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## Computer assisted rigid contact lens fitting training program

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*Pacific University*

Lan T. Tran

*Pacific University*

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## Computer assisted rigid contact lens fitting training program

### Abstract

Training eye care professionals and students to fit Rigid Gas Permeable contact lenses is a detailed process with many variables. Reliable, consistent, quality fitting comes only after considerable patient contact. This thesis proposes a method of increasing trainee fitting experience without increasing the number of patient encounters. This can potentially reduce fitting errors and excessive number of trial fittings. This method involves using the program "SUPERFIT", in combination with worksheets that instruct the trainee to move through the program using different fitting variables, such as keratometry readings, lens power, and peripheral K readings. Thus the trainee can directly observe different fitting relationships including tear volume, projected fluorescein patterns and power, diameter, and base curve relationships.

### Degree Type

Thesis

### Degree Name

Master of Science in Vision Science

### Committee Chair

Patrick J. Caroline

### Subject Categories

Optometry

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COMPUTER ASSISTED RIGID CONTACT LENS  
FITTING TRAINING PROGRAM

By

CLINT L. KASZA

LAN T. TRAN

A thesis submitted to the faculty of the  
College of Optometry  
Pacific University  
Forest Grove, Oregon  
for the degree of  
Doctor of Optometry  
May, 1998

Adviser:

Patrick J. Caroline, COT

A Computer Assisted Rigid Gas Permeable  
Contact Lens Fitting Program

Authors:

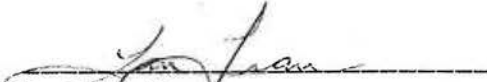


Clint L. Kasza

Advisor:

---

Patrick J. Caroline, COT

  
Lan T. Tran

**"SUPERFIT"**  
A Computer Assisted Rigid Gas Permeable  
Contact Lens Fitting Program


Authors:

  
Clint L. Kasza

Advisor:

\_\_\_\_\_  
Patrick J. Caroline, COT

Grade: \_\_\_\_\_

  
Lan T. Tran

Born in Denver in 1970, Clint was raised with three brothers in a rural community not far from where he was born. He placed first in a Voice of Democracy speech contest sponsored by the Veterans of Foreign Wars. In 1992 Clint Kasza graduated Cum Laude from Western State College of Colorado with a bachelor of science degree in Biology. He began attending Pacific University College of Optometry in 1994. He is a member of Amigos and volunteers at Cornelius Elementary School. In 1998 he will receive his Doctor of Optometry degree and then plans to work in Colorado, aiming to join a partnership and do missions work on a part time basis.

Lan Tran was born in Vietnam and came to the United States in 1975. She received her undergraduate degree in Visual Science at Pacific University in Forest Grove, Oregon in 1995. She will receive her Doctor of Optometry degree from Pacific University College of Optometry in Forest Grove, Oregon in May of 1998. She plans to work for an optometrist following graduation with the goal of joining a partnership within 5 years.

## **ABSTRACT**

Training eye care professionals and students to fit Rigid Gas Permeable contact lenses is a detailed process with many variables. Reliable, consistent, quality fitting comes only after considerable patient contact. This thesis proposes a method of increasing trainee fitting experience without increasing the number of patient encounters. This can potentially reduce fitting errors and excessive number of trial fittings. This method involves using the program "SUPERFIT", in combination with worksheets that instruct the trainee to move through the program using different fitting variables, such as keratometry readings, lens power, and peripheral K readings. Thus the trainee can directly observe different fitting relationships including tear volume, projected fluorescein patterns and power, diameter, and base curve relationships.



## Acknowledgements:

We sincerelly appreciate the time, patience, and helpful expertise that was contributed by Dan Vanlaningham and Matt Terwillegar who wrote the program "Superfit", and spent hours assisting in making this thesis possible.

## INTRODUCTION

Fitting Rigid Gas Permeable contact lenses often requires numerous calculations which are dependent on the patient's corneal topography. The "**SUPERFIT**" program will design an RGP lens based on the central or peripheral keratometry readings and spectacle prescription of the patient. Lens parameters such as lens diameter, base curve, optical zone diameter, secondary radius, and other peripheral lens factors will also be calculated by the program based on whether the practitioner uses an alignment fit or interpalpebral fitting philosophy. Once these parameters are calculated, the practitioner is able to assess how the lens will fit on the cornea by viewing the projected fluorescein pattern and tear layer depth. The program is written in Visual Basic for Windows and is available for IBM compatible PC's. The worksheet set was created for the student/practitioner for use with the program as a graphical fitting tool in the Pacific University contact lens curriculum.

## MATERIALS AND METHODS

The program "**SUPERFIT**", written by Daniel Vanlaningham and Matt Terwilleger was generously made available as an educational tool to Pacific University College of Optometry. Written in Visual Basics for Windows, the program is widely accepted in its format.

By entering keratometry readings, including peripheral readings if available, the program designs a lens that is a theoretically an appropriate fit. The user also puts in needed contact lens power. From here, the theoretical lens can be modified in base curve power, optical zone diameter, peripheral curvature, overall diameter, and back vertex power. Modification of any one aspect of the lens causes an appropriate change of any influenced characteristics of the lens. Two sagittal profiles of the lens and the cornea are continuously displayed on the screen, showing the fitting relationship in two meridians, ninety degrees apart. Tear layer volume in one meridian is also continuously displayed. By making the proper selection, a projected fluorescein pattern will be displayed using the data from the last information entered about the lens.

The worksheets were developed by theorizing different fitting circumstances, spherical, with the rule, against the rule, and combining these with different fitting philosophies, intrapalpebral, and apical alignment. Then each fitting relationship was systematically approached. First the trainee is asked to draw the projected fluorescein pattern to help them visualize how the lens will fit and how it may move. Next, tear layer volume is assessed to determine patient comfort, lens stability, tear movement, and any areas of lens bearing. The final lens power is then considered, which is empirically calculated by the program. This function of the program may be blocked so that the trainee has to work out an appropriate power without assistance. Then the student is asked to make modifications in the lens, such a flatter or steeper fit, changing the posterior optical zone, or peripheral curves. Observations of changes that occur in the fitting relationship and resulting power changes are to be written down.

## **DISCUSSION**

The program used in this thesis is unique in that it provides a theoretical RGP contact lens fit, complete with an empirical fluorescein pattern and tear layer volume projection, from keratometry values, not corneal topography. Since most eye care professionals must learn to understand fitting in terms of "K" values, and because clinically keratometry readings are most often available, the program is superbly set up to assist trainees in their understanding of corneal astigmatism, associated "K" values, and how this relates to contact lens fitting.

Fitting methods and philosophies vary with corneal shape and steepness, which is also accounted for in the worksheets. Different fitting methods are "tried" on the patient, and the student is then required to judge the best fitting method. The program helps them determine not only which method is best, but why. The program can be seen to offer an advantage over "text book" learning because of the required student interaction and rapid feedback.

Effective rigid gas permeable contact lens fitting requires precise calculations, experience, and keen observations to provide a comfortable fit with clear vision in a consistent fashion. The fitting relationships of base curve, back vertex power, tear layer depth, optical zone diameter, overall diameter, and peripheral and secondary curves are all intricately related. The worksheets developed from this thesis have been organized so that perceptual, functional, and empirical understanding of the previously mentioned fitting relationships can be enhanced in those learning to fit RGP lenses.

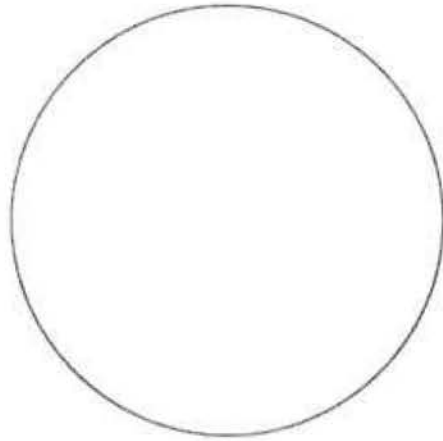
Worksheet I  
Spherical Corneas

A. Low Myope

K's: 43.12/43.12 @ 090

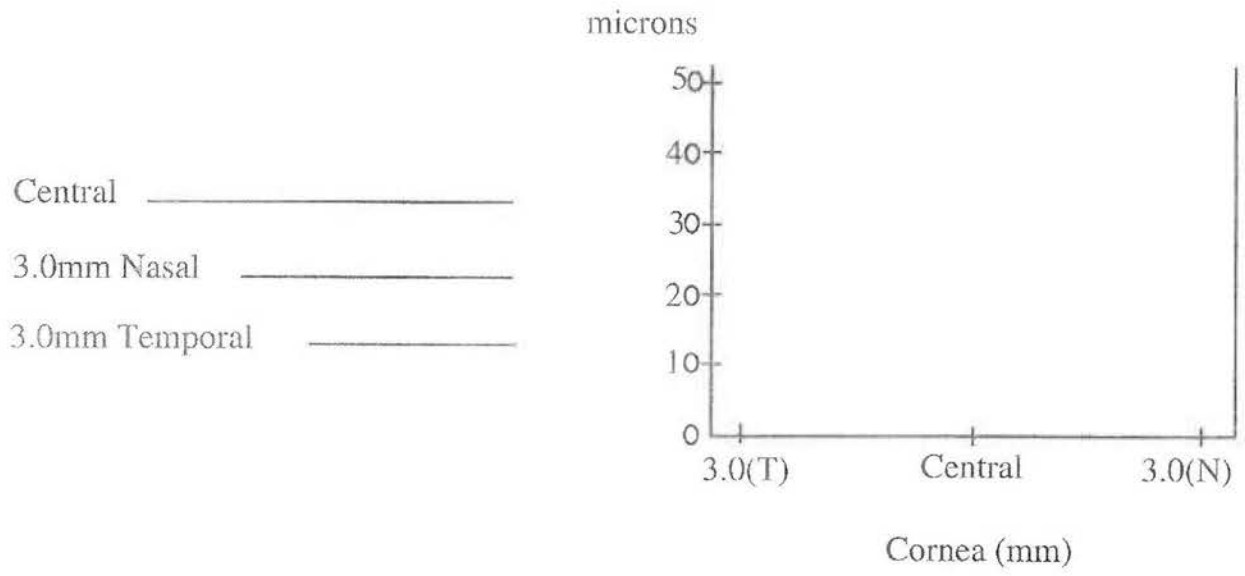
7a: -2.00 D sph

1. Draw the Flourescein Pattern of a lens fitted 0.50 D flatter than "K".

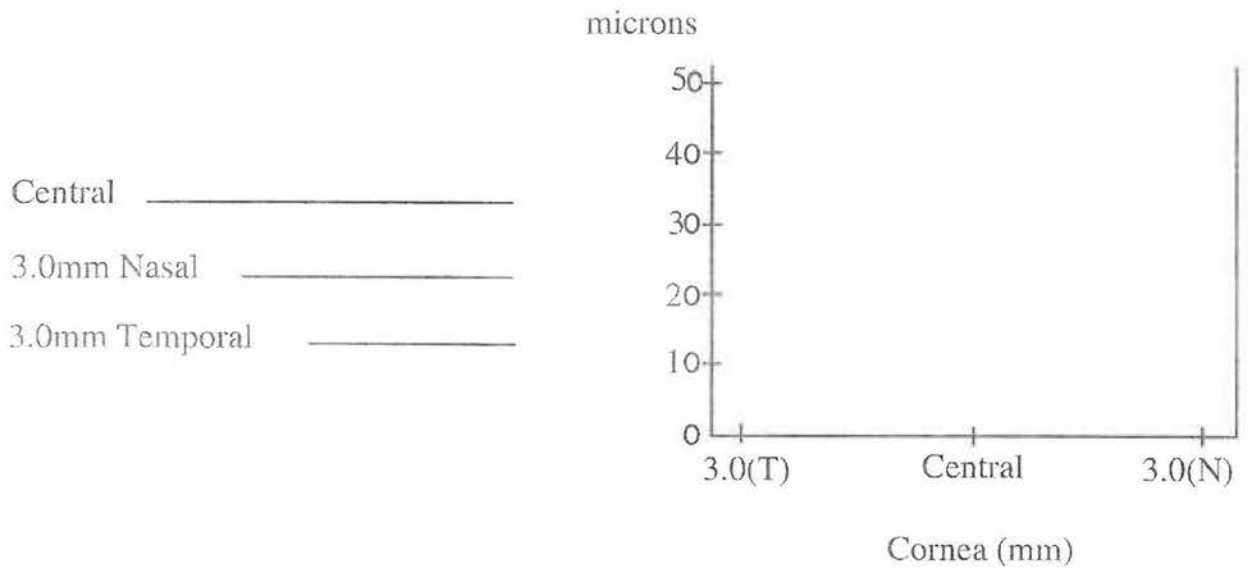


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted 0.50 D flatter than "K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.



