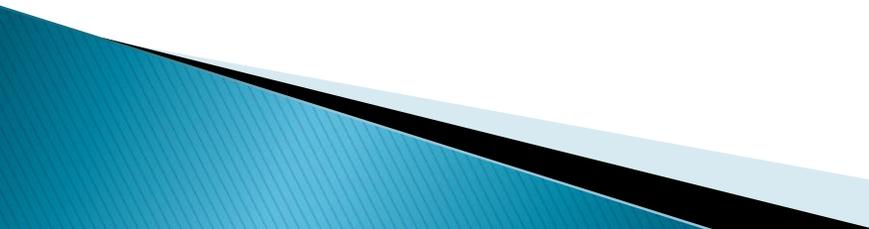
O.D.        -1.00 -0.25 X 180        10 Δ BI

O.S.        -1.00

O.D.        -1.00 -0.25 x 180        5 Δ BI

O.S.        -1.00        5 Δ BI

# Splitting Compounding Prism

- ▶ Sometimes there is prescribed prism in both lenses, one lens vertical and one lens horizontal.
  - ▶ If the prism is fairly strong we can split the prism for the same reasons as previously discussed: weight, thickness, and appearance.
  - ▶ The following example will demonstrate how the use of compounding prism will balance the two lenses:
- 

# Splitting Compounding Prism

- ▶ Example:

- ▶

- ▶ OD            pl 3 BU

- ▶ OS            pl 4 BI

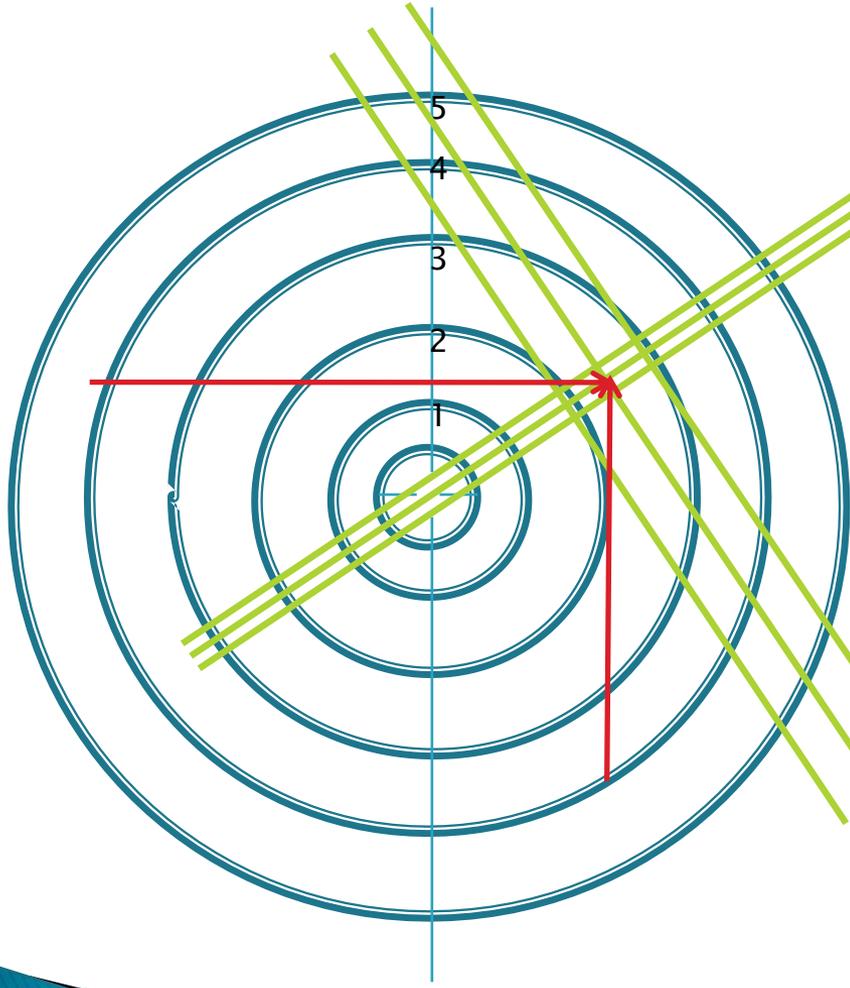
- ▶ The best result would be the following:

- ▶ OD            pl 1.5 BU & 2 BI

- ▶ OS            pl 1.5 BD & 2 BI

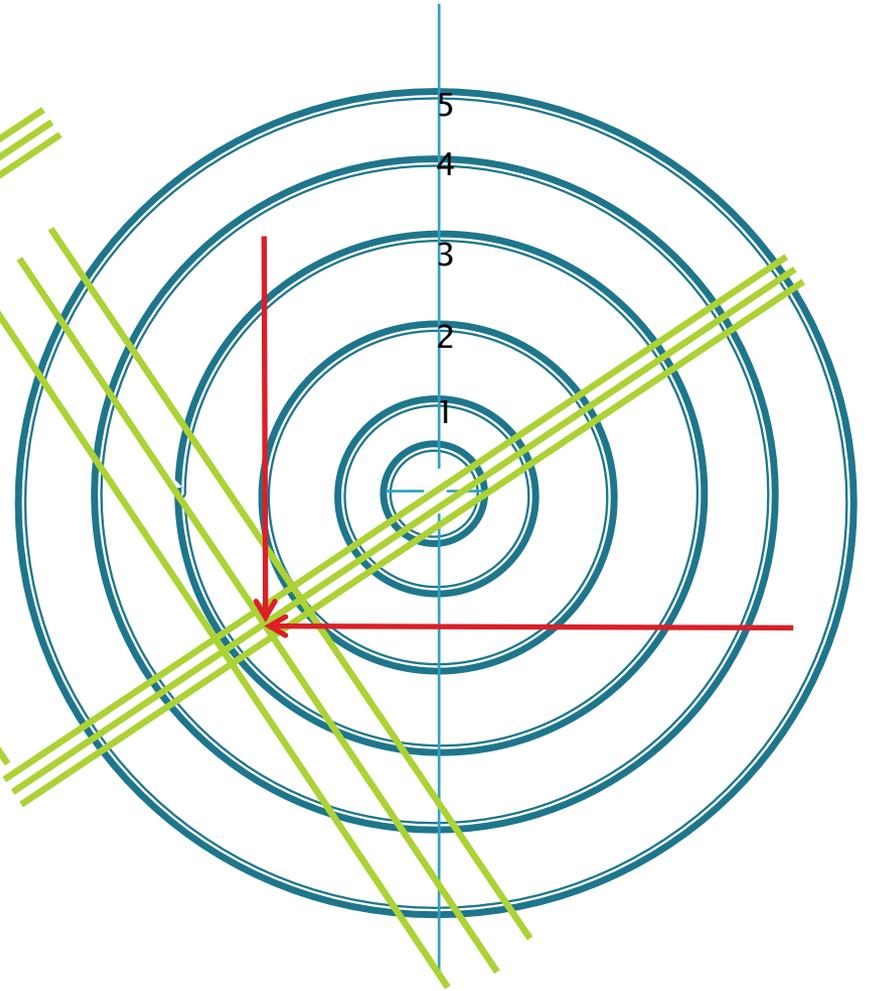
OD

pl 1.5 BU & 2 BI



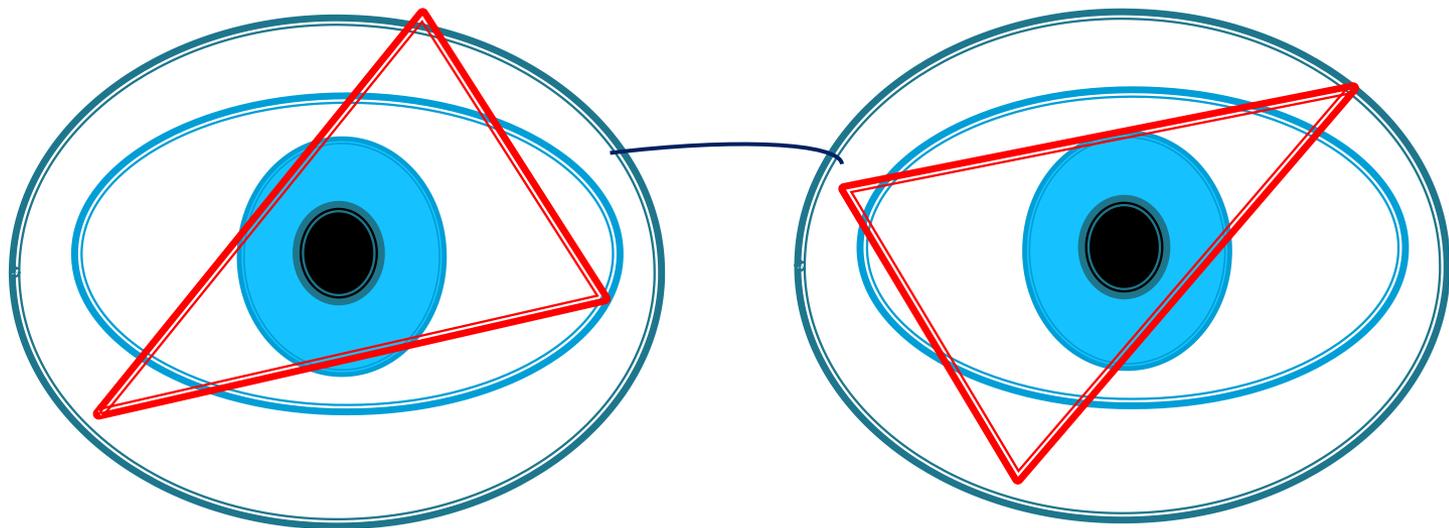
OS

pl 1.5 BD & 2 BI



OD

OS



# Prescribed Prism at Degree Meridians

- ▶ Looks like cylinder power with a twist
  - ▶ It will show the total amount of prism and give a meridian for the base direction.
  - ▶ The doctor/refractionist may prescribe prism that has both a vertical and horizontal component in the same lens.
- 

