Prentice's Rule and Finding the Power of a Lens in Any Meridian

By
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Course Description

- This course will include unwanted prism, prism by decentration, Prentice's Rule, prism imbalance and finding the power of a lens in any meridian.

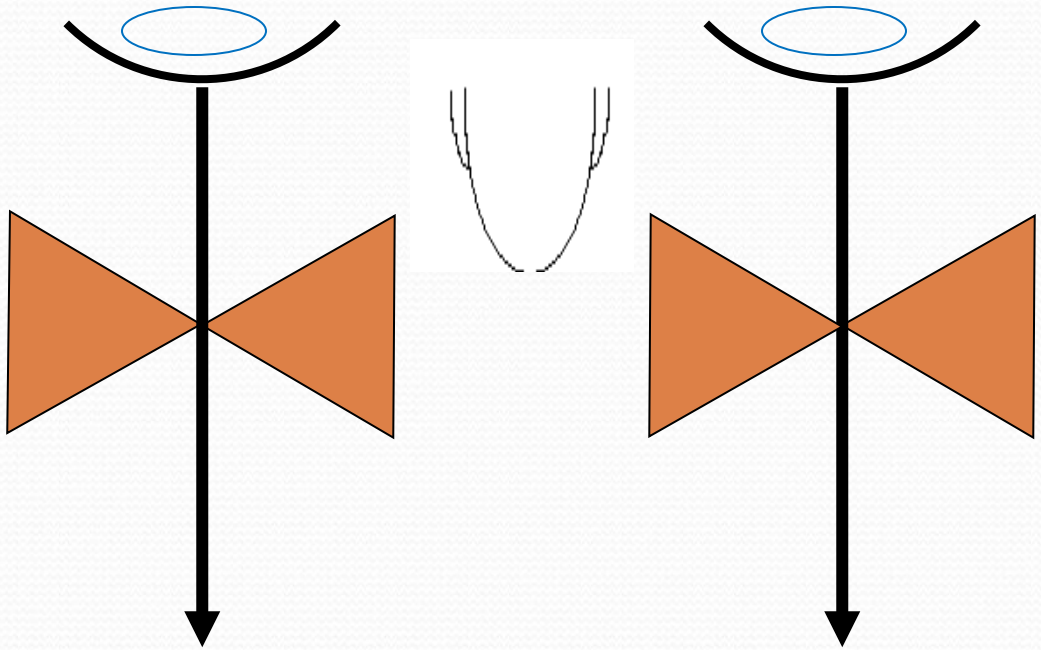
Learning objectives/outcomes

- At the completion of this course, the participant will be able to:
  - Identify unwanted prism
  - Be able to induce prism by decentration
  - Utilize Prentice's Rule
  - Find the power of a lens in any meridian
  - Explain vertical imbalance
  - Describe ways of correcting vertical imbalance