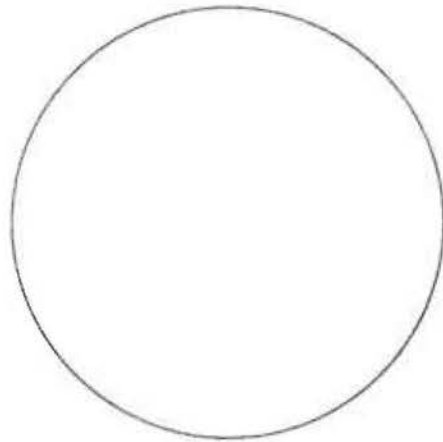


B. Low Myope

K's: 43.12/43.12 @ 090

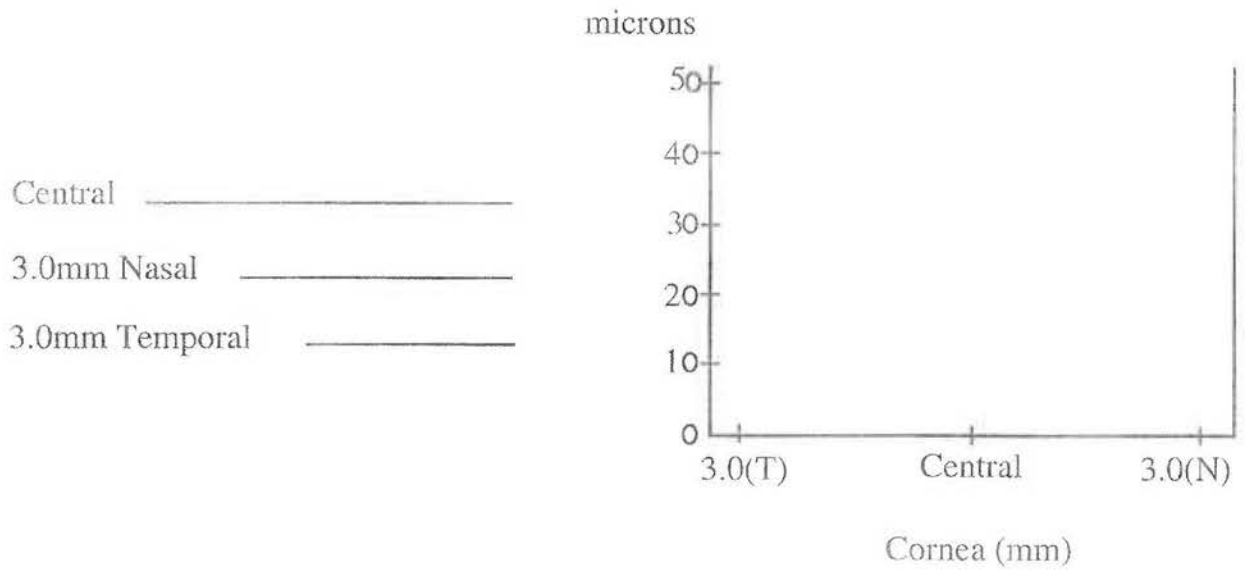
7a: -2.00 D sph

1. Draw the Flourescein Pattern of a lens fitted "0n-K".

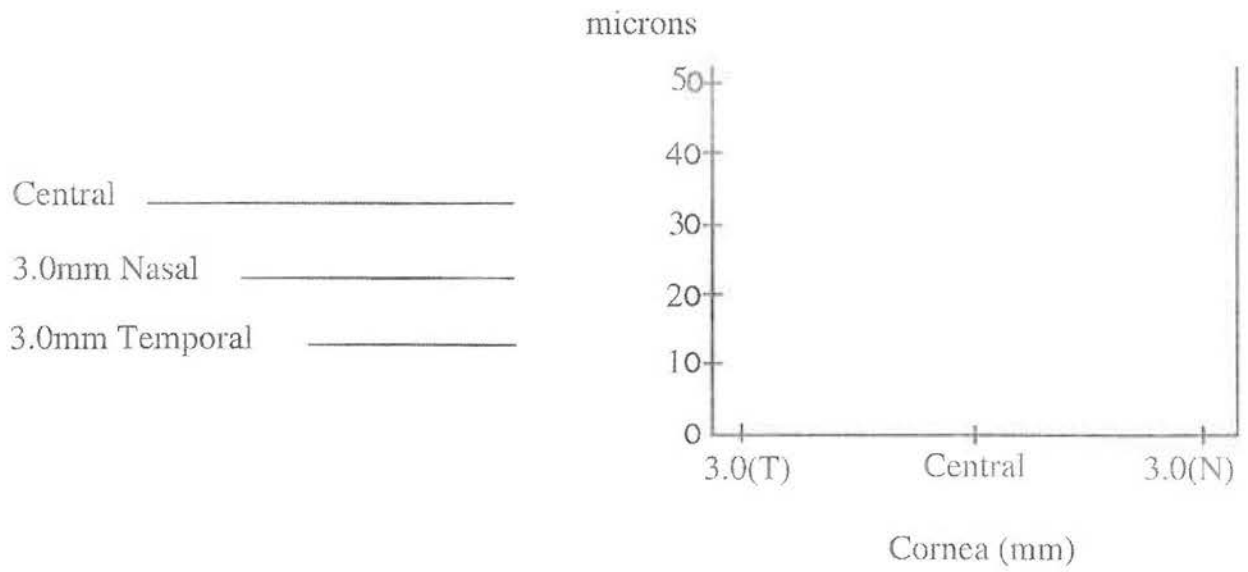


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted "on-K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

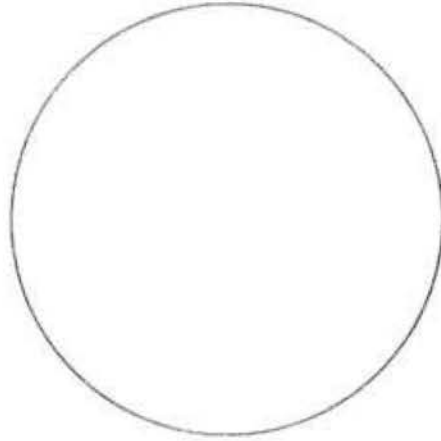
b) Describe the change.

C. Low Myope

K's: 44.25/44.25 @ 090

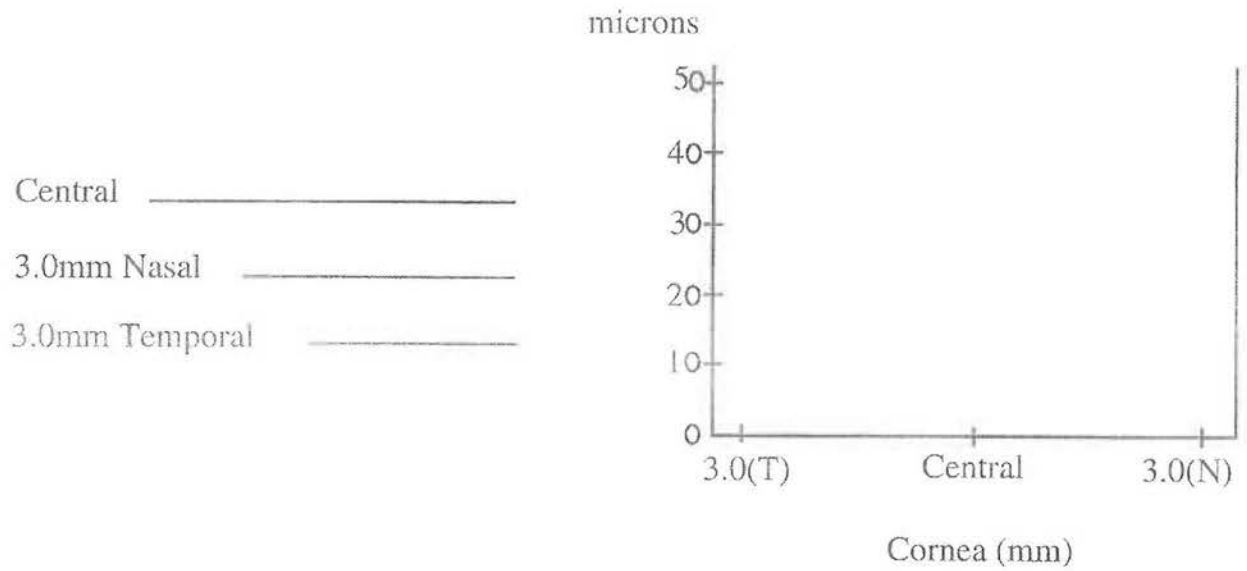
7a: -2.00 D sph

1. Draw the Flourescein Pattern of a lens fitted 0.50 D steeper than "K".

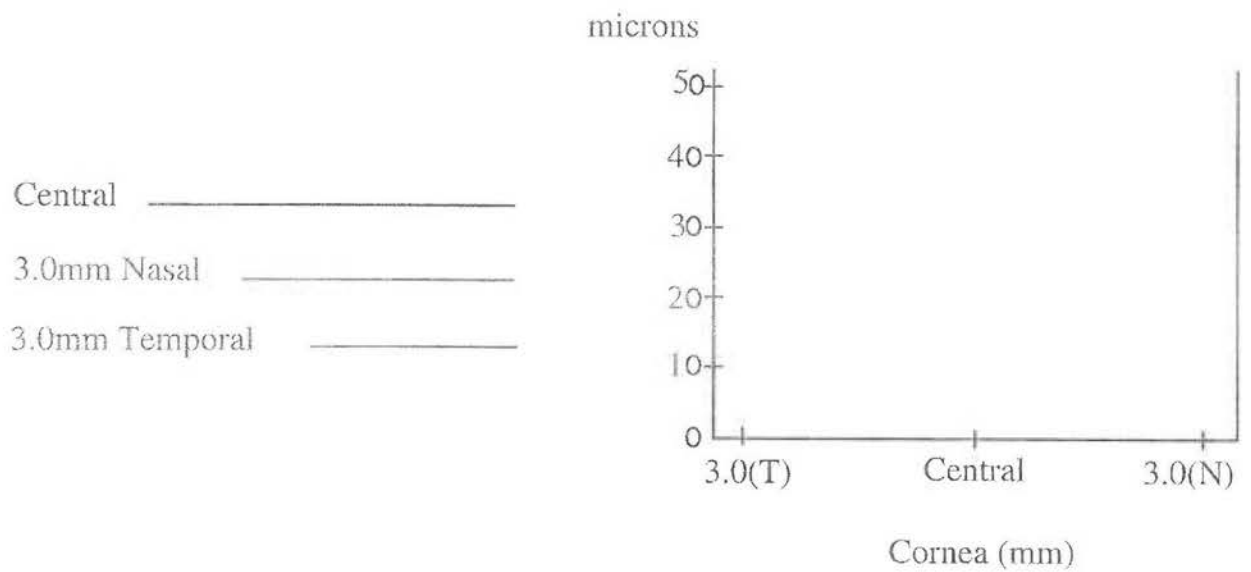


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted 0.50 D steeper than "K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