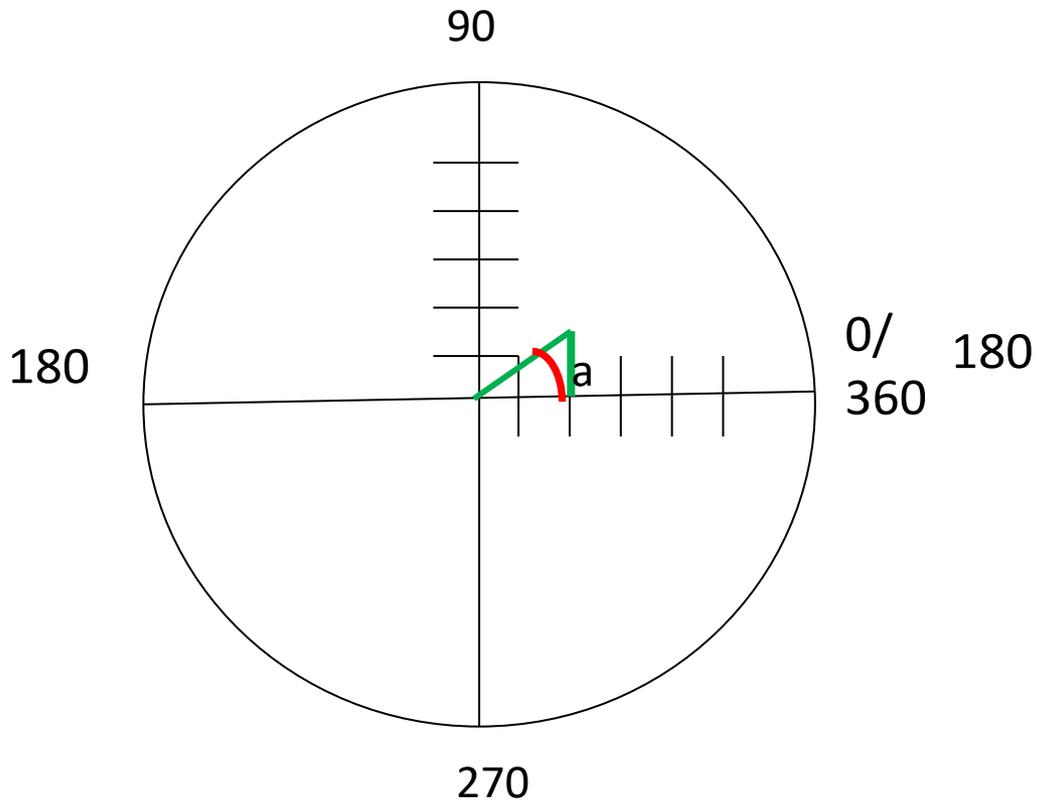
# Prescribed Prism at Degree Meridians

- ▶ The doctor/refractionist may write the prescribed prism as follows:
  - ▶ OD            PI 2.5 @ 037
  - ▶ OS            PI 2.5 @ 217

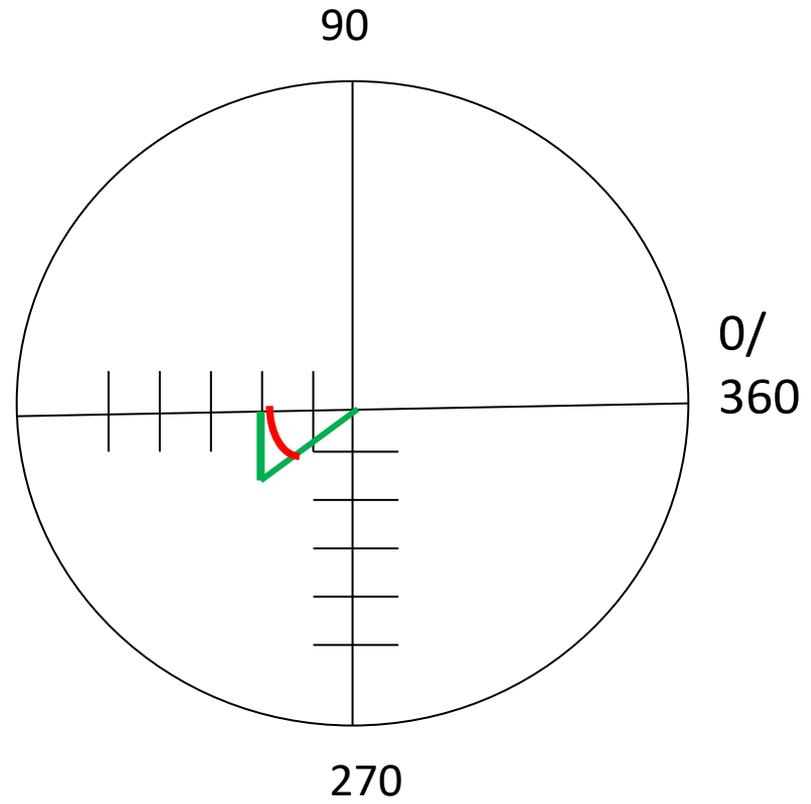
# Prescribed Prism at Degree Meridians

- ▶ Or, some eyecare professionals like to write it like this:
- ▶ ODPI 2.5 BU&I @ 037
- ▶ OS PI 2.5 BD&I @ 217