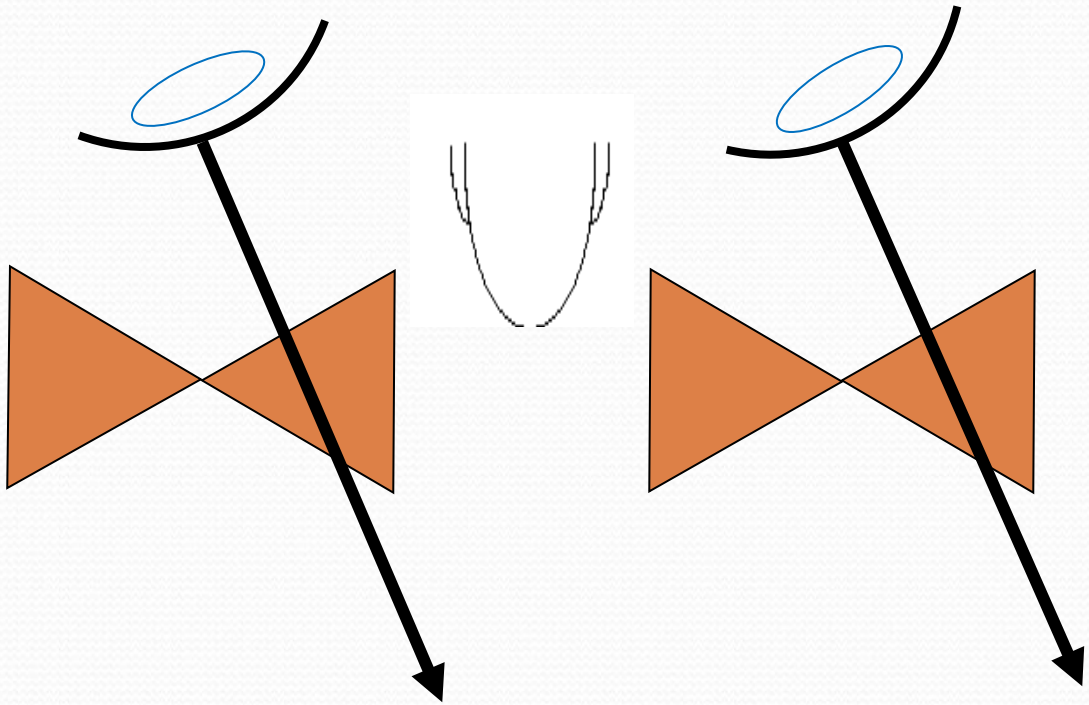
Prismatic Effect

- Unwanted prism

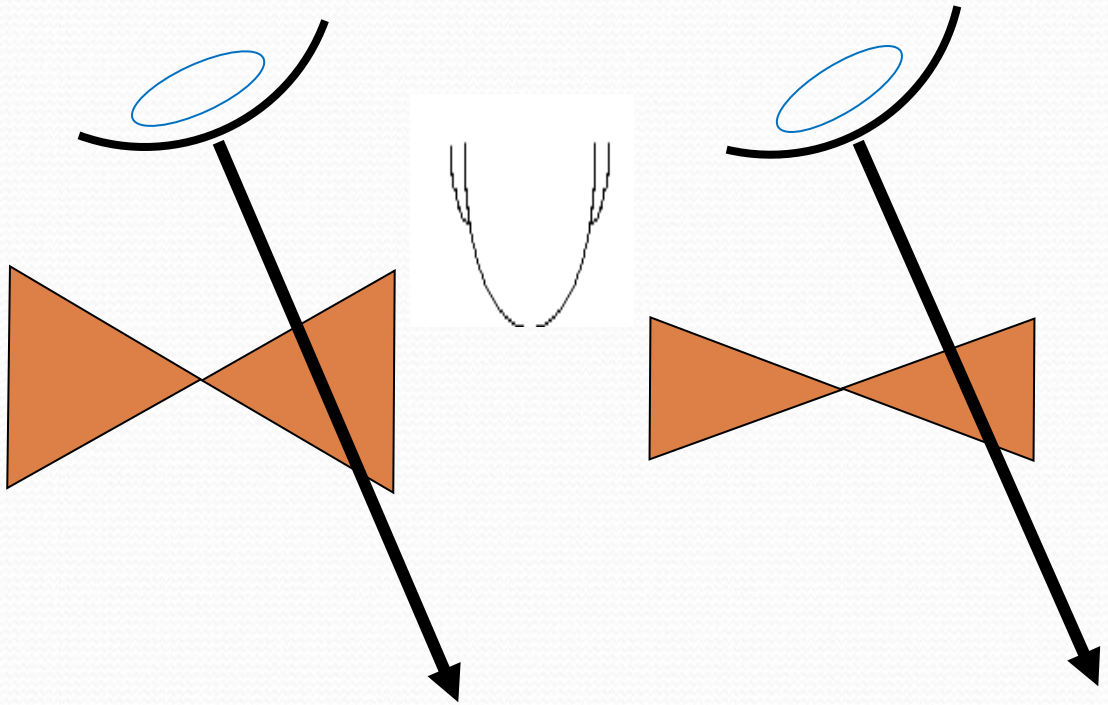
Aligning OC at patient's visual axis



Equal Prism



Equal Prism



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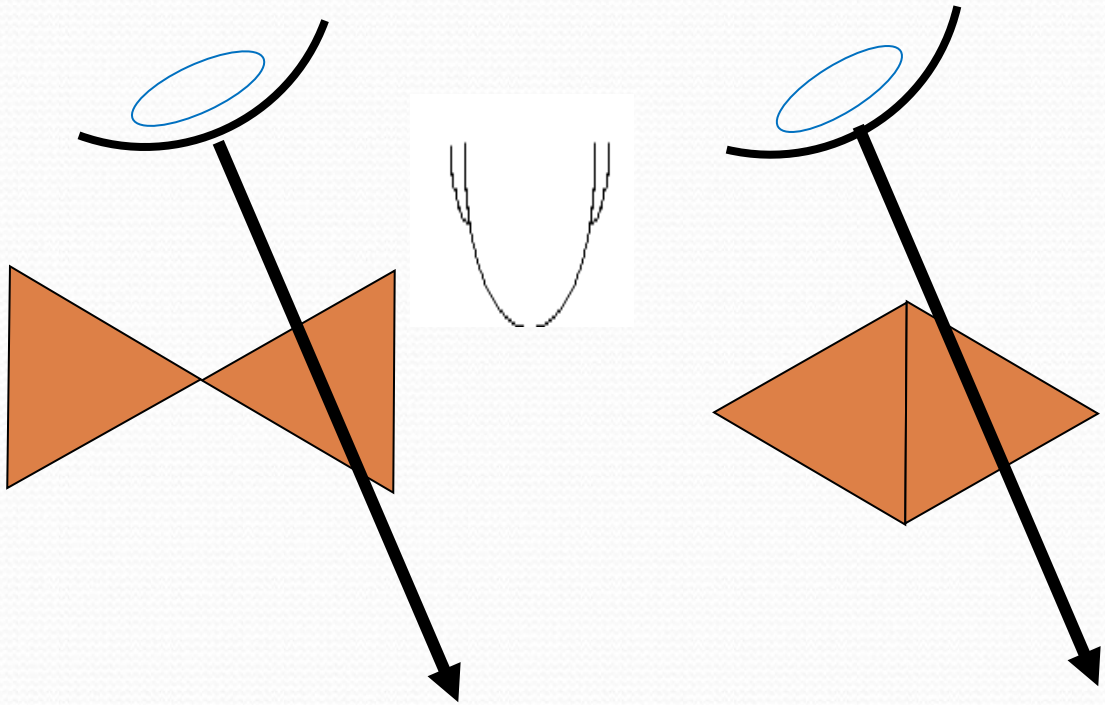
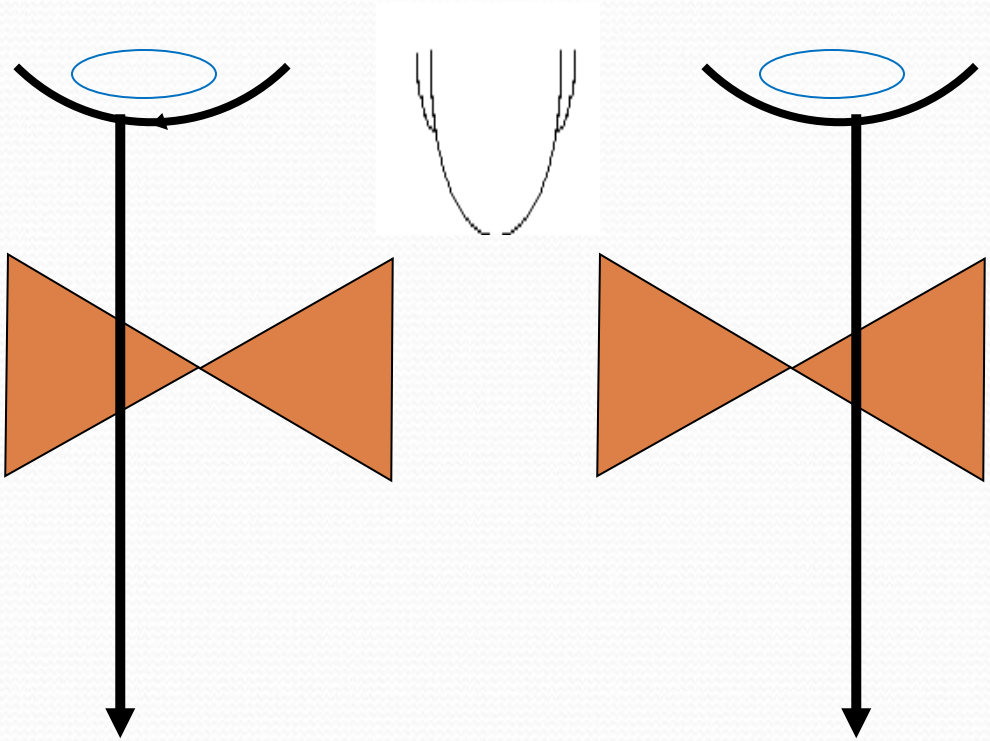
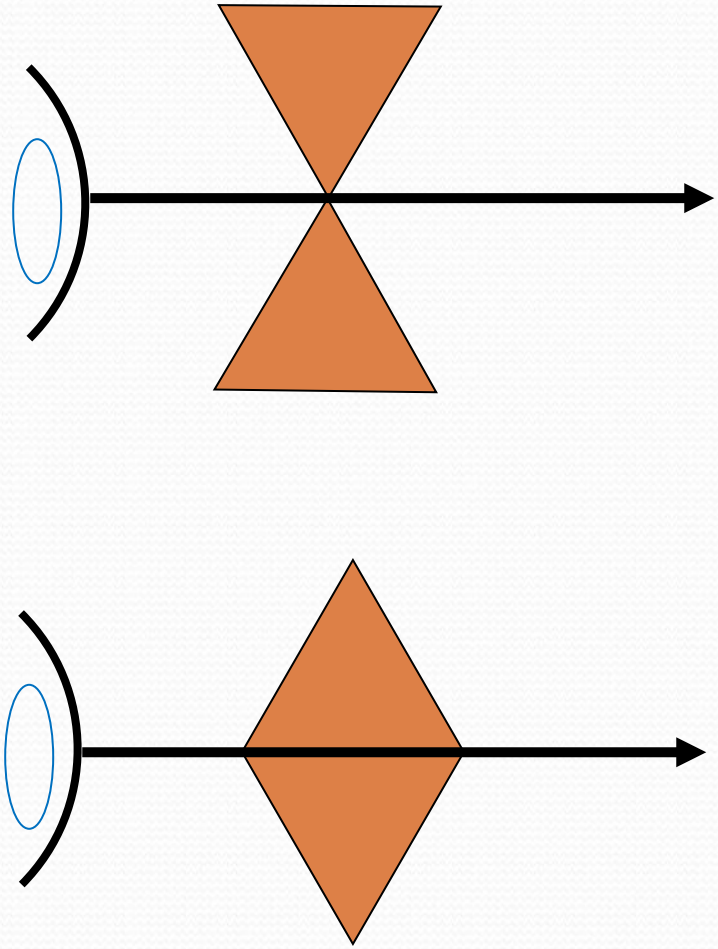


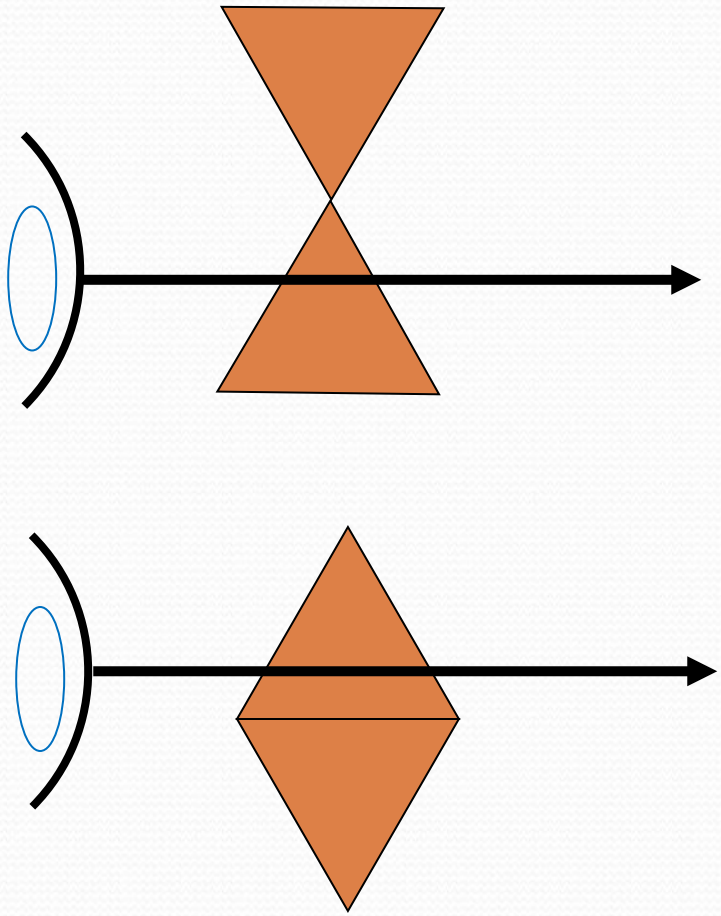
Prism



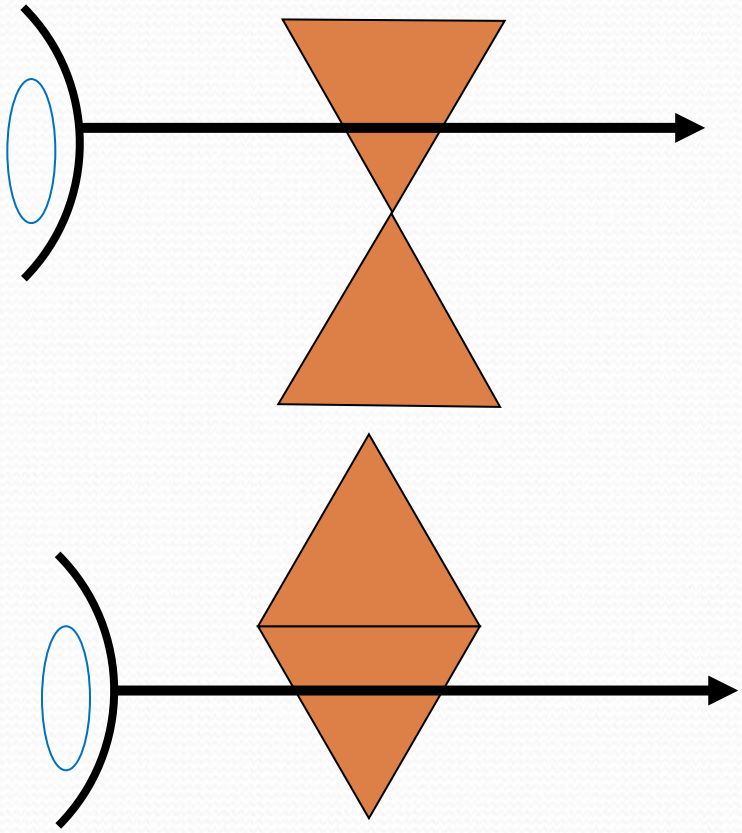
No Prism



Base Down Prism



Base Up Prism



Prentice's Rule

$P \Delta = hD$

Where P = prismmatic effect

H = distance from optical center in centimeters

D = power in meridian of prism base

Direction

Prentice's Rule

Example

- Rx -4.00 sphere OU
- Patient's PD is 62mm (31mm OU)
- Glasses check out with PD as 66mm

- What is the prismatic effect

P Δ = hD

H = 2 mm each eye (convert to cm)

H = .2 cm each eye

D = -4.00 OU

P Δ = .2 X 4.00

P Δ = .8

Exercise

- Find the prismatic effect 4 mm below the optical center of a +2.50 DS lens
  - P Δ = hD
  - P Δ = 4mm X +2.50
  - P Δ = .4 X +2.50
  - P Δ = 1 Δ BU