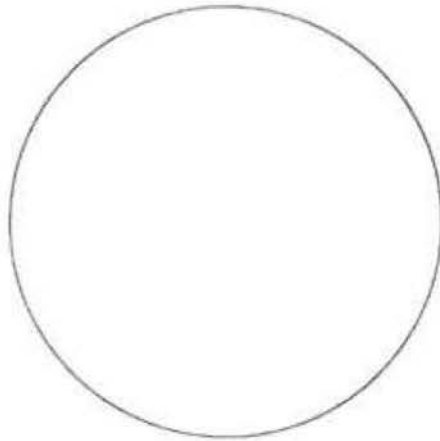
Worksheet II  
With-the-Rule Astigmatism

I: A. Low Astigmatism

K's: 43.37/44.25 @ 100

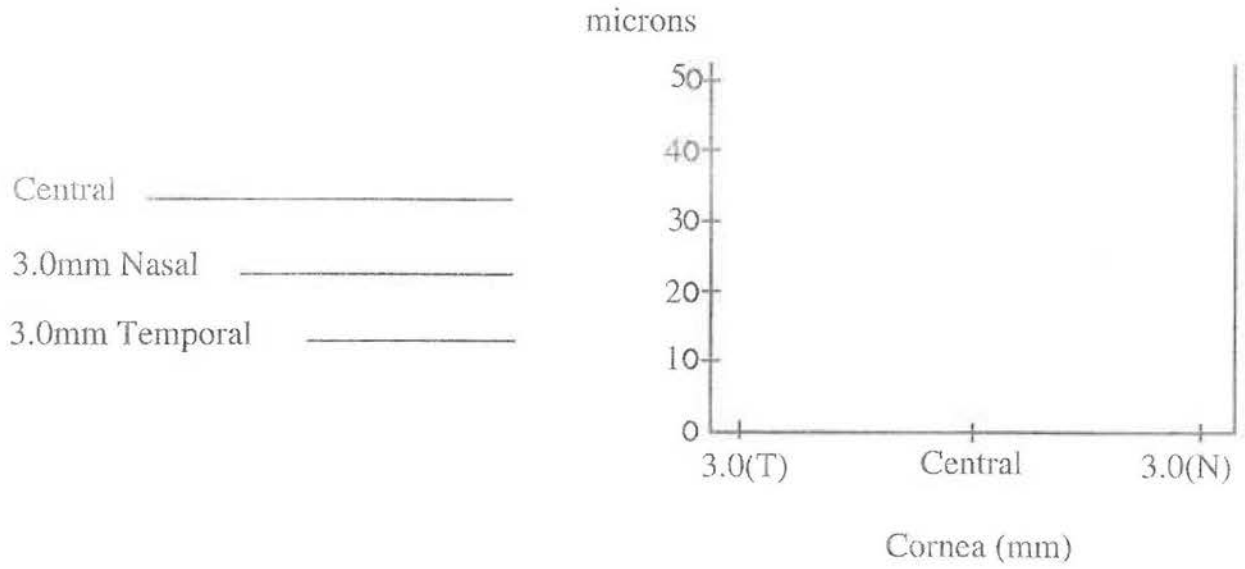
7a:

1. Draw the Flourescein Pattern of a lens fitted 0.50 D flatter than "K".

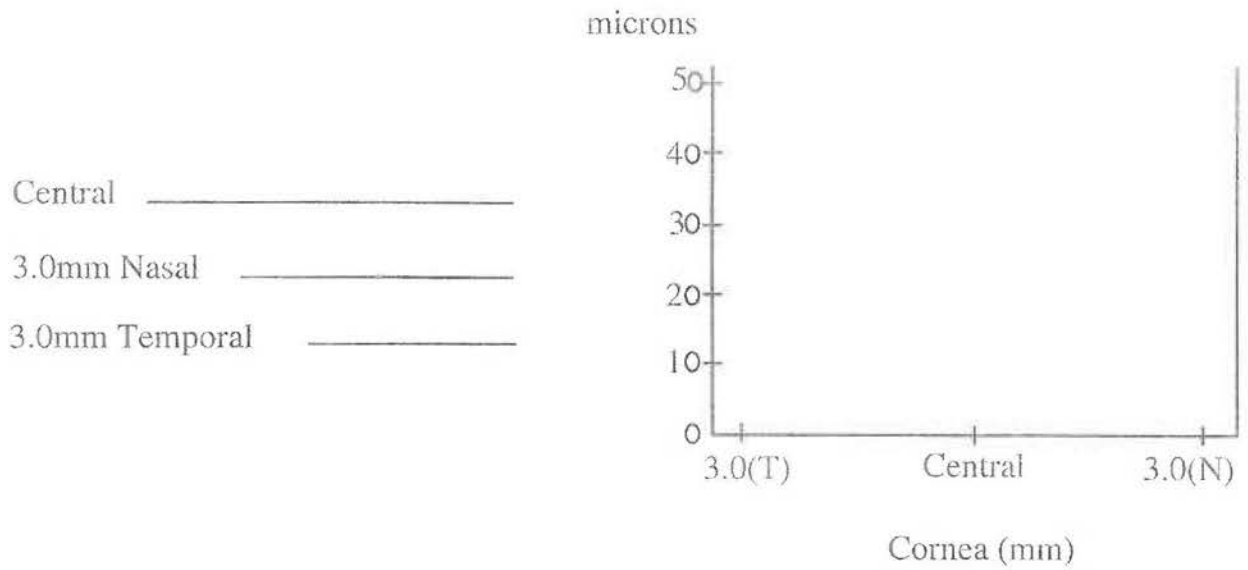


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian





3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted 0.50 D flatter than "K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

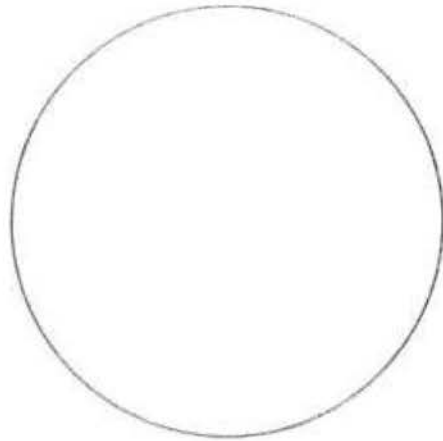
5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

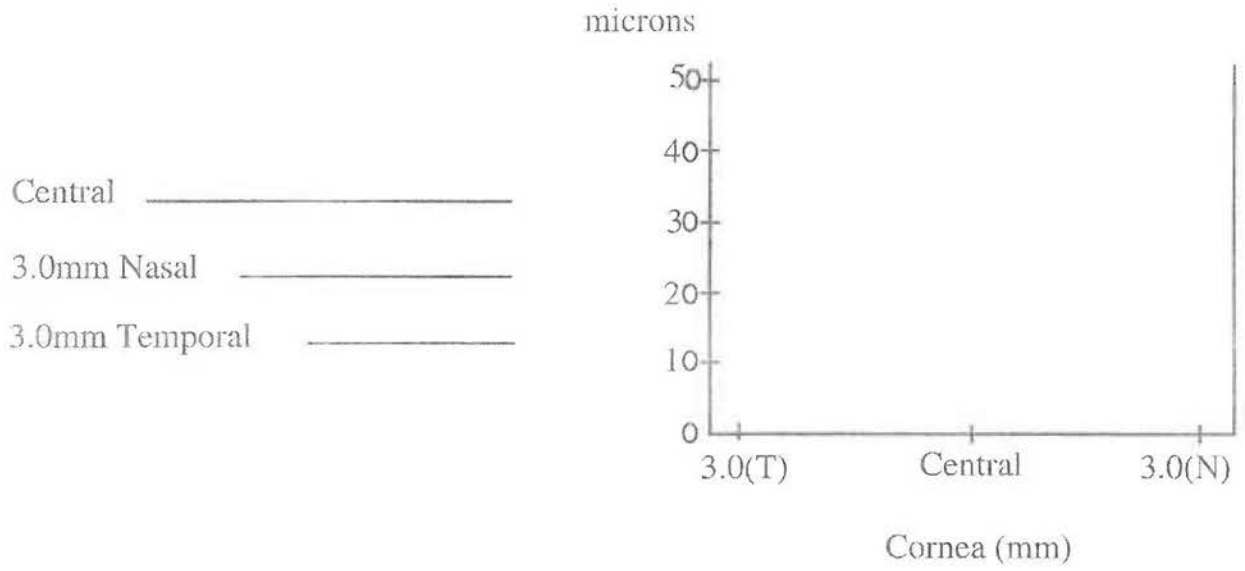
B. Low Astigmatism  
K's: 43.37/44.25 @ 100  
7a: -2.00 D sph

1. Draw the Flourescein Pattern of a lens fitted "on-K".

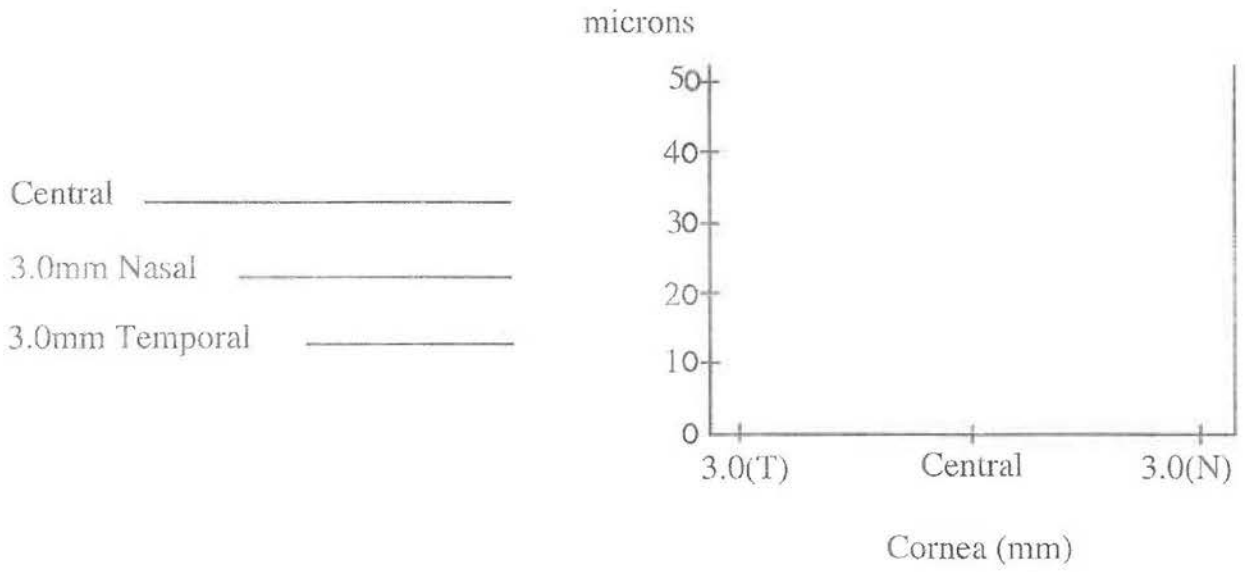


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted "on-K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

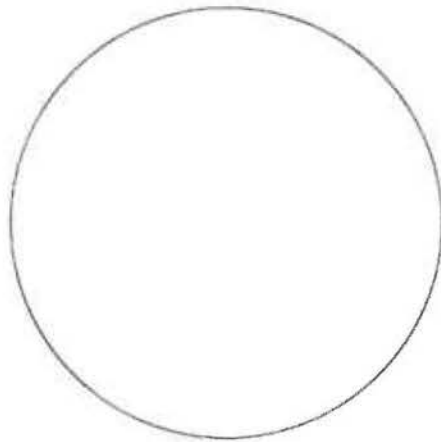
b) Describe the change.