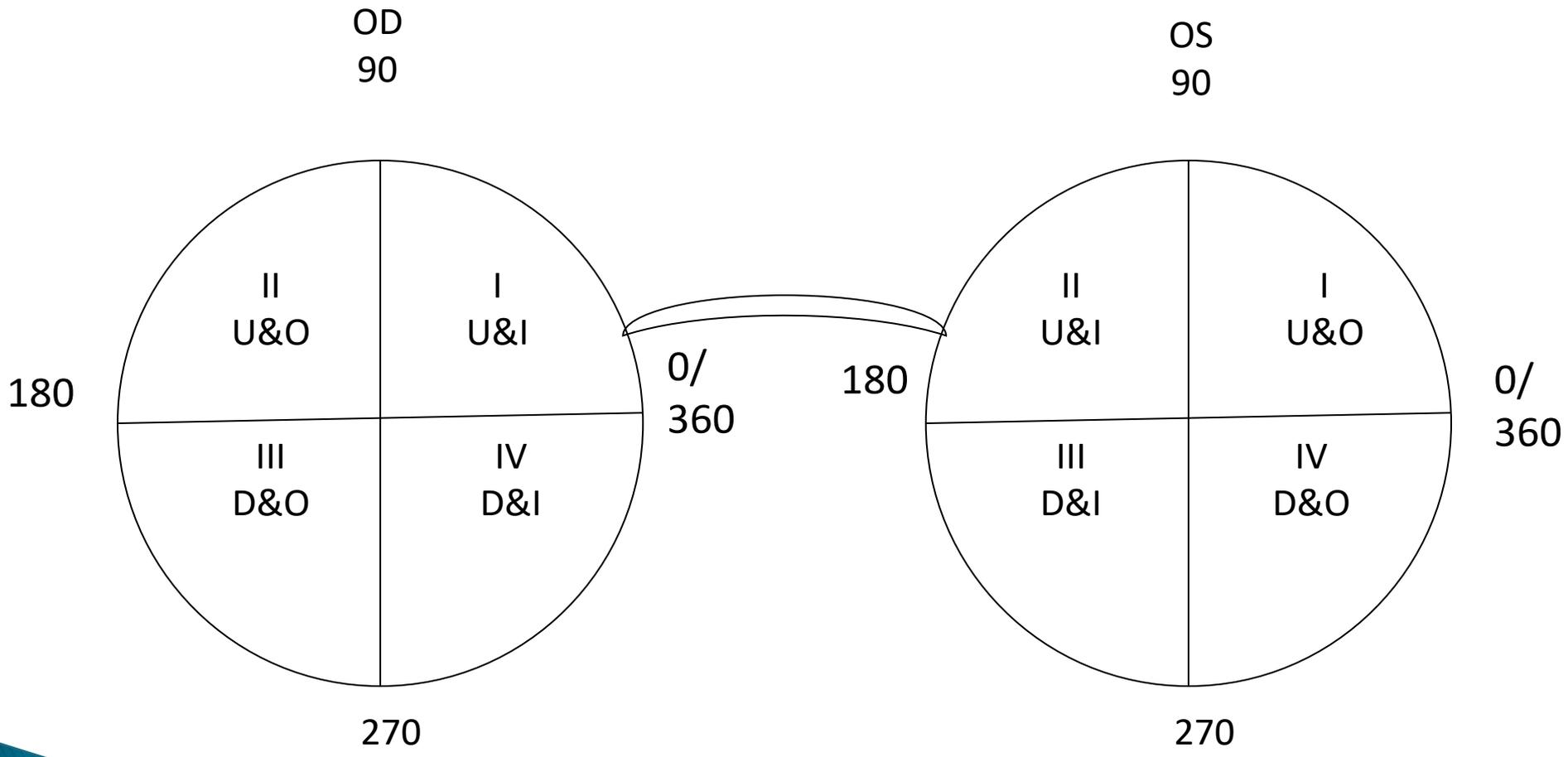
OD pl 1.5 BU & 2 BI



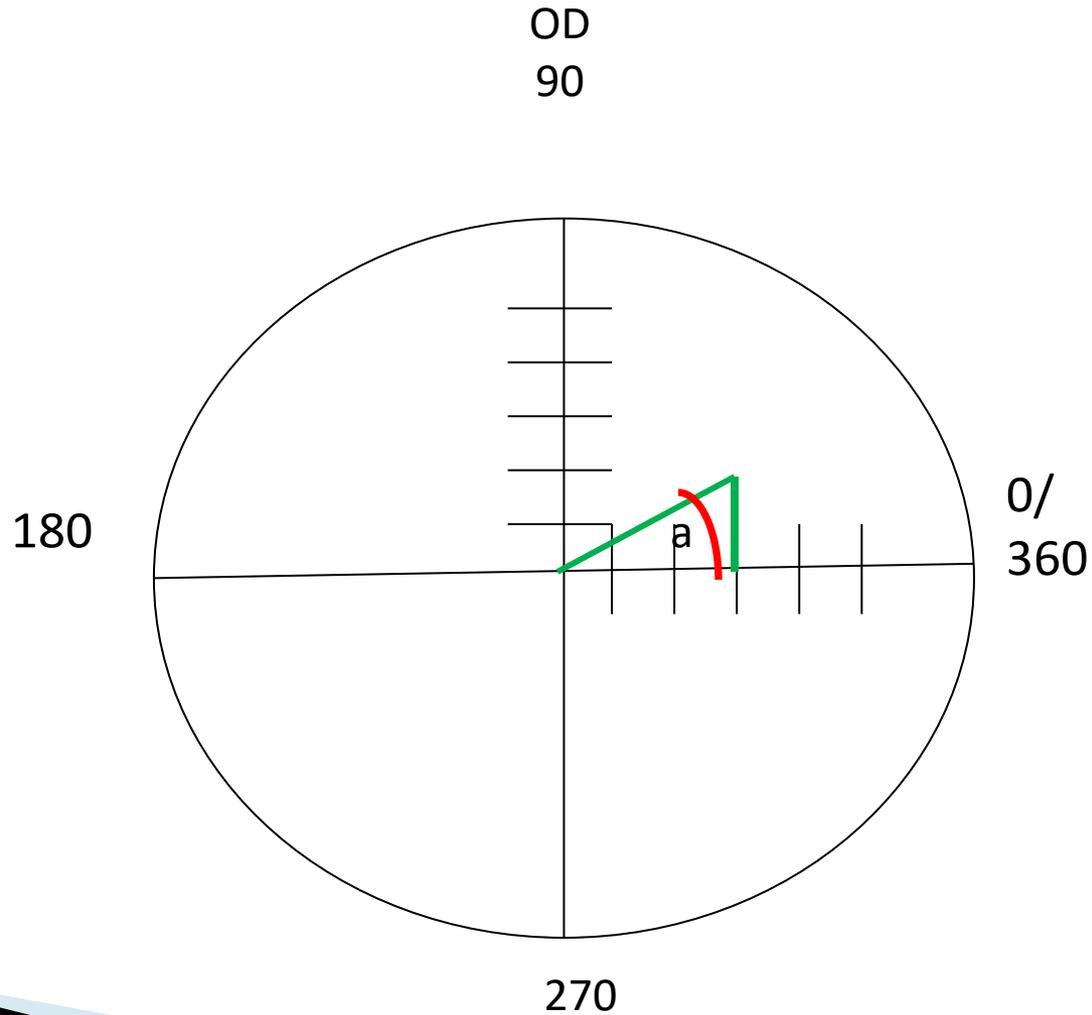
OD pl 1.5 BD & 2 BI



# Resultant Prism



# Resultant Prism



# Resultant Prism

$$R = \sqrt{\text{Vertical Prism}^2 + \text{Horizontal Prism}^2}$$

*Example 2 diopters up and 3 diopters in*

$$R = \sqrt{2^2 + 3^2}$$

$$R = \sqrt{4 + 9}$$

$$R = \sqrt{13}$$

$$R = 3.61 \text{ diopters}$$

- First identify how much prism. The resolved amount of prism is determined by using the above formula. That amount of prism is then ground at the axis that is arrived at by drawing the diagonal of the parallelogram graphed using the prescribed prisms.
  - In this example we have 3 diopters in and 2 diopters up in the right eye.
  - Although we show the entire process, here, let's go through the steps using your scientific calculator.
- 

Begin by simply looking at the formula and plugging in the known values to the formula

$$R = \sqrt{2^2 + 3^2}$$

The next level is pretty straight forward. Look for your squared button with is  $x^2$ . Next do the math.