Simple version

$$P\Delta = \frac{hD}{10}$$

Where P = prismatic effect

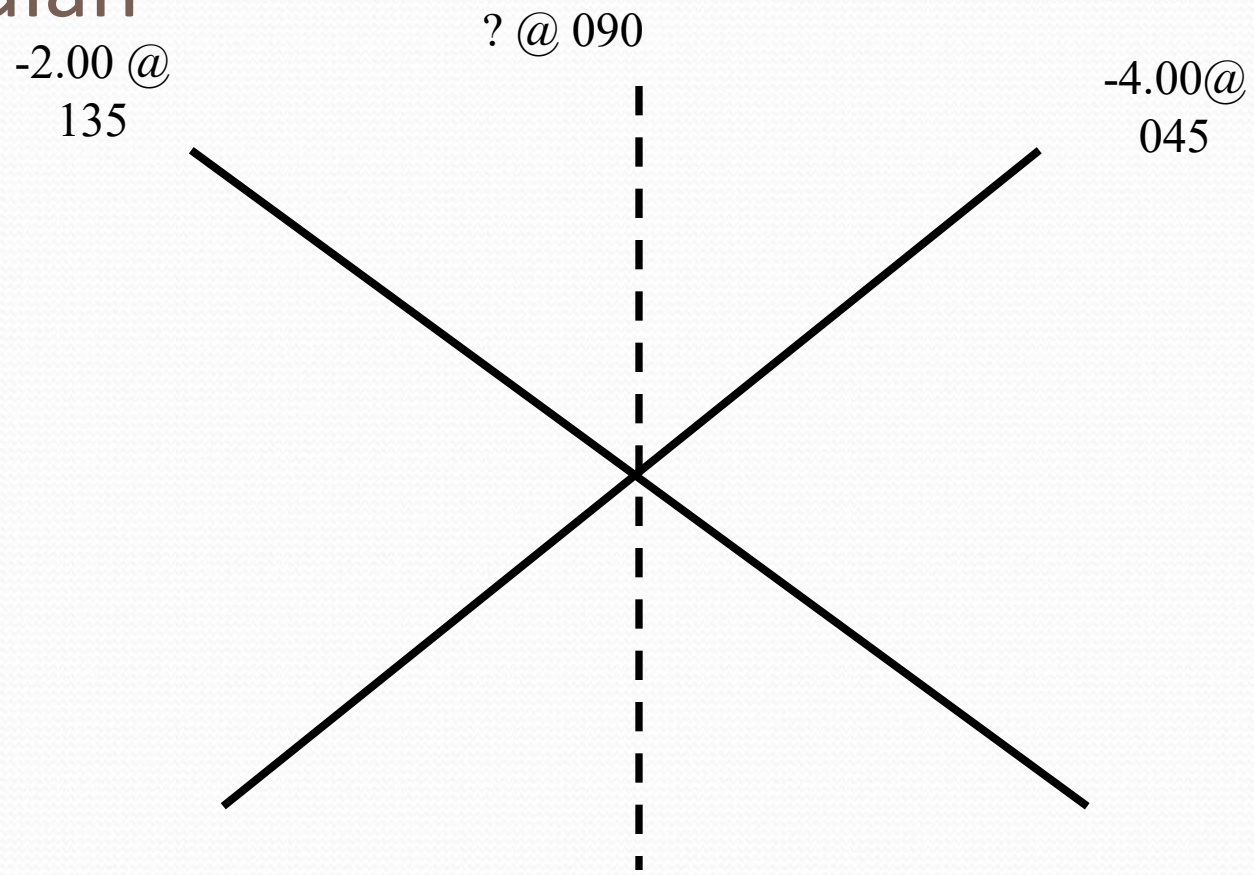
H = distance from optical center in millimeters

D = power in meridian of prism base

Finding the power in of a lens in any meridian

- The formula is simple when we are considering sphere lenses.
- However, most prescriptions contain cylinder power, and sometimes we need to find how much cylinder is in a particular meridian.

Finding the power in of a lens in any meridian

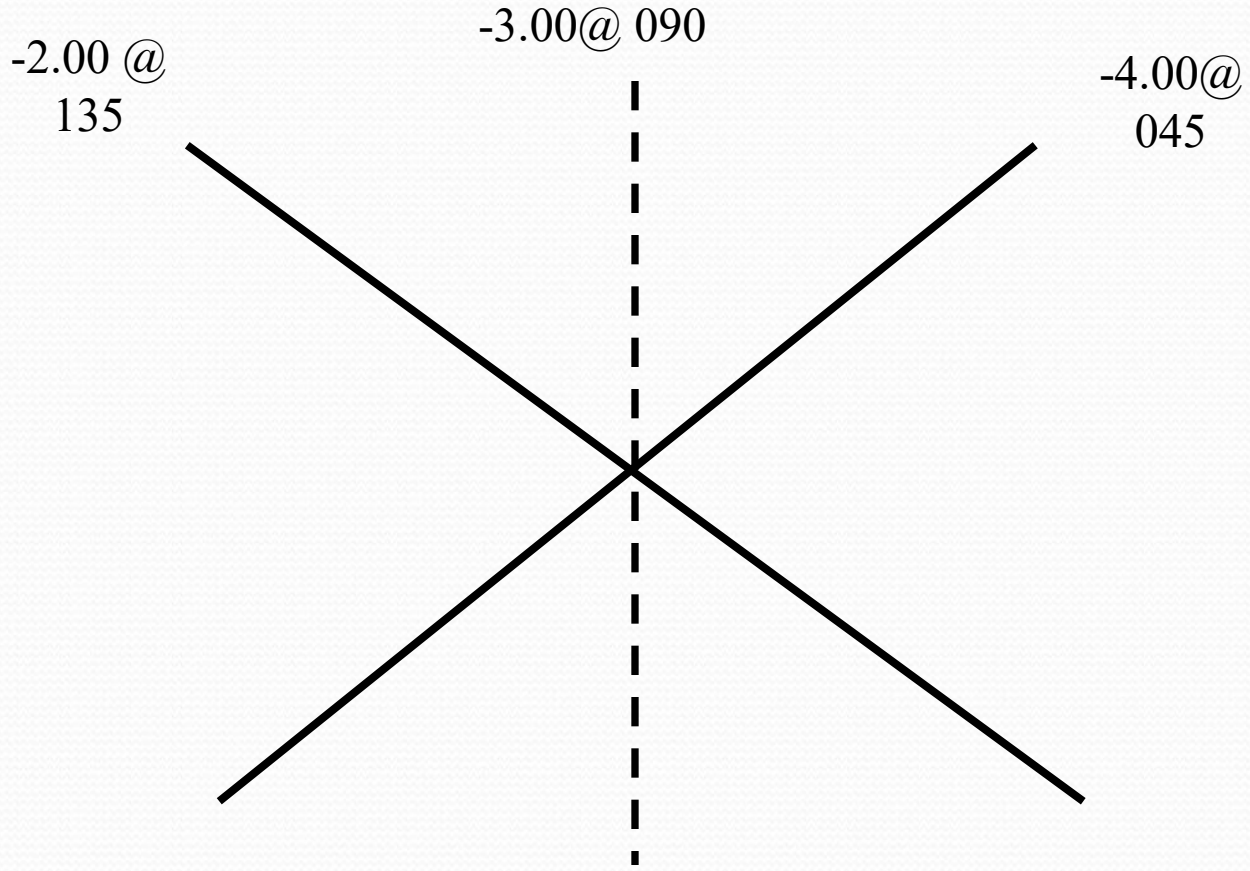


Rx -2.00 -2.00 X 135

Simple formula

Degrees from Axis	Memorize	Percentage of cylinder Power in this meridian
0	0	0
5	1	1
10	2	3
15	4	7
20	5	12
25	6	18
30	7	25
35	8	33
40	8	41
45	9	50
50	9	59
55	8	67
60	8	75
65	7	82
70	6	88
75	5	93
80	4	97
85	2	99
90	1	100

Finding the power in of a lens in any meridian



Rx -2.00 -2.00 X 135

Unequal Refractive Errors

- Why do you need to know
- Unequal powers

- Isometropia
- Anisometropia
- Antimetropia

Anisometropia

- “unequal measure”
- The condition when the two eyes require a different degree of correction (1.00 or more) but the same kind of correcting lens (+ or -)
- The condition may cause vertical prism imbalance (double vision/diplopia) at near or cause a difference in the retinal image sizes between the two eyes

Anisometropia

- Example Rx:

  OD -7.00 D. sphere

  OS -3.00 D. sphere

- Example Rx:

  OD +7.25 sphere

  OS +5.25 sphere

Antimetropia

- “opposite measure”
- The condition when the two eyes require opposite kinds of corrective lenses (+ or -)
- The condition may cause vertical prism imbalance at near (double vision/diplopia) or cause a difference in the retinal image sizes between the two eyes

Antimetropia

- Example Rx:

  OD +1.75 sphere

  OS -1.00 sphere

- Example Rx;

  OD -2.25 sphere

  OS +1.50 sphere

Aniseikonia

- “unequal images”
- Anisometropia or antimetropia may result in the condition whereby two unequal images are sent by the eyes to the brain
- More prevalent due to refractive surgeries

- Meridional Aniseikonia
  - Normal or less aniseikonia in one meridian and more in another due to high astigmatism in that meridian

Iseikonic lenses

- A lens or pair of lenses used to correct aniseikonia
- The following variables are used:
  - Base curve
  - Thickness
  - Vertex distance
  - Index of refraction

Vertical Imbalance At The Reading Level

- Let's go back and discuss the vertical imbalance at the reading level.
- Eye moves down through lens
  - Plus lens creates base up prism as the eye moves down
  - Minus lens creates down prism as the eye moves down

Vertical Imbalance At The Reading Level

- Using Prestice's Rule, let's determine if there is imbalance at the reading level in the following Rx. Reading level is 10mm.

  -0.25 +3.00 X 180

  -1.00 +1.00 X 090

  ADD OU +1.50

- First you need to determine the total power in the vertical meridian of both lenses.