C. Low Astigmatism

K's: 43.37/44.25 @ 100

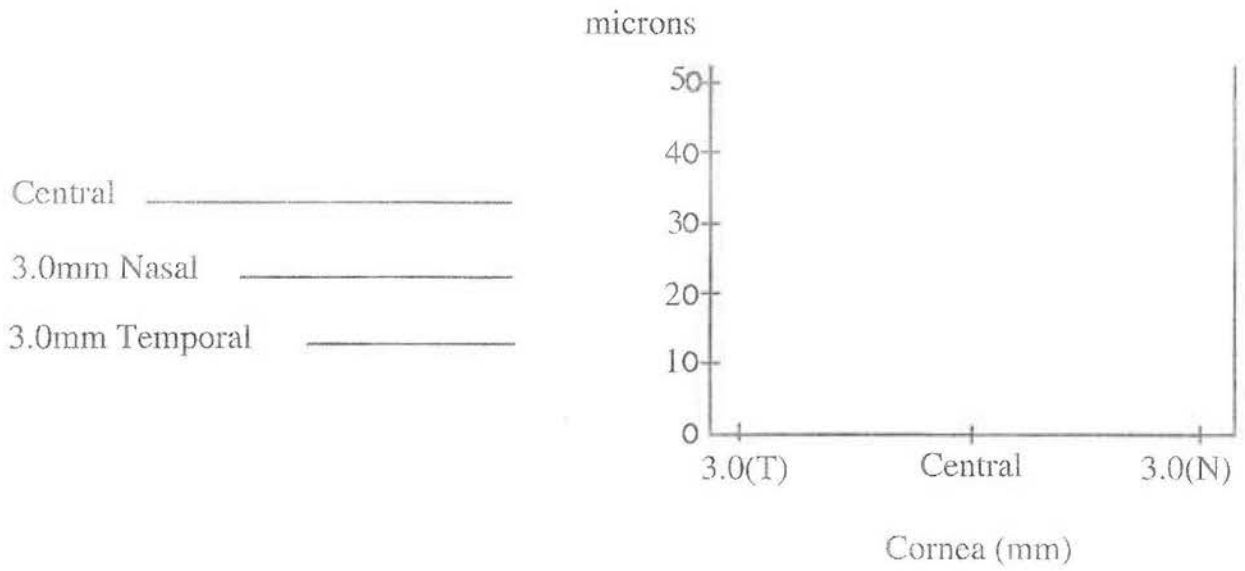
7a: -2.00 D sph

1. Draw the Fluorescein Pattern of a lens fitted 0.50 D steeper than "K".

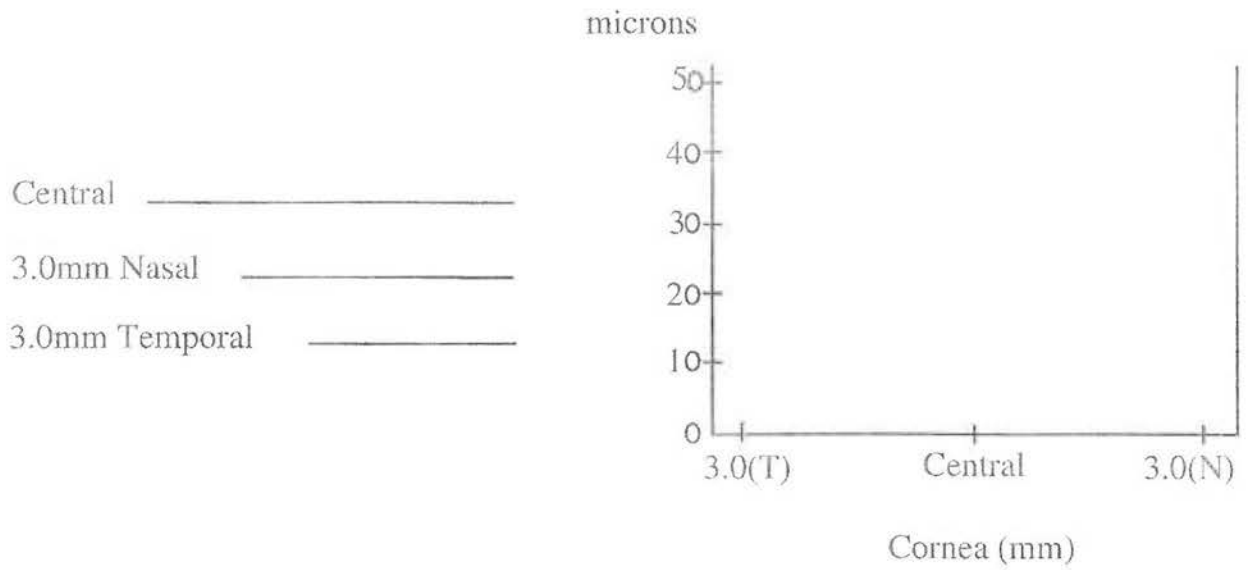


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted 0.50 D steeper than "K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

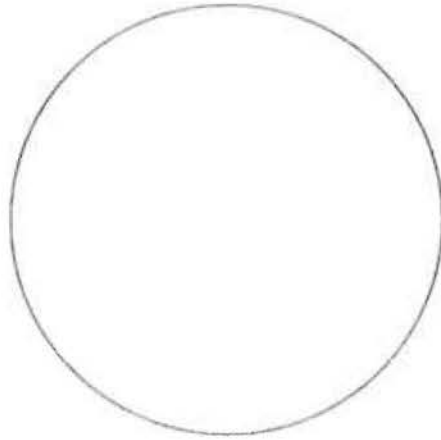
b) Describe the change.

II: A. Moderate Astigmatism

K's: 443.75/45.12 @ 080

7a:

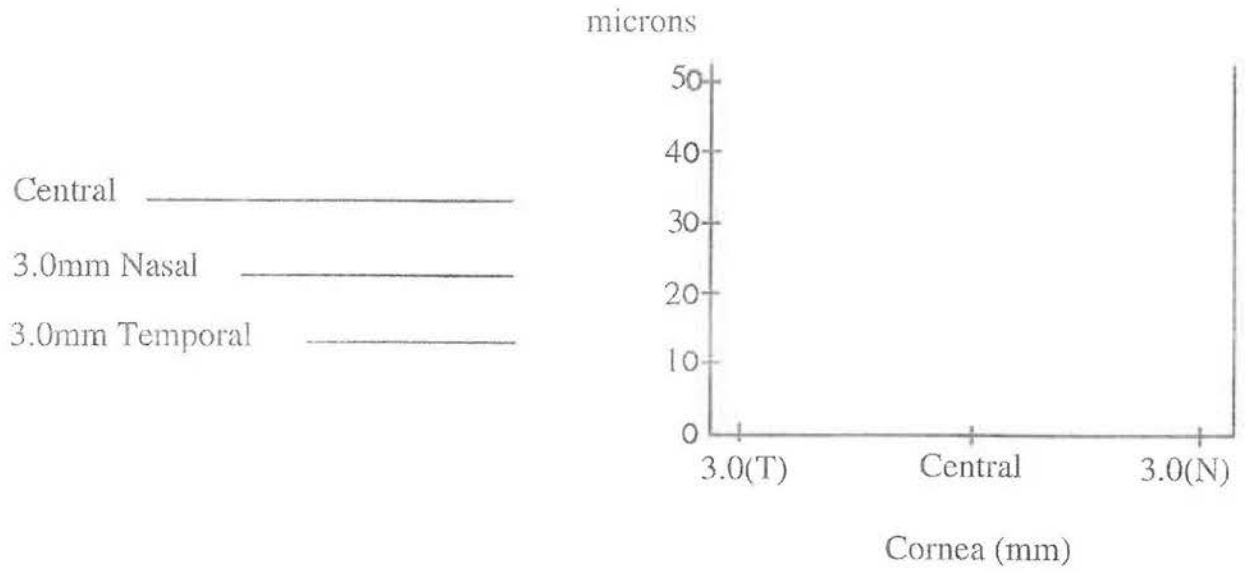
1. Draw the Flourescein Pattern of a lens fitted 0.50 D flatter than "K".



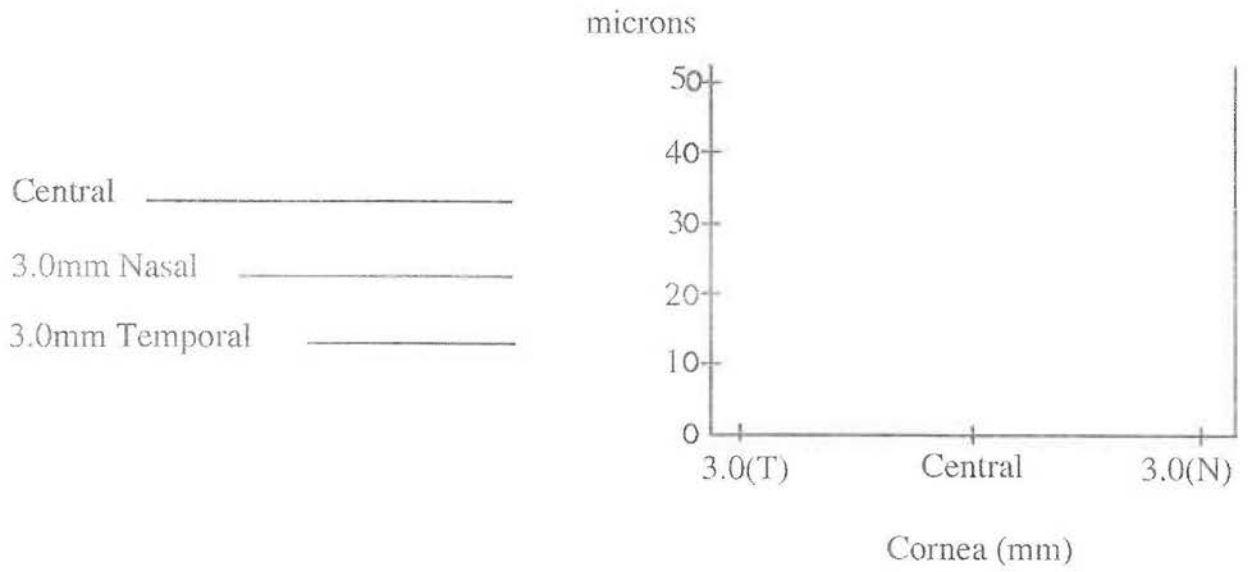


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted 0.50 D flatter than "K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

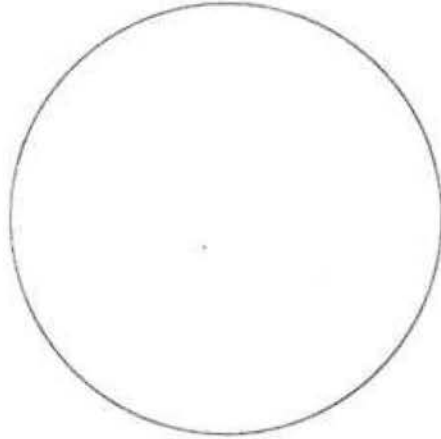
b) Describe the change.