2 squared is 4 and 3 squared is 9. Added together they are 13.

$$R = \sqrt{2^2 + 3^2}$$

$$R = \sqrt{4 + 9}$$

$$R = \sqrt{13}$$

# Resultant Prism

$$R = \sqrt{13}$$

Leaving 13 on your calculator use the

$$\sqrt{x}$$

on your calculator. The result will be  
3.605551275 rounded to 3.61 diopters

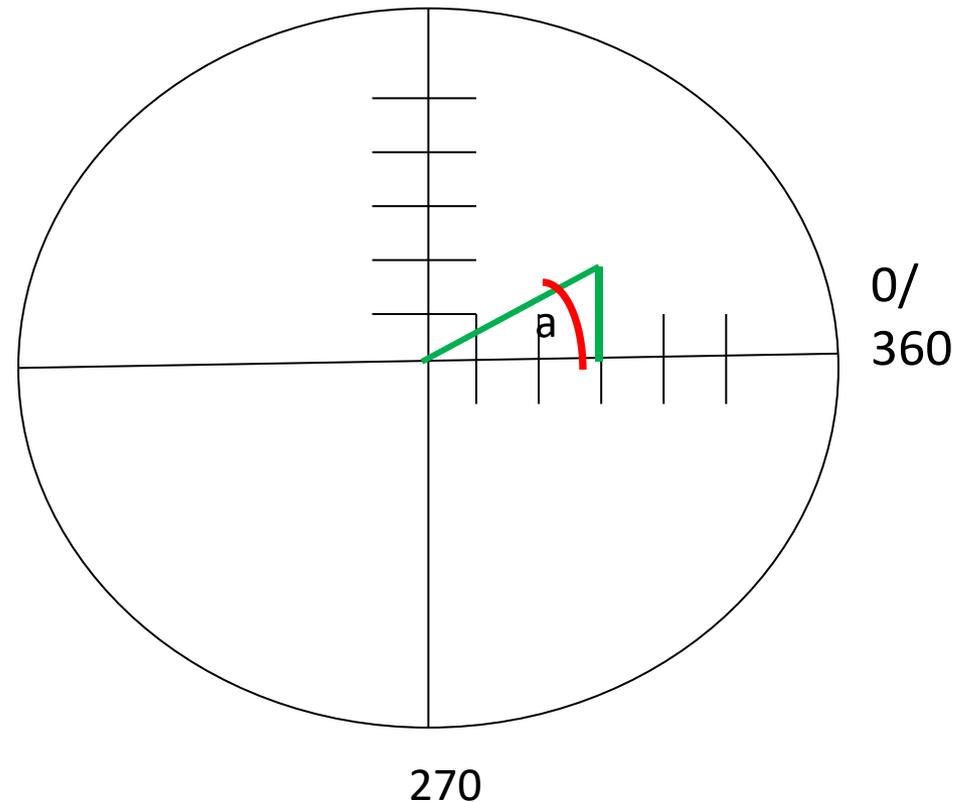
$$R = 3.61 \text{ diopters}$$

# Resultant Prism

- the green lines here represent the resultant prism and form a right triangle.
- The resultant prism is the length of the longest line in the right triangle.
- This would also equate to the hypotenuse of a right triangle.
- The resultant formula that we just did shows that there is 3.61 prism diopters, but we need to know the degree of the axis, which is represented by the red angle  $a$ .
- To find out that, we continue to use another formula.