Vertical Imbalance At The Reading Level

OD -0.25 +3.00 X 180

ADD +1.50

For the right lens, we want to find the power in the 90th degree meridian. Based on Prentice's Rule, the axis is 90 degrees away from that meridian, so we will use 100% of the cylinder power and add it to the sphere power. That makes our distant power +2.75. Then we must add the ADD power which gives us a total power at the reading level of +4.25.

Vertical Imbalance At The Reading Level

OS -1.00 +1.00 X 090

ADD +1.50

For the left lens, we want to find the power in the 90th degree meridian as well. Based on Prentice's Rule, the axis is 0 degrees away from that meridian, so we will use 0% of the cylinder power. That makes our distant power -1.00. Then we must add the ADD power which gives us a total power at the reading level of +0.50.

Vertical Imbalance At The Reading Level

OD -0.25 +3.00 X 180

OS -1.00 +1.00 X 090

ADD OU +1.50

OD total power at the reading level is +4.25

OS total power at the reading level is + 0.50

Reading level is 10 mm therefore,…

Vertical Imbalance At The Reading Level

- OD = +4.25
- P Δ = 10 X +4.25 must convert to CM
- P Δ = 1.0 X +4.25
- P Δ = 4.25 Δ

- OS = +0.50
- P Δ = 10 X +0.50 must convert to CM
- P Δ = 1.0 X +0.50
- P Δ = 0.5 Δ

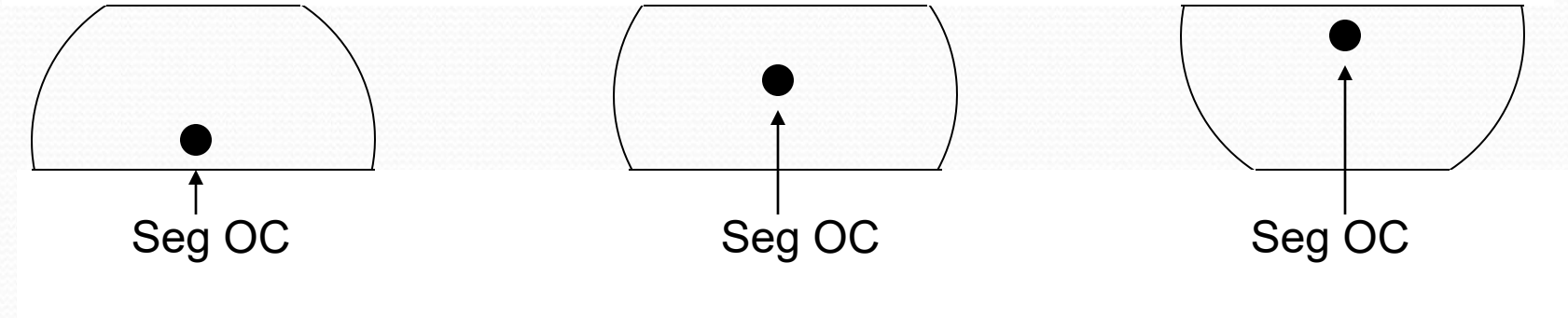
- Therefore, there is 3.75 diopters of prism imbalance at the reading level of 10 mm.

Correcting Vertical Imbalance At The Reading Level

- Prism segments

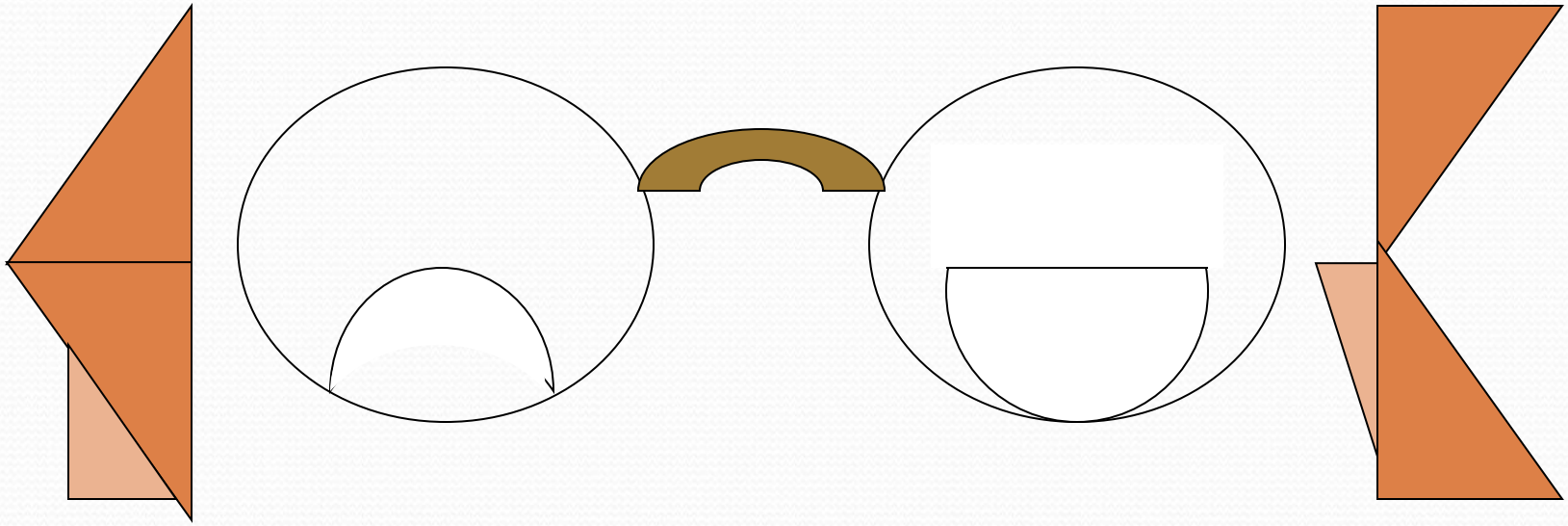
Correcting Vertical Imbalance At The Reading Level

- Compensated segments



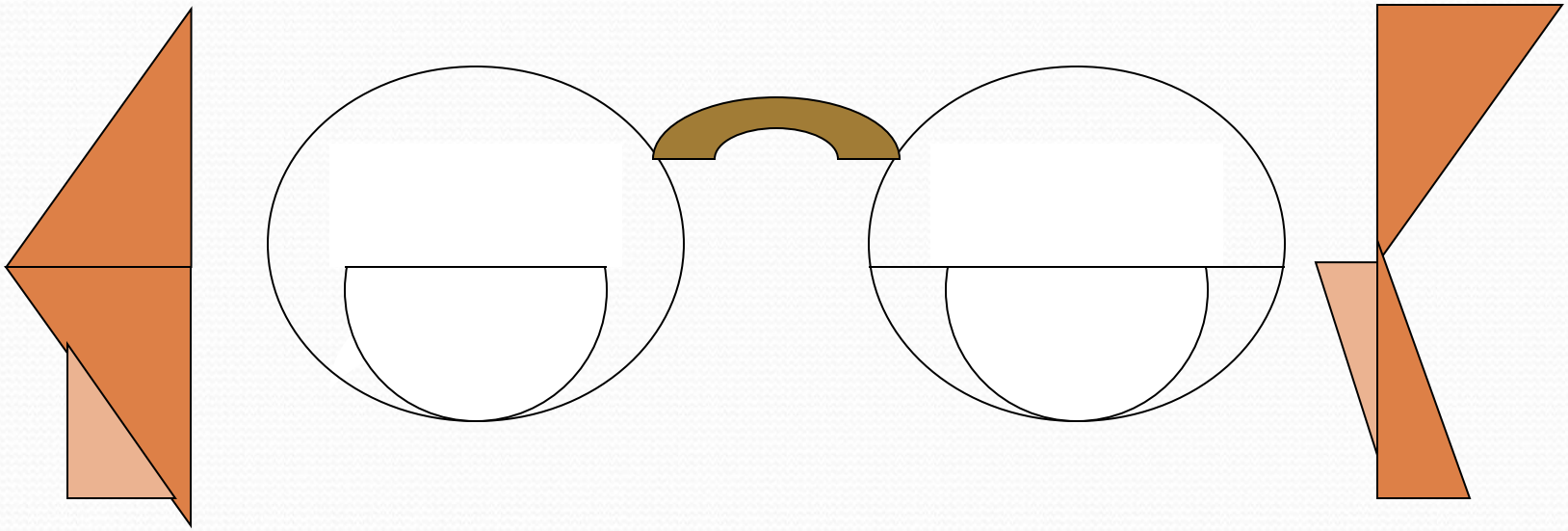
Correcting Vertical Imbalance At The Reading Level

- Dissimilar segments
- One round and one straight top
- Look strange and limited in reduction of vertical prism



Correcting Vertical Imbalance At The Reading Level

- Bi-centric Grinding (Slab-off)
  - Corrects up to 5 diopters of vertical imbalance
  - Slab off
    - Most minus or least plus in glass lenses
    - Reverse for reverse slab done in plastic lenses



Prism by Decentration

- How far would you need to decenter a 4.00 sphere lens to produce 1.6Δ
- Reverse the formula to read
- h =(P/D) X 10

- Solution
- h = 1.60 divided by 4.00 x 10
- h = .4 X 10
- h = 4 mm

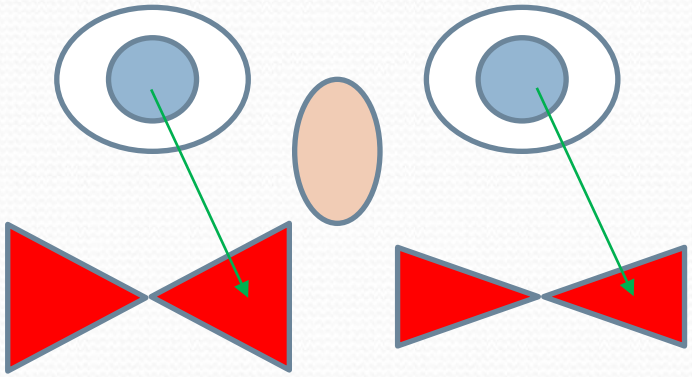
Prism by Decentration

- If 1.60 diopters of prism is created by 4 mm of decentration, what is the dioptric power of the lens being decentered:
- Reverse the formula to read
- D =(P/h) X 10

- Solution
- D = 1.60 divided by 4 x 10
- D = .4 X 10
- D= 4.00 diopters

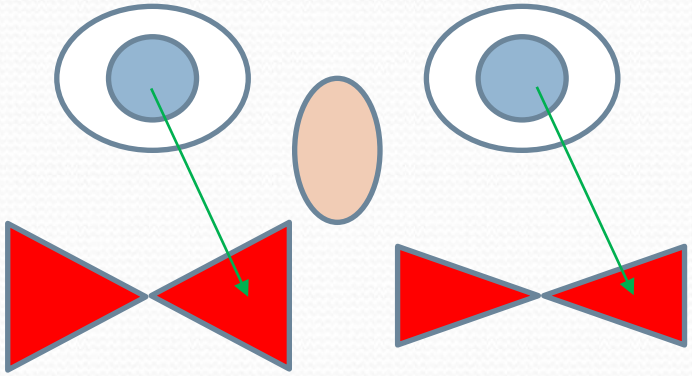
Examples

If a person moves his/her eyes away from the optical center of a lens to the left in the following Rx, what would occur to the patient's vision? OD -3.00 sph OS -1.00 sph.