B. Moderate Astigmatism

K's: 43.75/45.12 @ 080

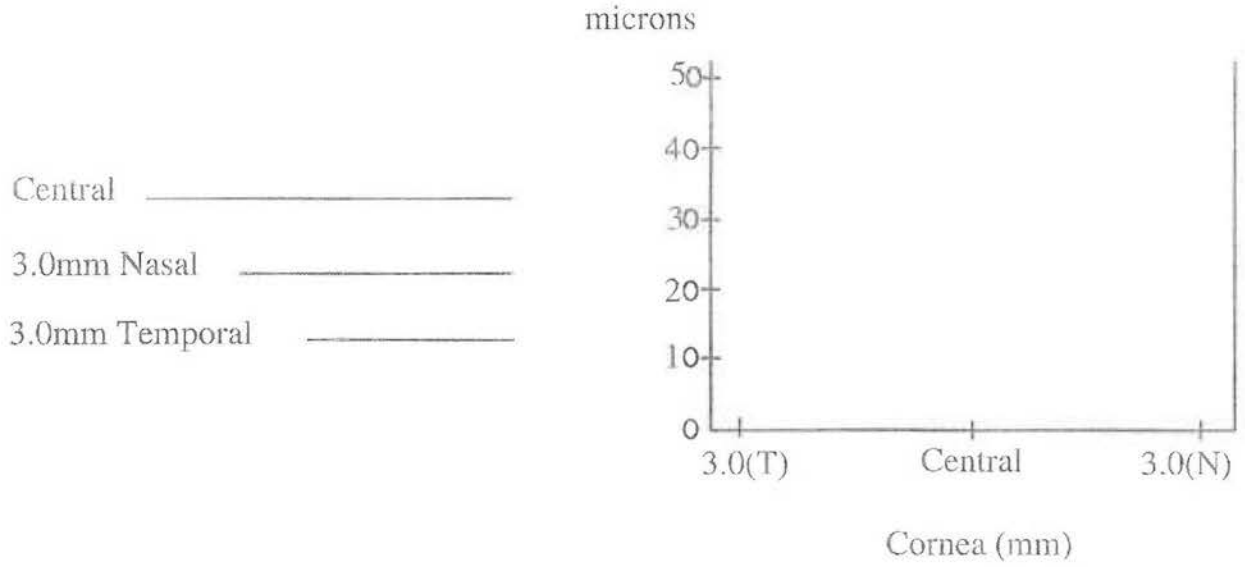
7a:

1. Draw the Flourescein Pattern of a lens fitted "on-K".

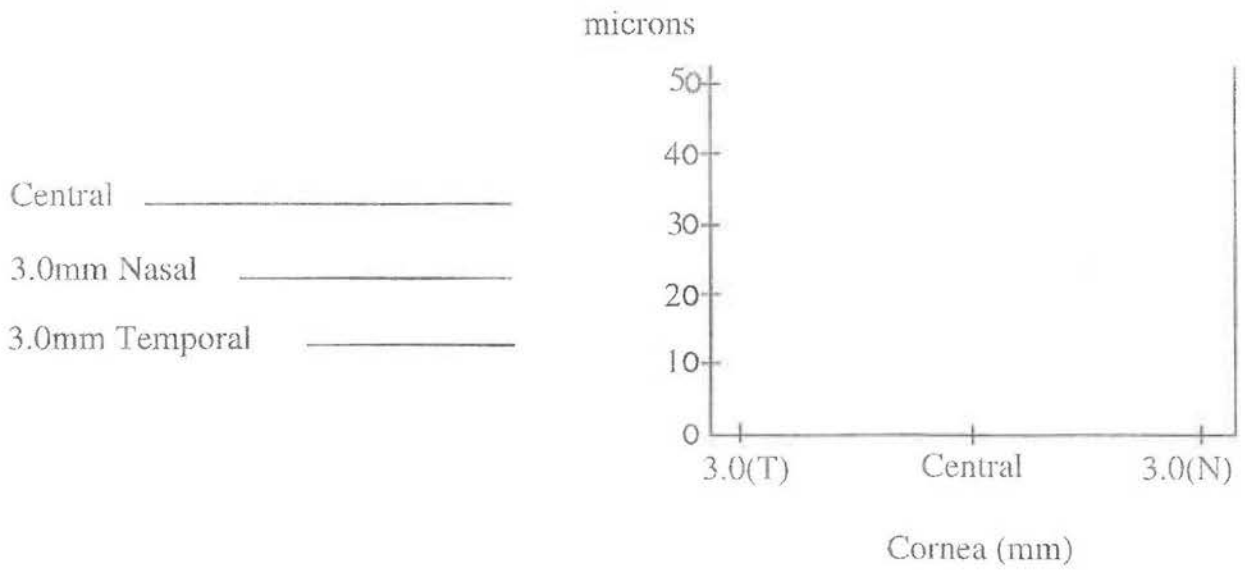


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted "on-K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

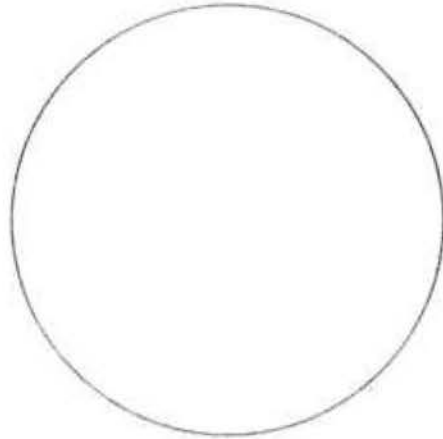
b) Describe the change.

C. Moderate Astigmatism

K's: 43.75/45.12 @ 080

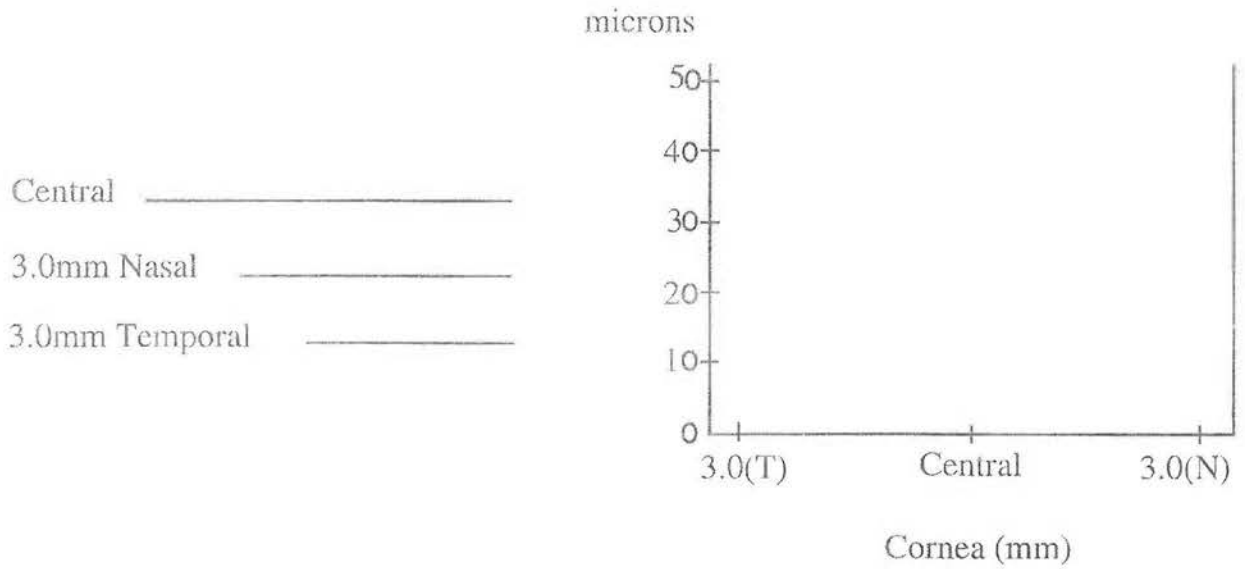
7a:

1. Draw the Flourescein Pattern of a lens fitted 0.50 D steeper than "K".

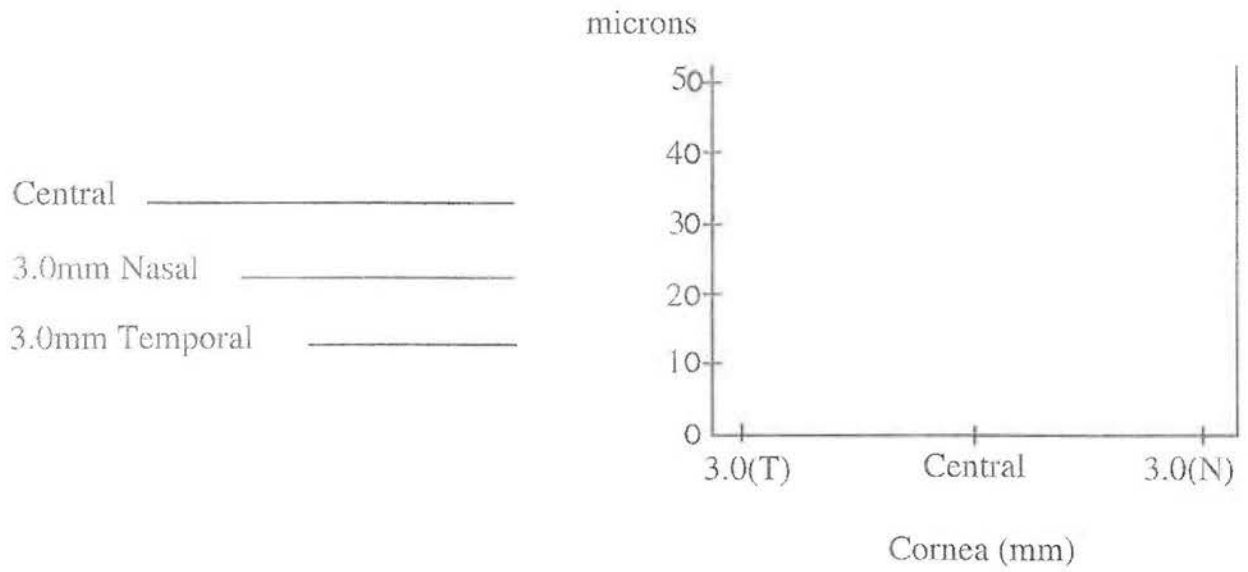


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted 0.50 D steeper than "K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

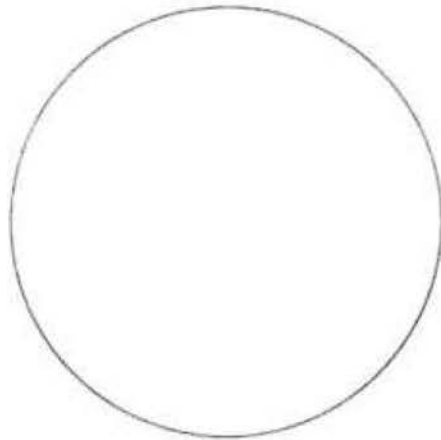


III: A. High Astigmatism

K's: 46.12/48.37 @ 090

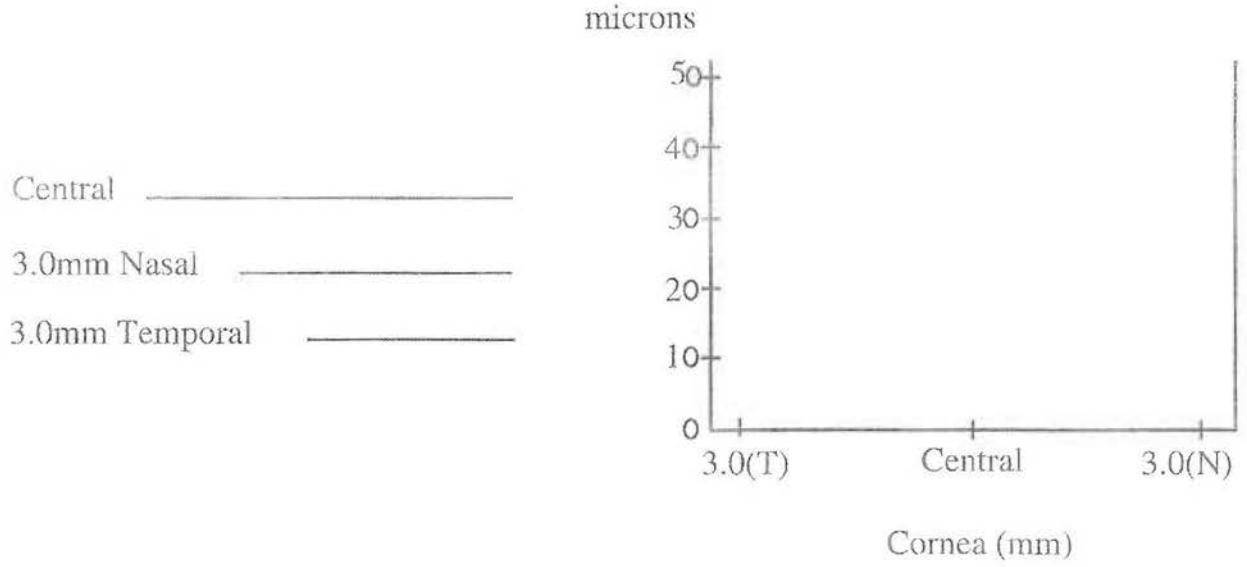
7a:

1. Draw the Flourescein Pattern of a lens fitted 0.50 D flatter than "K".

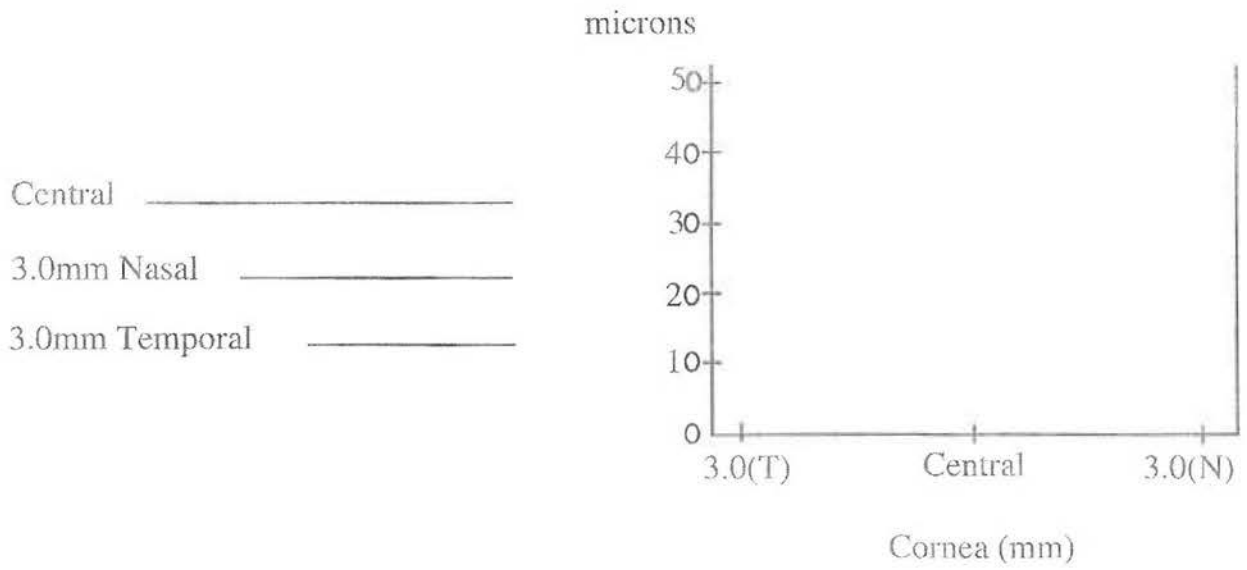


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted 0.50 D flatter than "K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

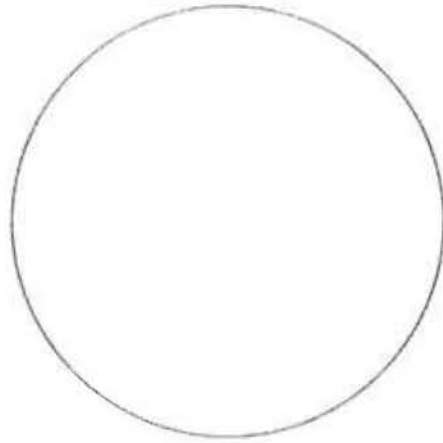
b) Describe the change.

B. High Astigmatism

K's: 46.12/48.25 @090

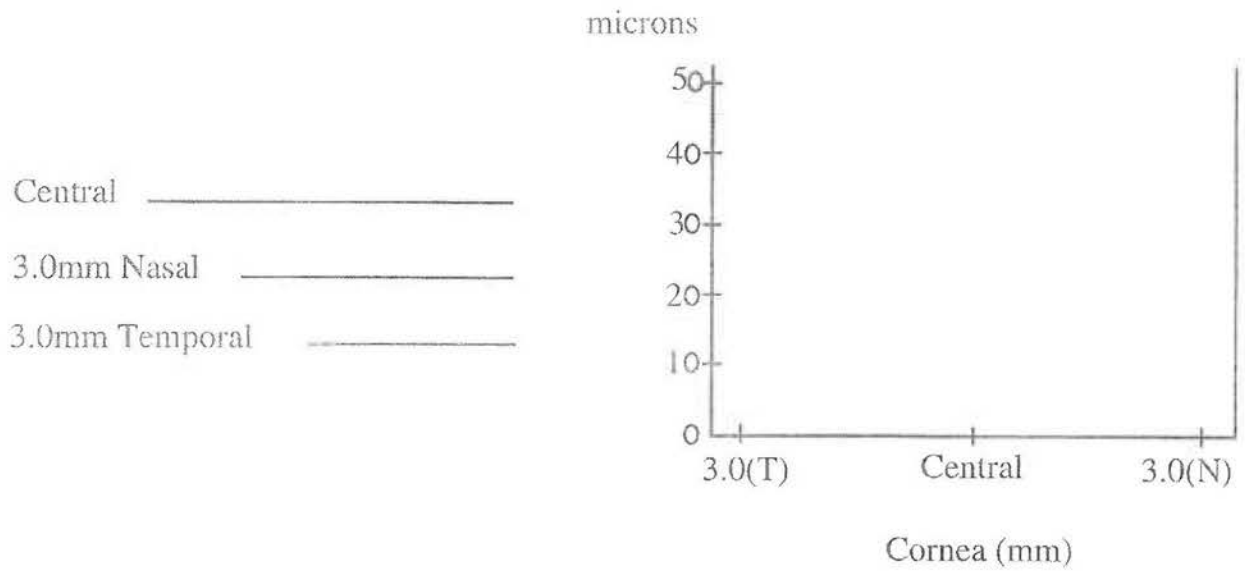
7a:

1. Draw the Flourescein Pattern of a lens fitted "on-K".

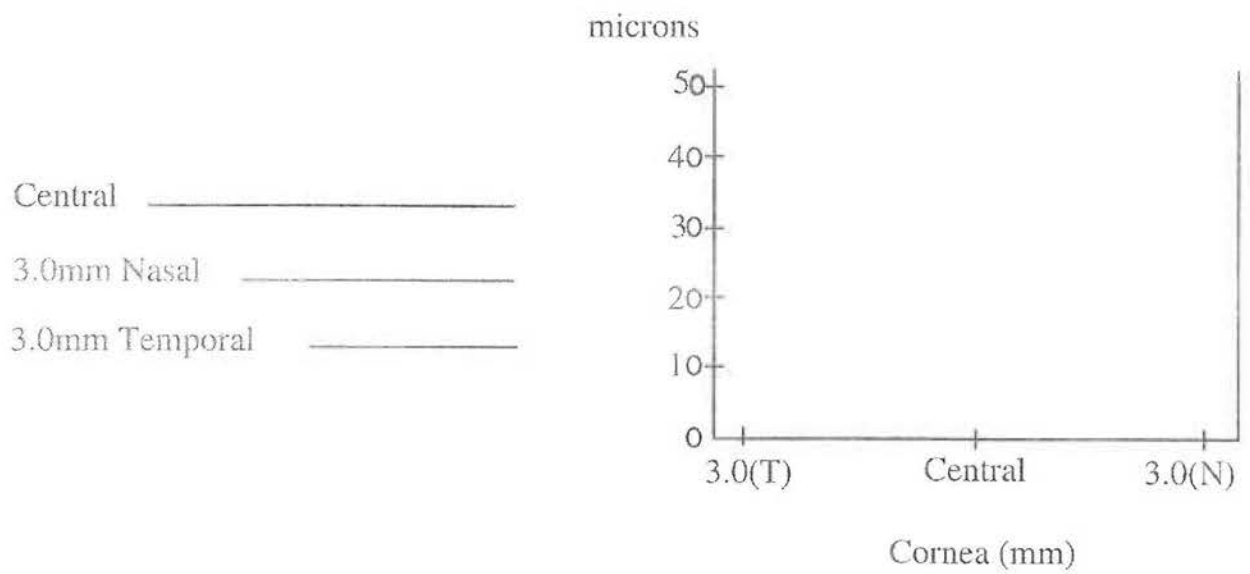


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted "on-K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

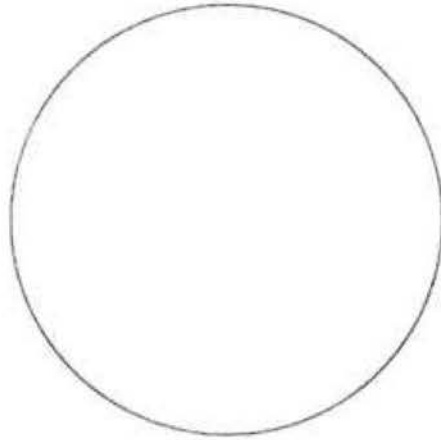
b) Describe the change.

C. High Astigmatism

K's: 46.12/48.37 @ 090

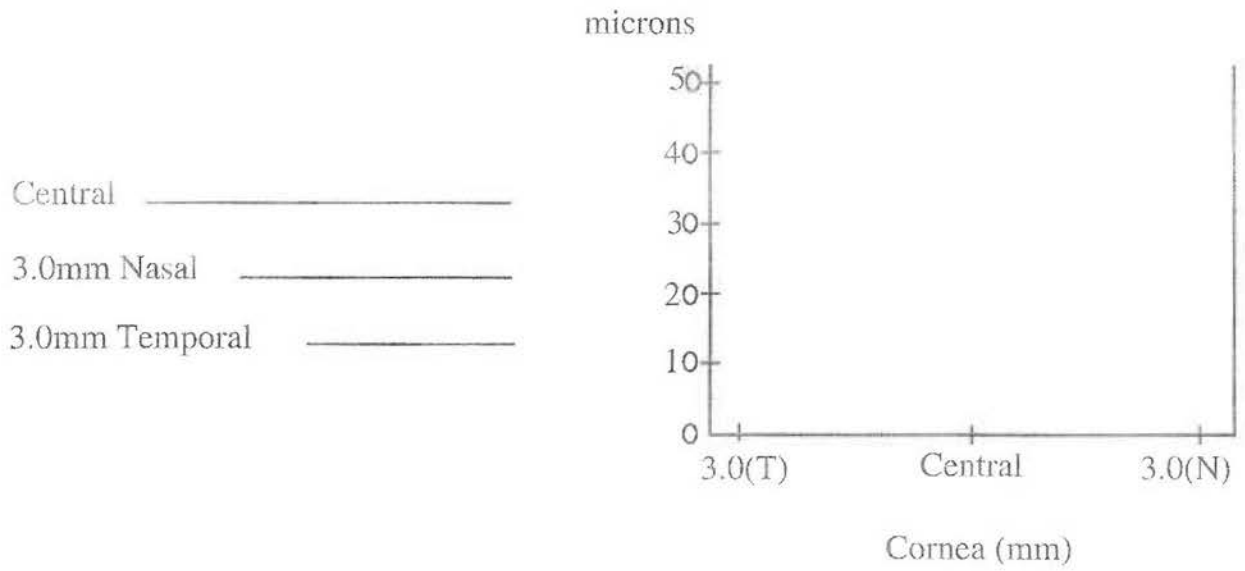
7a:

1. Draw the Flourescein Pattern of a lens fitted 0.50 D steeper than "K".

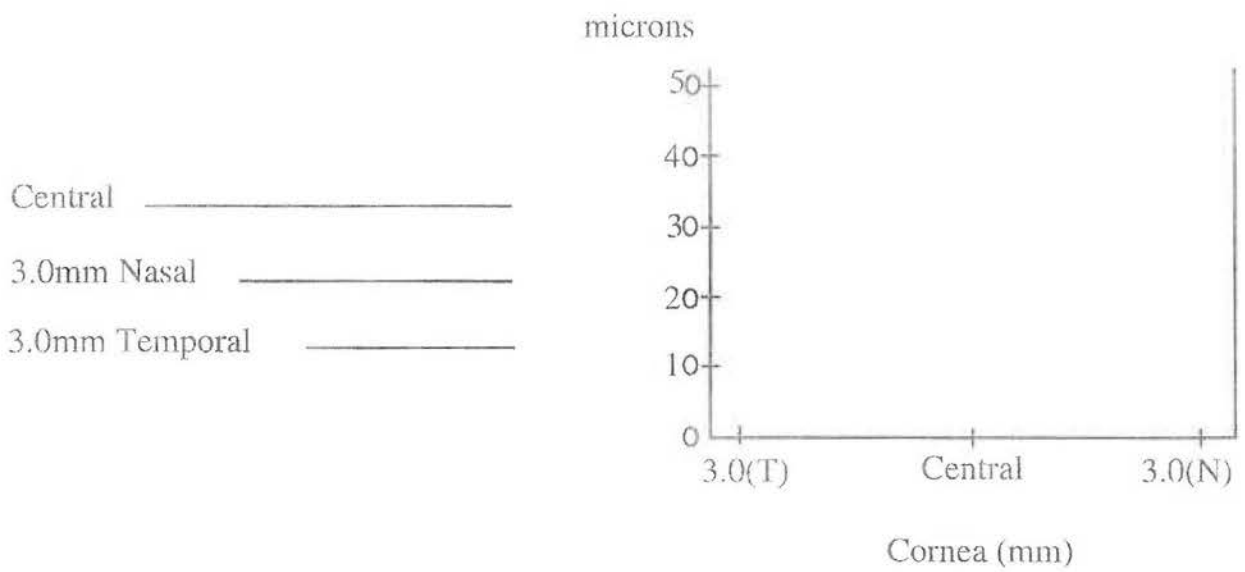


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian





3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted 0.50 D steeper than "K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

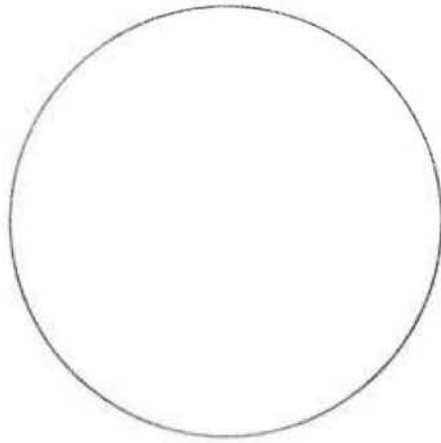
Worksheet III  
Against-the-Rule Astigmatism

I: A. Low Astigmatism

K's: 44.25/43.75 @ 114

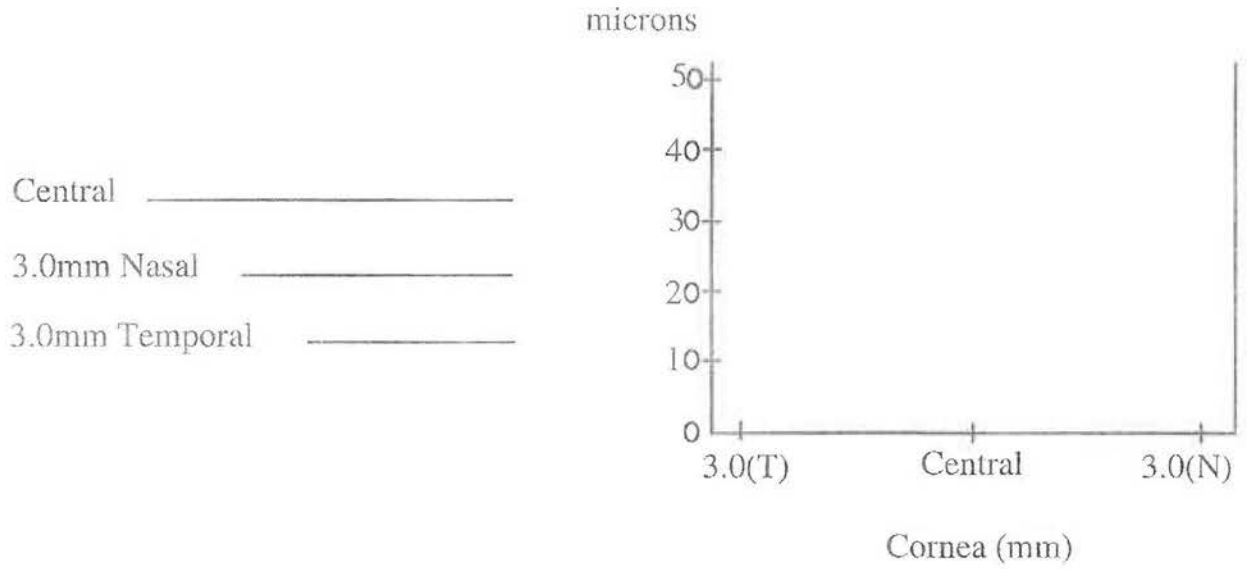
7a:

1. Draw the Fluorescein Pattern of a lens fitted 0.50 D flatter than "K".

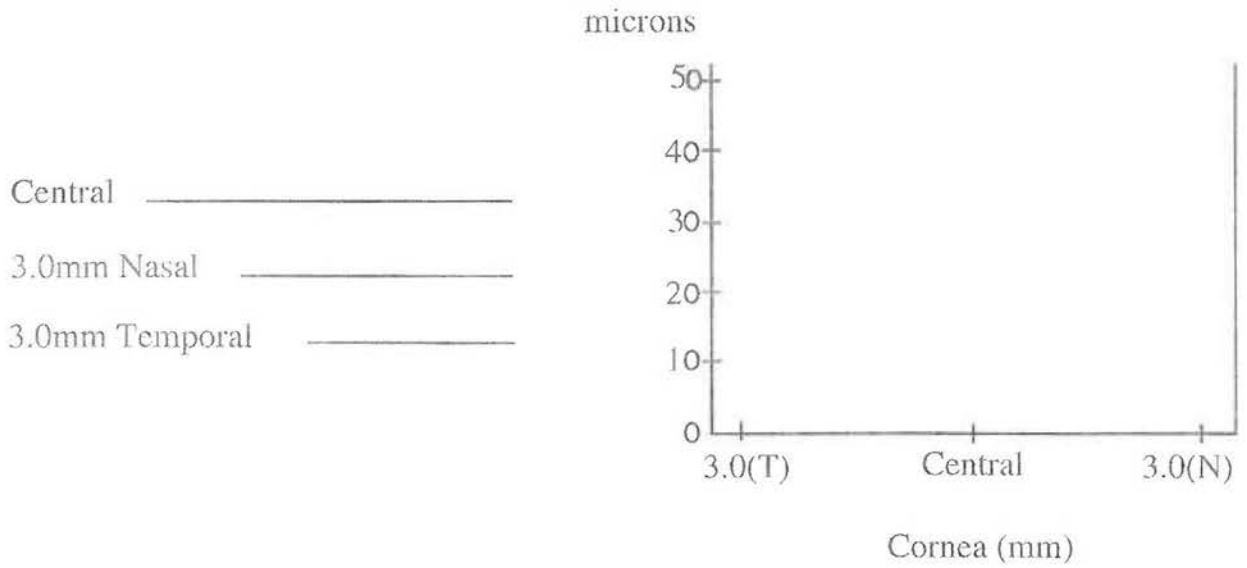


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted 0.50 D flatter than "K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

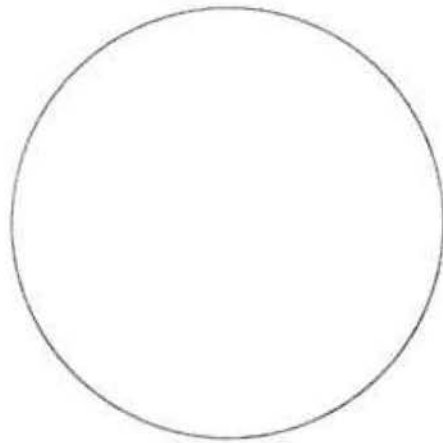
b) Describe the change.

B. Low Astigmatism

K's: 43.75/45.12 @ 080

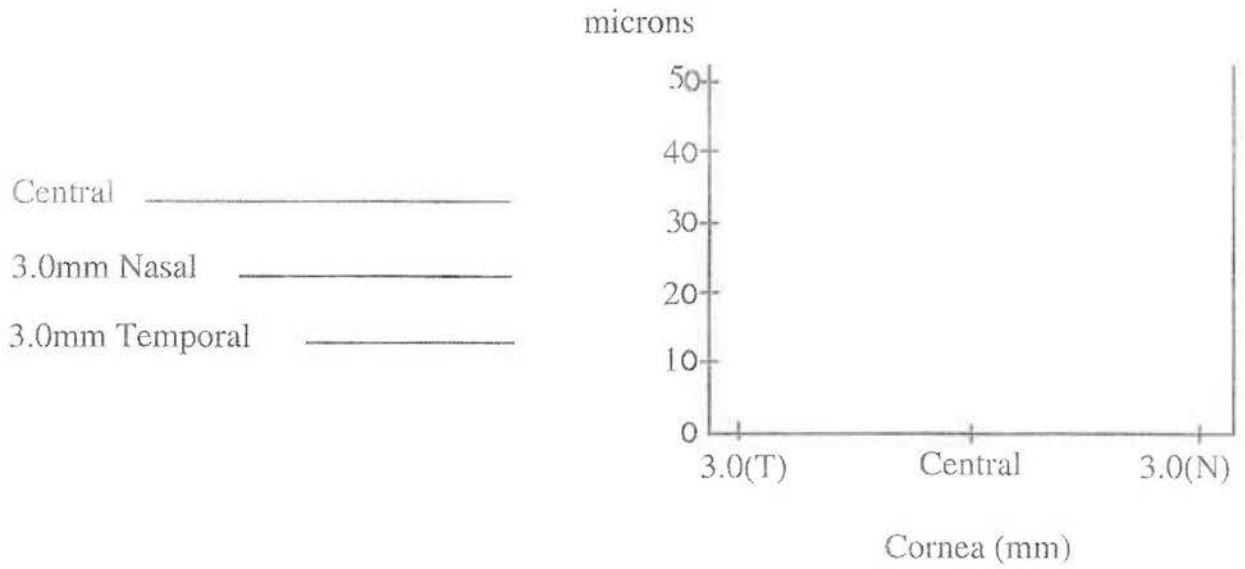
7a:

1. Draw the Flourescein Pattern of a lens fitted "on-K".

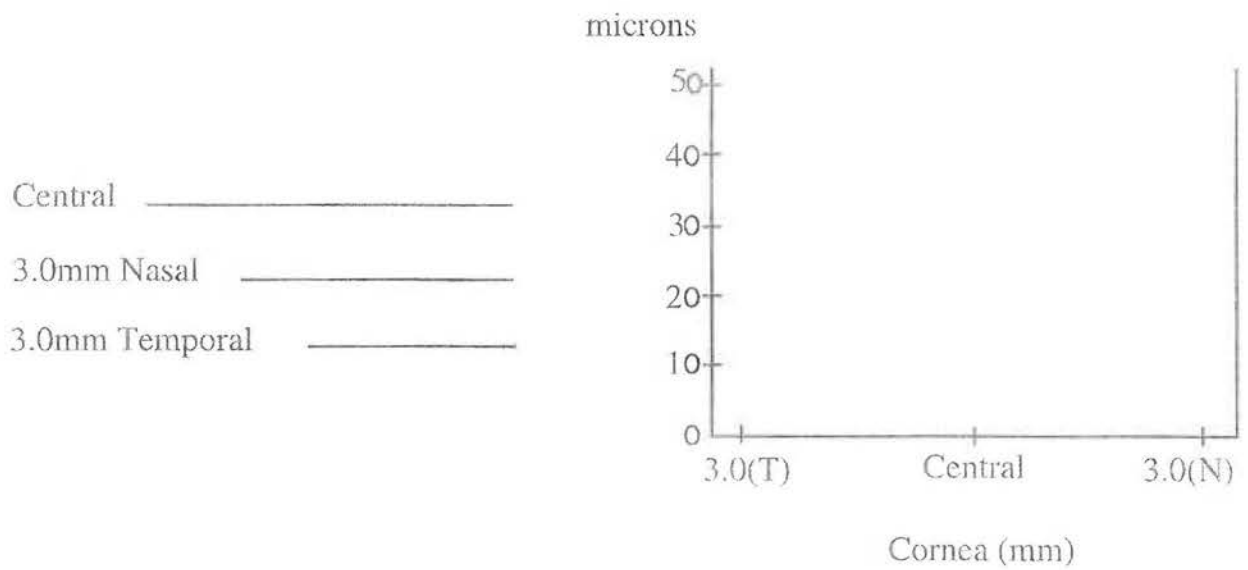


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted "on-K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

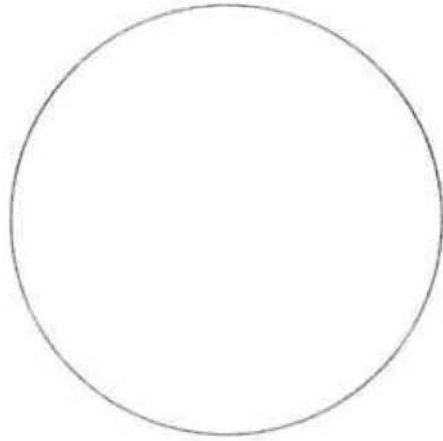
b) Describe the change.