OD  
90

OD  
90



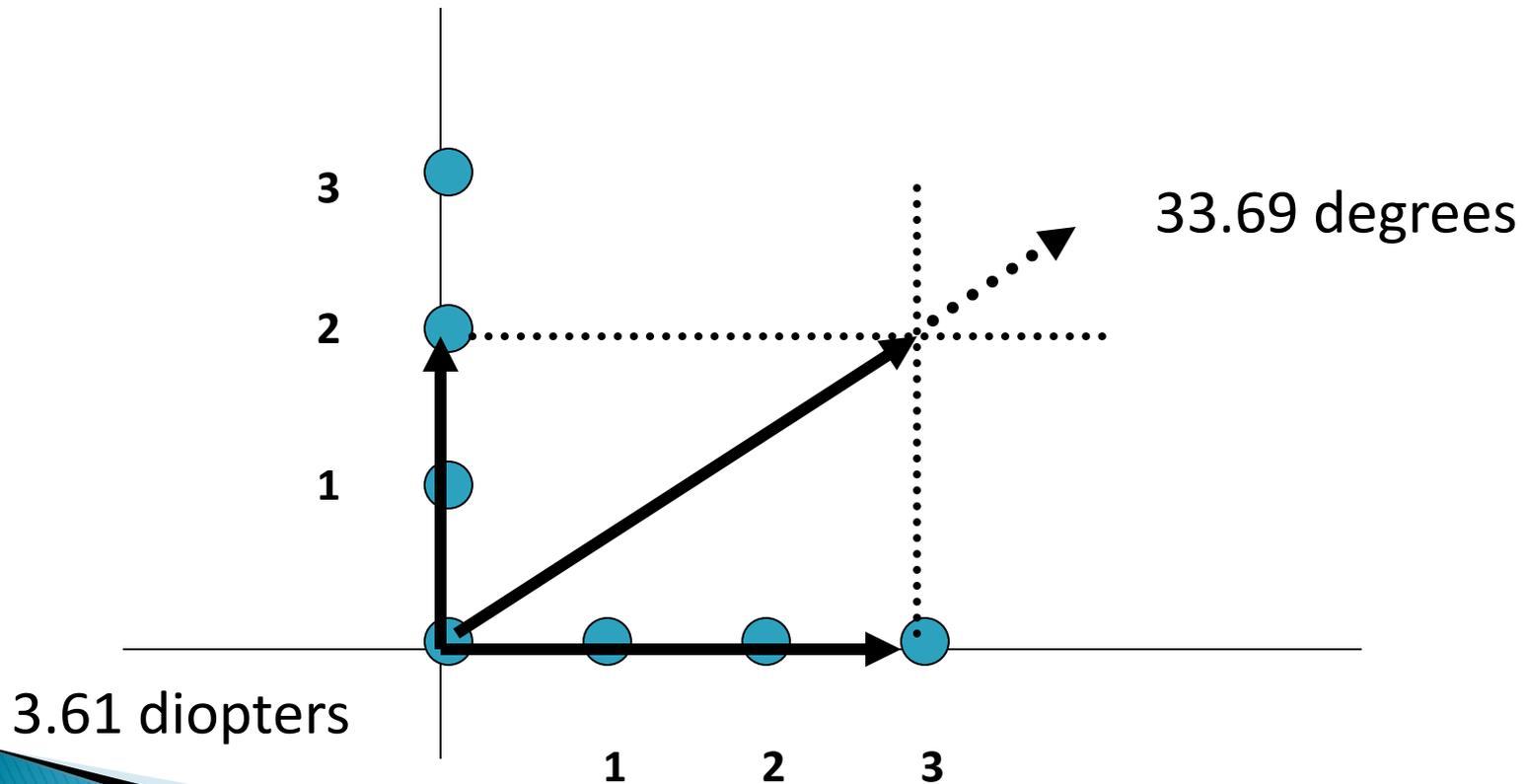
# Resultant Prism Degree

- ▶  $\tan a = V/H$
- ▶  $\tan a = 2/3$
- ▶ First divide 2 by 3 = .666666667 don't round yet
- ▶ Then go to 2<sup>nd</sup> function on your calculator and THEN TAN.
- ▶ The answer is 33.690006753 rounded to 33.69
- ▶ Note, you may have a button on the calculator labeled "inv" or "arc" rather than using the 2<sup>nd</sup> function button.

# Resultant Prism Degree

- ▶ Look at your quadrants. If the answer falls within the quadrant you want, i.e. I, that is your answer. If, however it is in another quadrant, you will add 90 to your answer for quadrant II, 180 to your answer for quadrant III and 270 to your answer for quadrant IV.

3.61 diopters ground at 33.69 degrees



- ▶ Resultant Prism or Compounding Prism shows the prism's polar orientation (Rx II) Vs. rectangular orientation (RX I).
  - ▶ Compounding prism is expressed in dioptric power and it's orientation in degrees.
- 

# Resolving Prism

- ▶ The trigonometrical function of identifying the prism

# Conclusion

- ▶ As you can see there are a number of things regarding prism that you would need to look for and identify when both analyzing an Rx as well as when inspecting a pair of mounted lenses.
  - ▶ In order to maximize your patient's vision, it is incumbent upon you, the dispenser, to identify all of the concerns and then make recommendations as to how to improve the vision of your patient.
- 

**Questions / Answers / Comments**  
**Thank You**