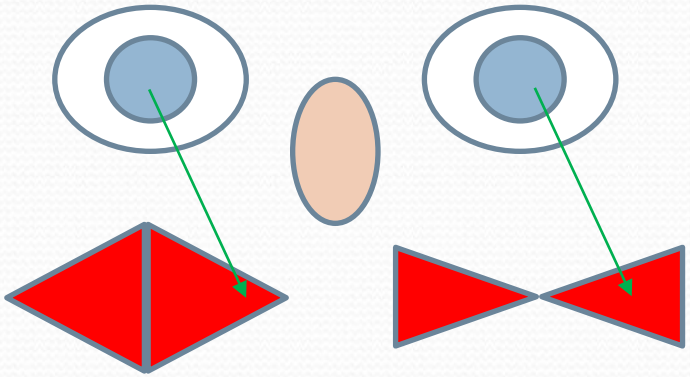


If a person moves his/her eyes away from the optical center of a lens to the left in the following Rx, what would occur to the patient's vision? OD -3.00 sph OS -1.00 sph.

Answer The patient would be viewing through base in prism in the right lens and base out prism in the left lens and the resulting prism would be unequal, the image would be somewhat displaced unequally and there would be imbalance.



If a person moves his/her eyes away from the optical center of a lens to the left in the following Rx, what would occur to the patient's vision? OD +3.00 sph OS -1.00 sph.



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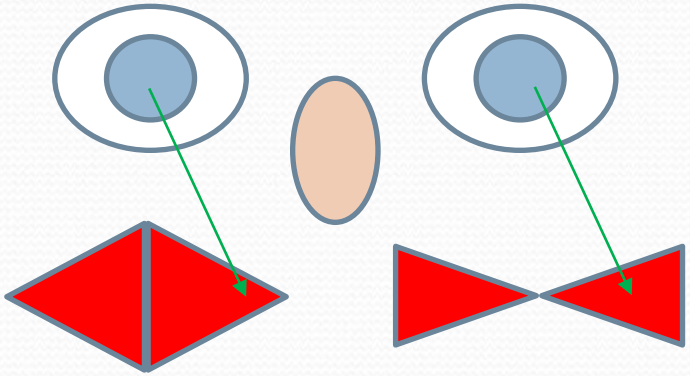
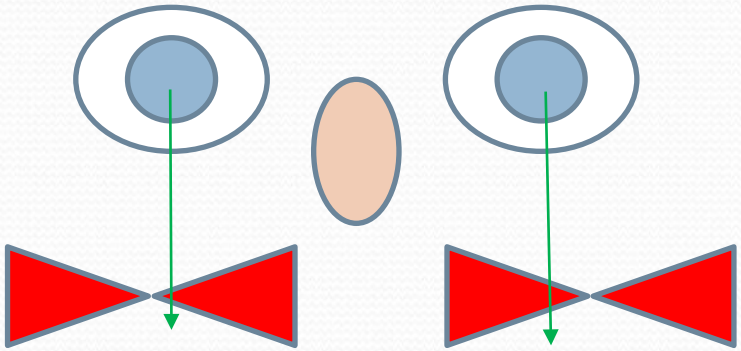
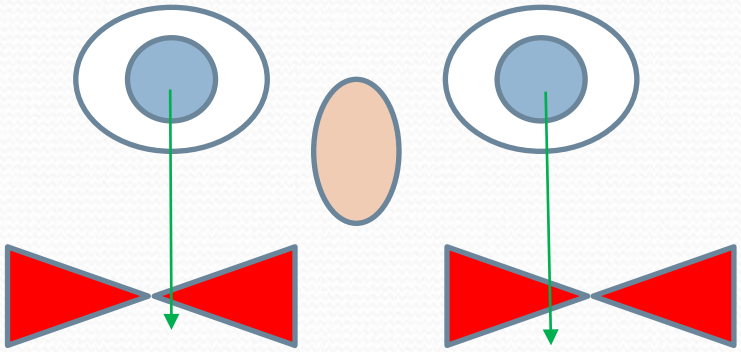


Given the following prescription -2.00 sph OU, if the patient's PD is 62mm and the glasses are made with the centers ground at 65mm, what type prism would the patient experience and how much?



Given the following prescription -2.00 sph OU, if the patient's PD is 62mm and the glasses are made with the centers ground at 65mm, what type prism would the patient experience and how much?

Answer P = hd/10 = 2 x 1.5 = 3/10 = .3Δ Base in prism OU



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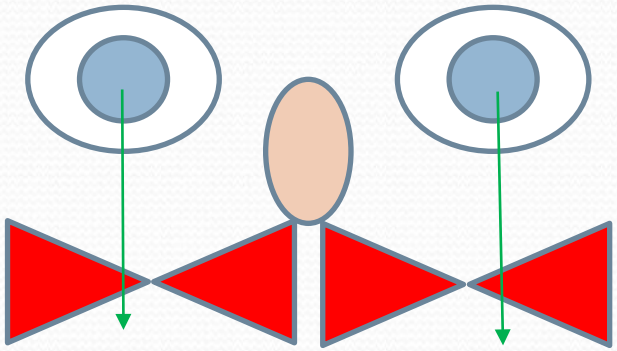
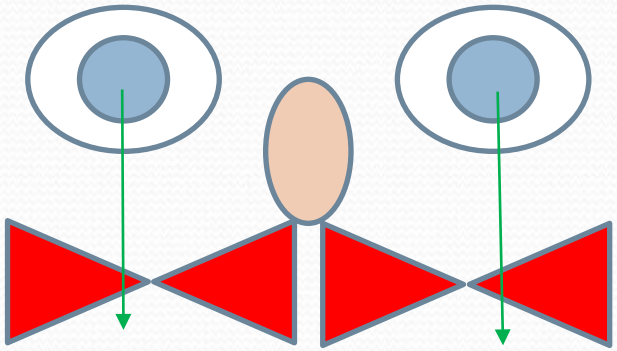


Given the following prescription -3.00 sph OU, if the patient's PD is 64mm and the glasses are made with the centers ground at 62mm, what type prism would the patient experience?

Answer Base out prism OU

How much P = hd/10 = 3 x 1 = 3/10 = .3Δ



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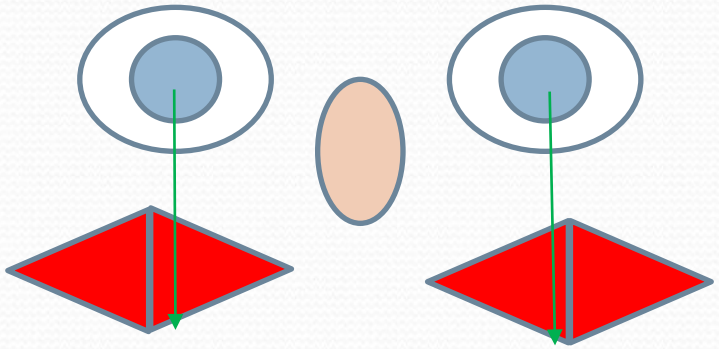

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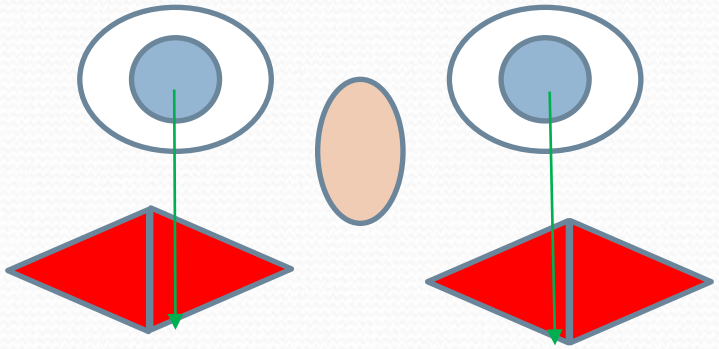
Answer Base out prism OU



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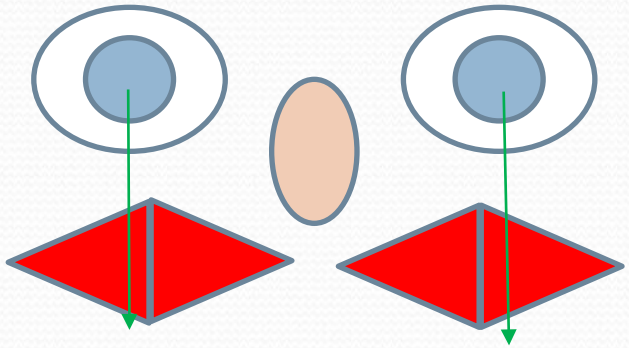

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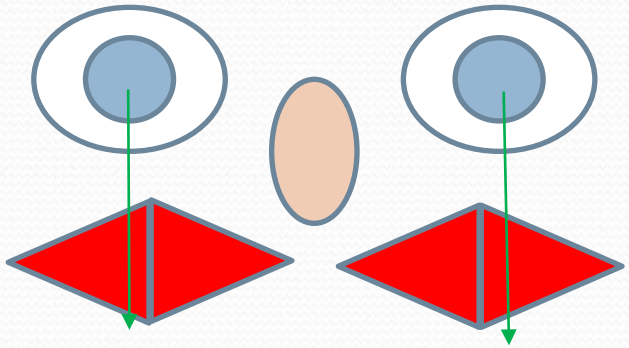
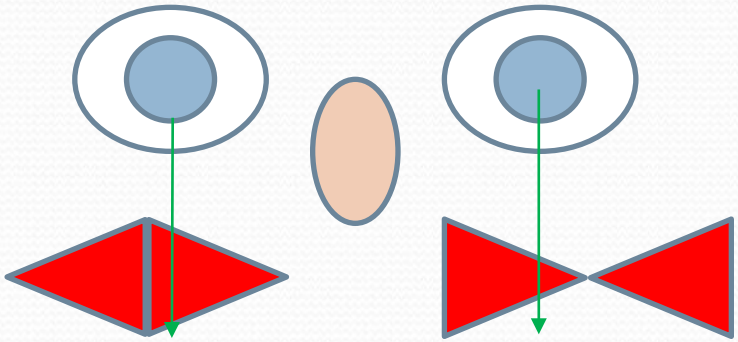
Answer Base in prism OU

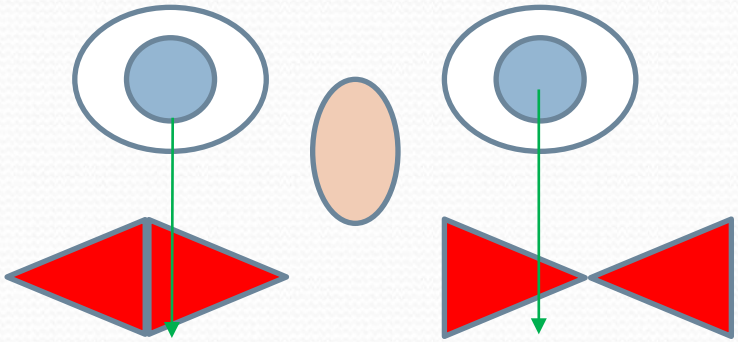


Given the following prescription OD+1.00 sph OS -1.00 sph, if the patient's PD is 62mm and the glasses are made with the centers ground at 64mm, what type prism would the patient experience?



Given the following prescription OD+1.00 sph OS -1.00 sph, if the patient's PD is 62mm and the glasses are made with the centers ground at 64mm, what type prism would the patient experience?

Answer Base out prism OD/Base in prism OS



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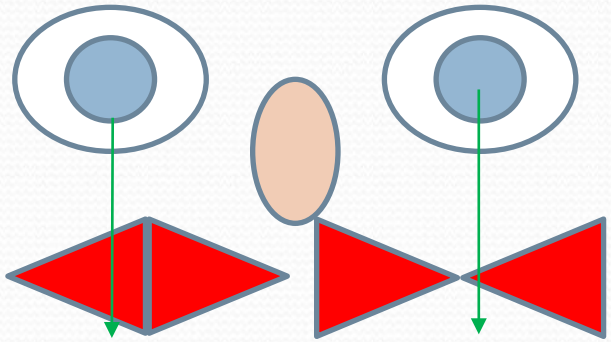

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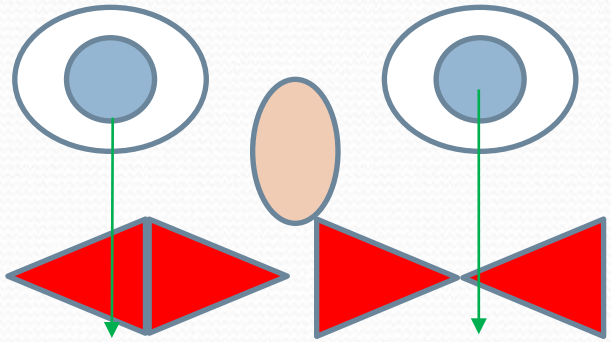
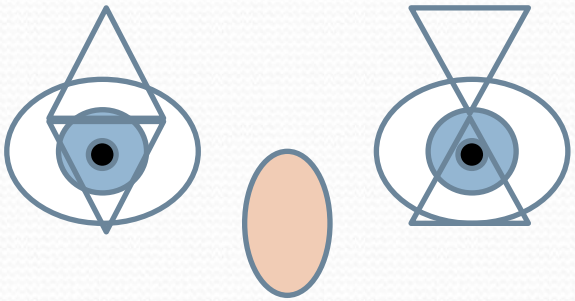
Answer Base in prism OD/Base out prism OS

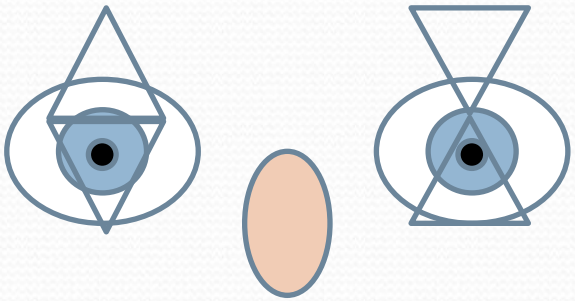


Given the following prescription OD+1.00 sph OS -1.00 sph, if the glasses are made with the centers ground at 3mm above the patient's optical axis, what type prism would the patient experience while looking straight ahead?

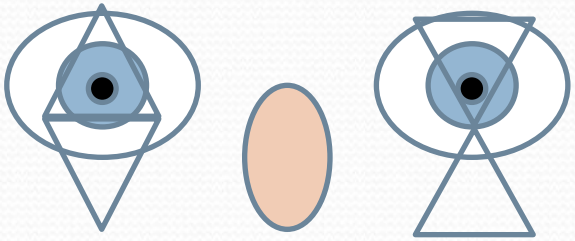


Given the following prescription OD+1.00 sph OS -1.00 sph, if the glasses are made with the centers ground at 3mm above the patient's optical axis, what type prism would the patient experience while looking straight ahead?

Answer Base up prism OD/Base down prism OS

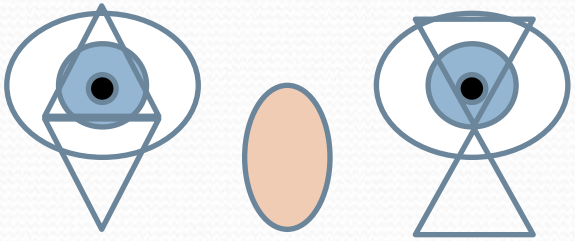


Given the following prescription OD -1.00 sph OS +1.00 sph, if the glasses are made with the centers ground at 3mm below the patient's optical axis, what type prism would the patient experience while looking straight ahead?

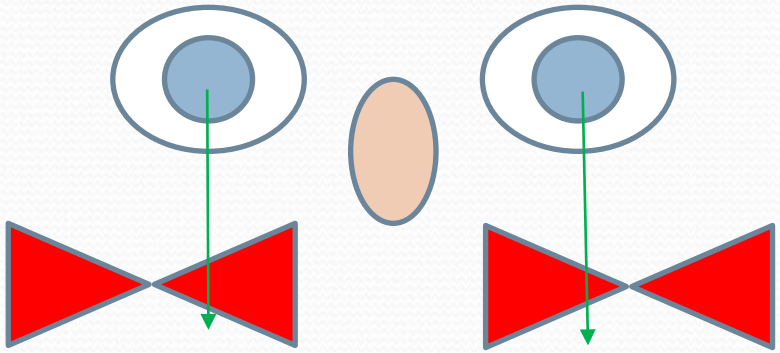


Given the following prescription OD -1.00 sph OS +1.00 sph, if the glasses are made with the centers ground at 3mm below the patient's optical axis, what type prism would the patient experience while looking straight ahead?

Answer Base down prism OD/Base up prism OS

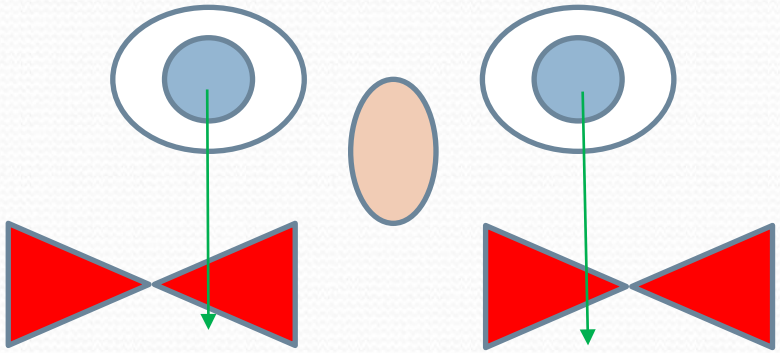


Given an Rx of -3.00 sphere OU. The patient's PD is 31mm OU. The PD in the glasses is 33 mm OU. How much prism is created and in what direction?

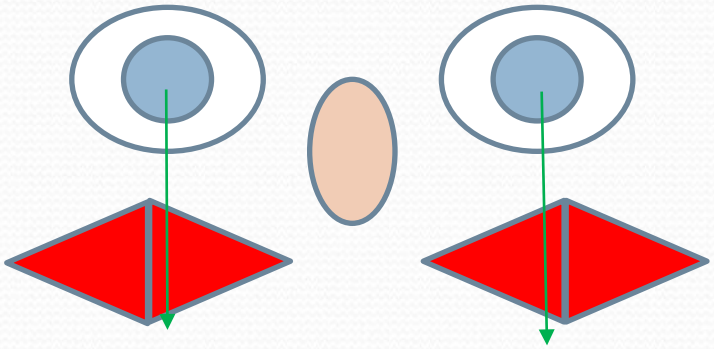


Given an Rx of -3.00 sphere OU. The patient's PD is 31mm OU. The PD in the glasses is 33 mm OU. How much prism is created and in what direction?

Answer P = hxd/10 = 3.00 x 2 – 6/10 = .6 and since it is minus and OC is out, the base is in. so .6 Δ BI OU

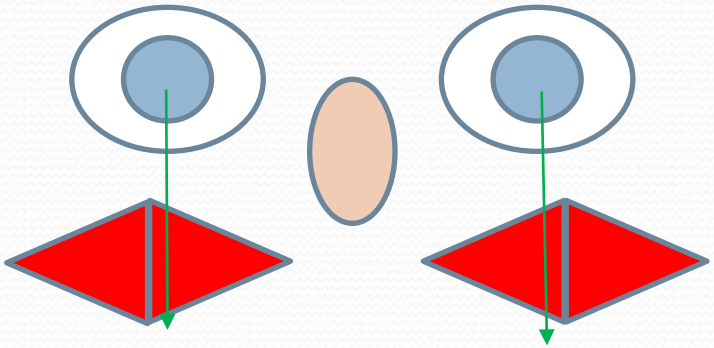


Given an Rx of +3.00 sphere OU. The patient's PD is 31mm OU. The PD in the glasses is 33 mm OU. How much prism is created and in what direction?

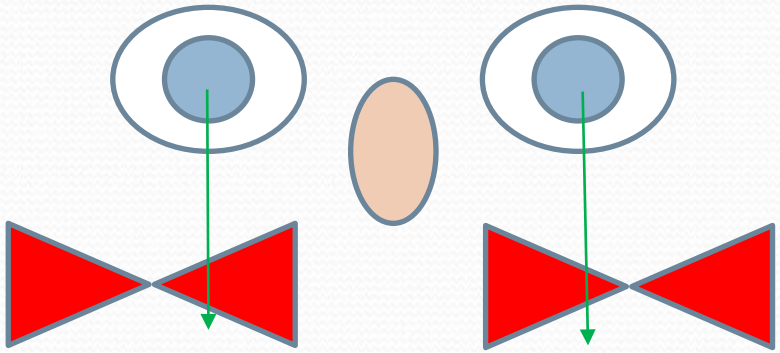


Given an Rx of +3.00 sphere OU. The patient's PD is 31mm OU. The PD in the glasses is 33 mm OU. How much prism is created and in what direction?

Answer P = hxd/10 = 3.00 x 2 – 6/10 = .6 and since it is plus and OC is out, the base is in. so .6 Δ BO OU

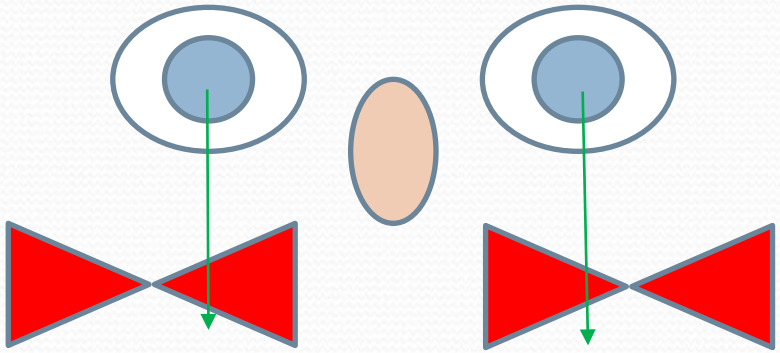


Given an Rx of - 5.00 sphere OU. The patient's PD is 31mm OU. The PD in the glasses is 34 mm OU. How much prism is created and in what direction?

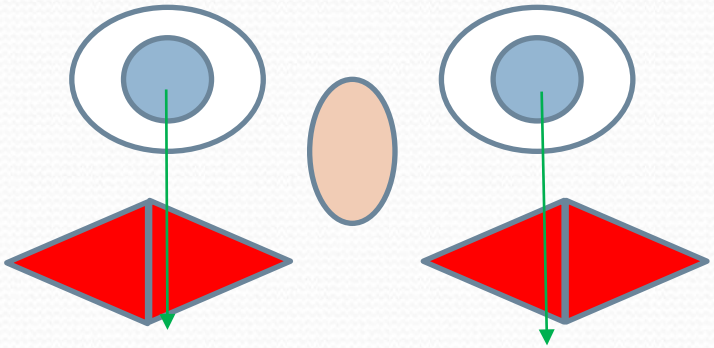


Given an Rx of - 5.00 sphere OU. The patient's PD is 31mm OU. The PD in the glasses is 34 mm OU. How much prism is created and in what direction?

Answer P = hxd/10 = 5.00 x 3 – 15/10 = 1.5 and since it is minus and OC is out, the base is in. so .1.5 Δ BI OU

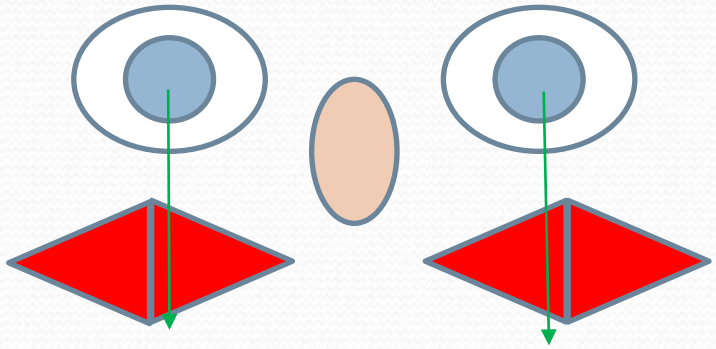


Given an Rx of +5.00 sphere OU. The patient's PD is 31mm OU. The PD in the glasses is 33 mm OU. How much prism is created and in what direction?



Given an Rx of +5.00 sphere OU. The patient's PD is 31mm OU. The PD in the glasses is 33 mm OU. How much prism is created and in what direction?

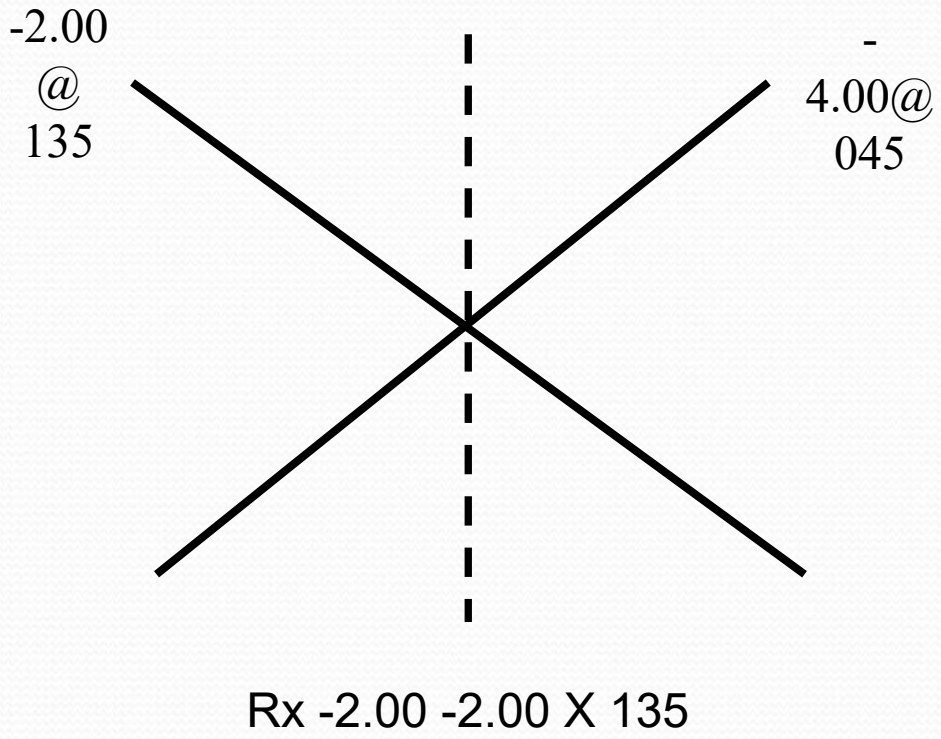
Answer P = hxd/10 = 5.00 x 2 – 10/10 = 1.0 and since it is plus and OC is out, the base is in. so 1.0 Δ BO OU



In a compound lens with the following Rx, what is the total power at the 045 degree meridian? -2.00 – 2.00 X 135

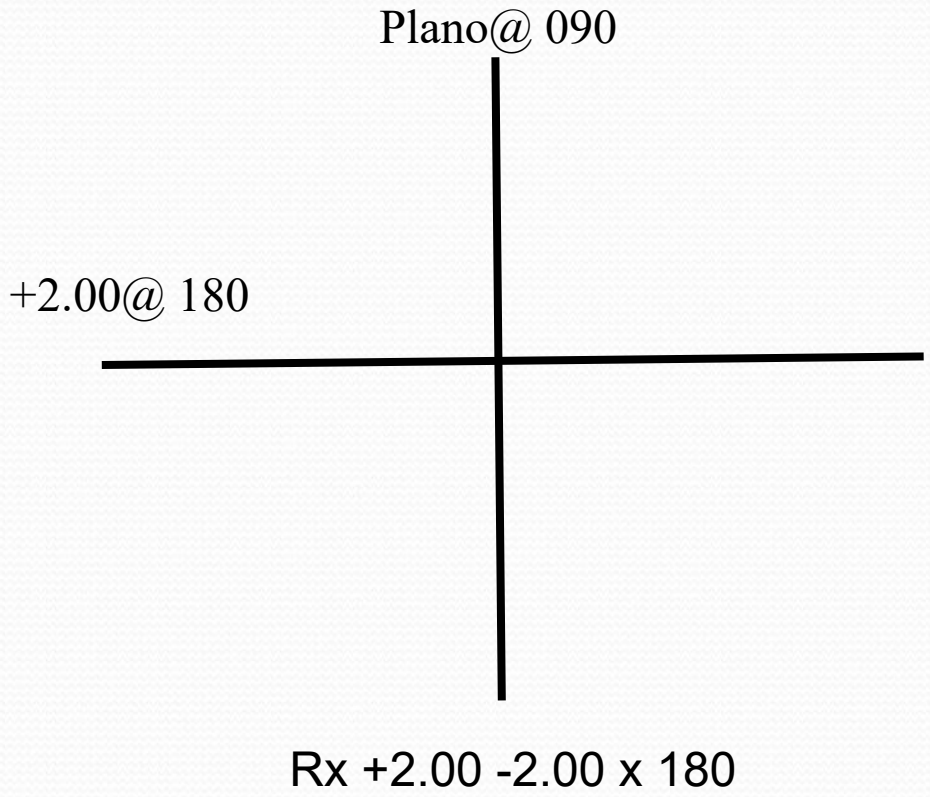
In a compound lens with the following Rx, what is the total power at the 045 degree meridian? -2.00 – 2.00 X 135

Answer -4.00



Given a prescription of +2.00 -2.00 X 180, what is the total power at the 090 degree meridian?

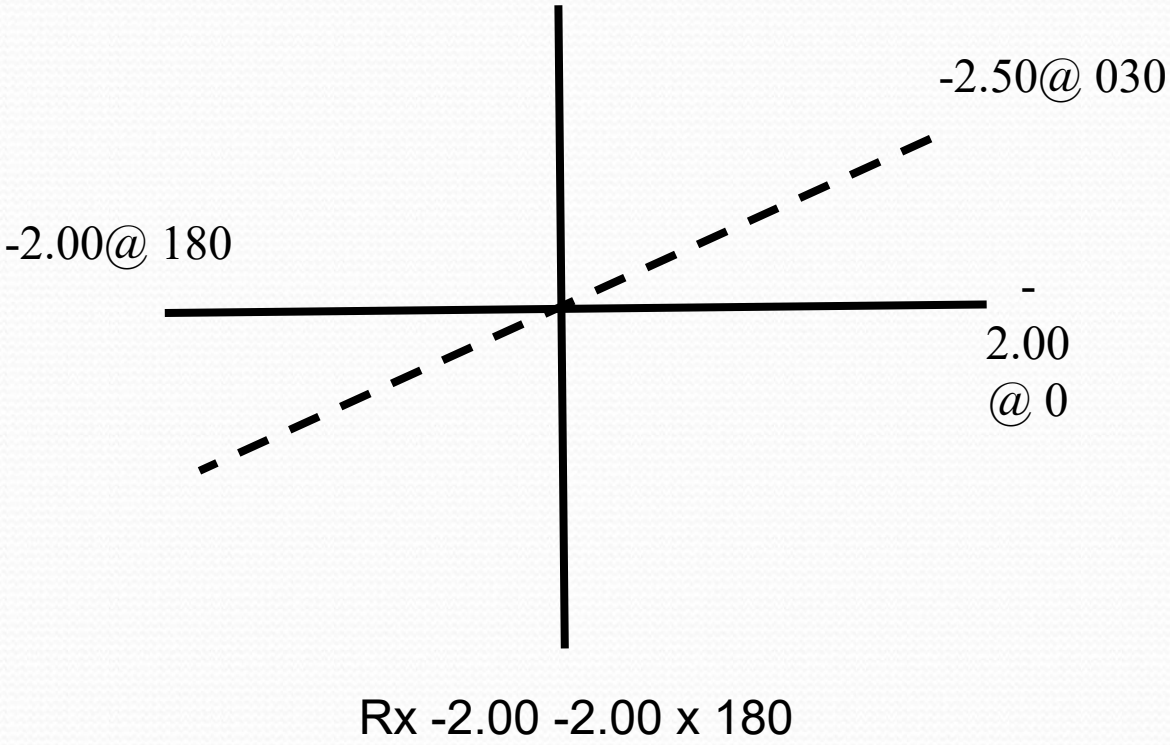
Answer 90 is 90 degrees away from axis so 100% of cylinder is used. +2.00 combined with -2.00 = Plano



Rx +2.00 -2.00 x 180

Given a prescription of -2.00 -2.00 X 180, what is the total power at the 030 degree meridian?

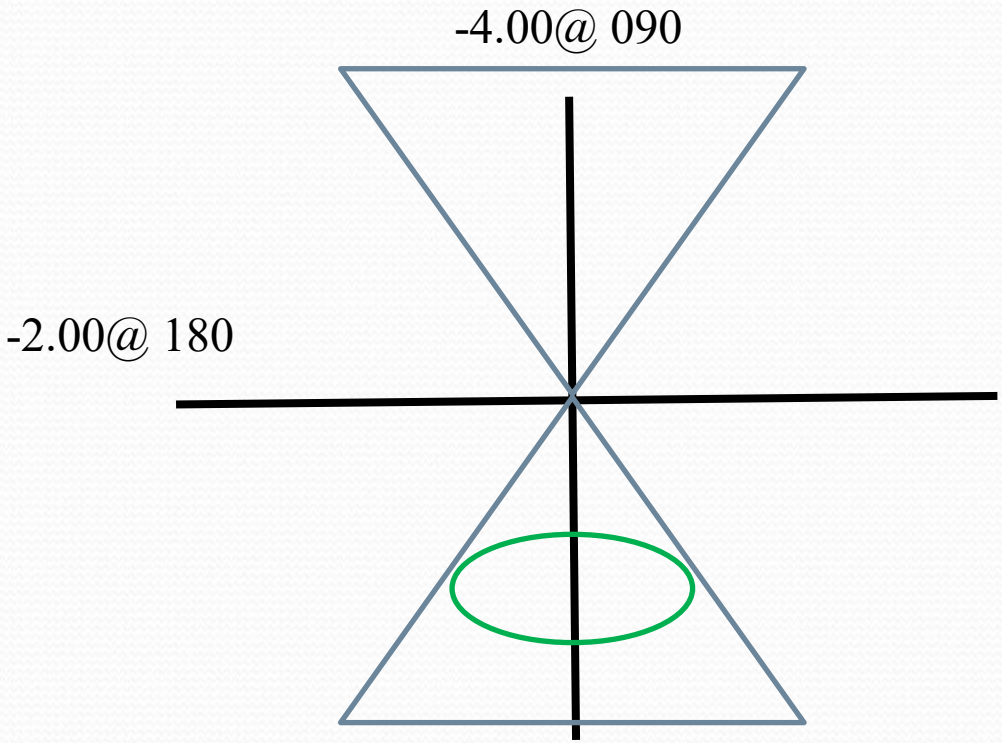
Answer 30 degrees away uses 25% of cylinder so -0.50 combined with sphere of -2.00 = -2.50D



Rx -2.00 -2.00 x 180

Given a prescription of OD -2.00 -2.00 X 180 ADD +2.00, what is the prism if the reading level is 10mm?

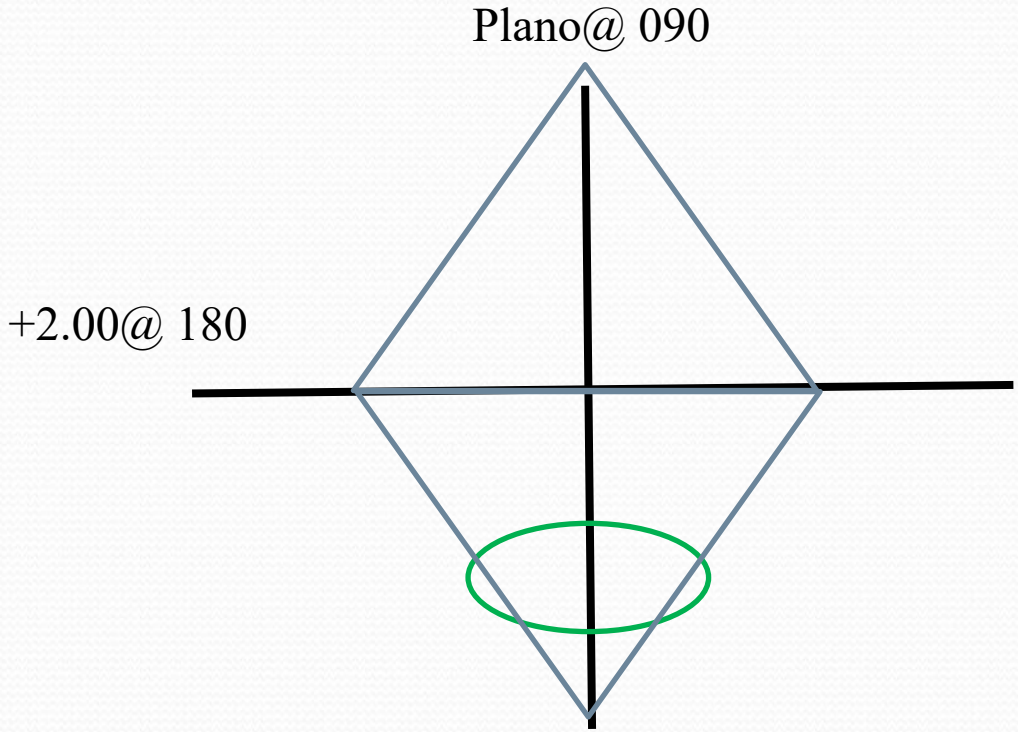
Answer Actual power in the vertical meridian is distant of -4.00 combined with +2.00 add = -2.00D
P = hxd/10 = 2.00 x 10 – 20/10 = 2.0 prism diopters base down since it is minus



Power at reading level is -2.00

Given a prescription of OS +2.00 -2.00 X 180 ADD +2.00, what is the prism if the reading level is 10mm?

Answer Actual power in the vertical meridian is distant of Plano combined with +2.00 add = +2.00D
P = hxd/10 = 2.00 x 10 – 20/10 = 2.0 prism diopters base up since it is plus



Power at reading level is
+2.00