C. Low Astigmatism

K's: 44.25/43.75 @ 114

7a:

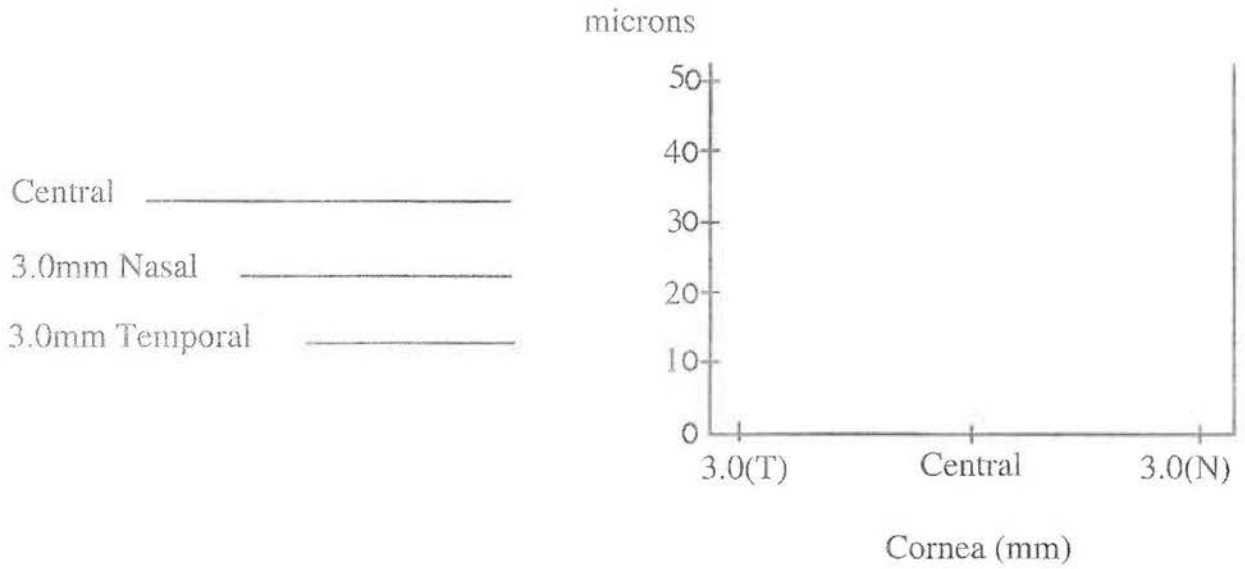
1. Draw the Flourescein Pattern of a lens fitted 0.50 D steeper than "K".



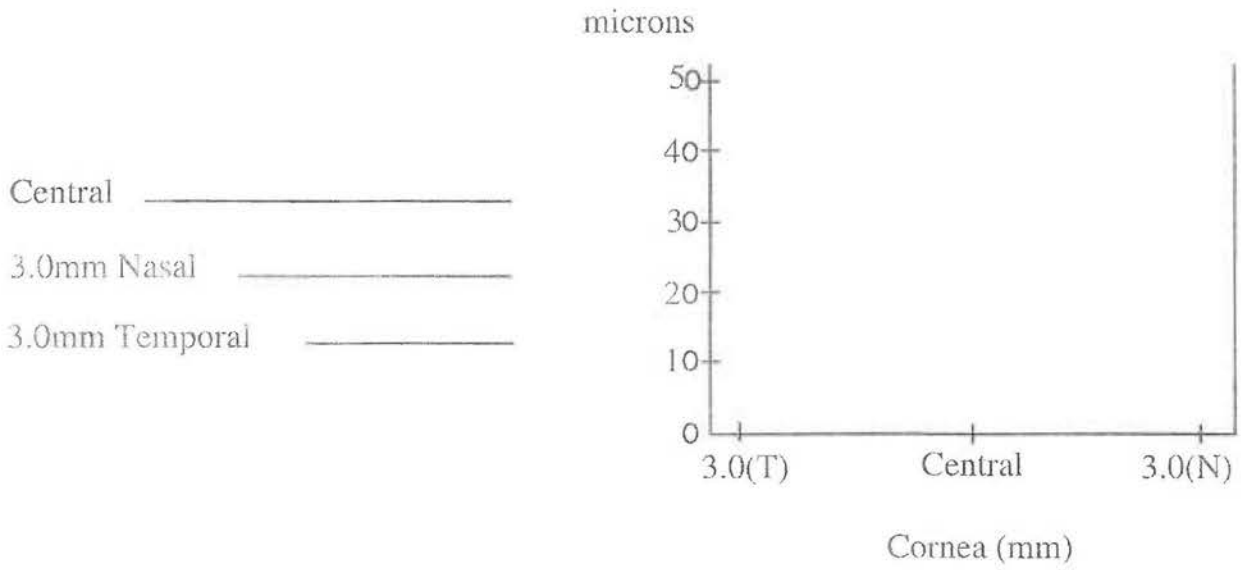


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted 0.50 D steeper than "K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

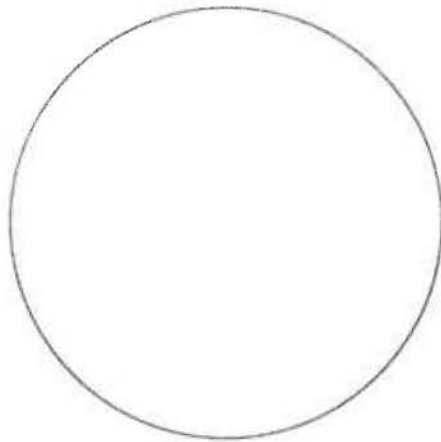
b) Describe the change.

II: A. Moderate Astigmatism

K's: 45.37/44.25 @ 076

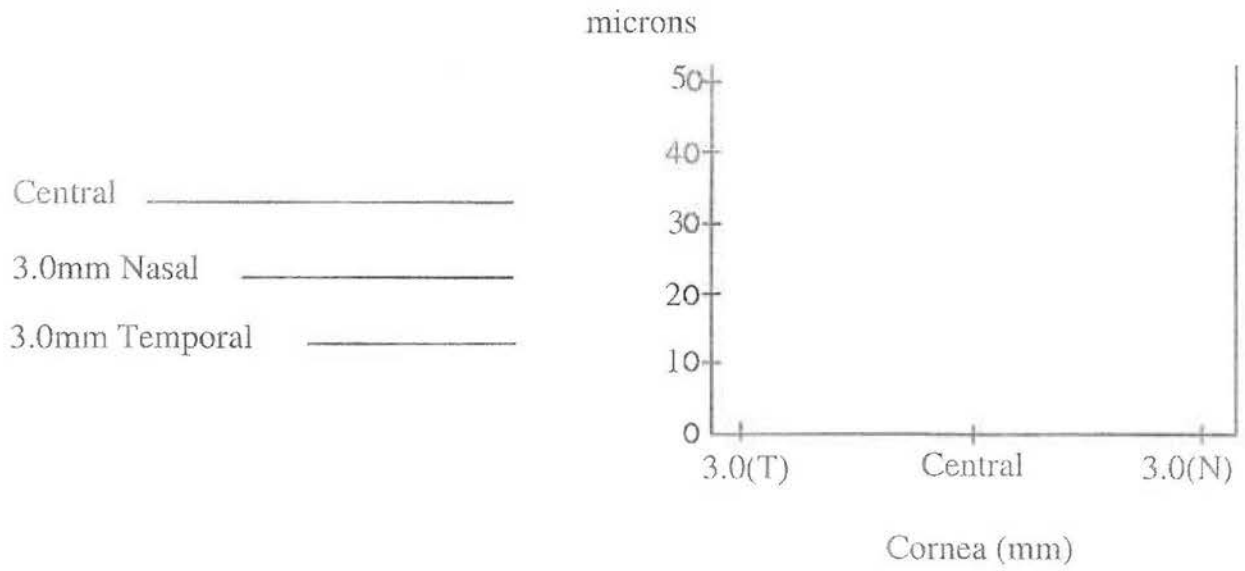
7a:

1. Draw the Flourescein Pattern of a lens fitted 0.50 D flatter than "K".

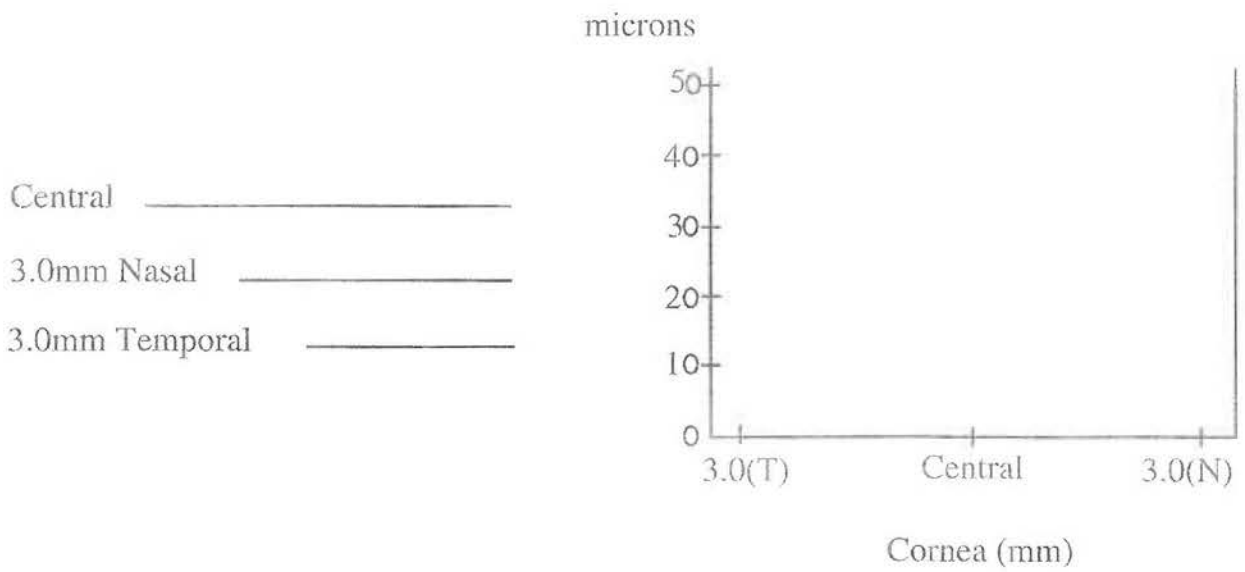


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted 0.50 D flatter than "K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

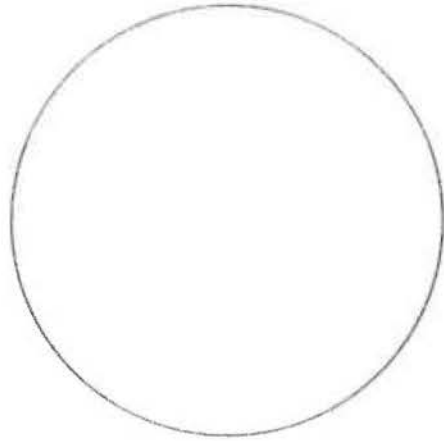
b) Describe the change.

B. Moderate Astigmatism

K's: 45.37/44.25 @ 076

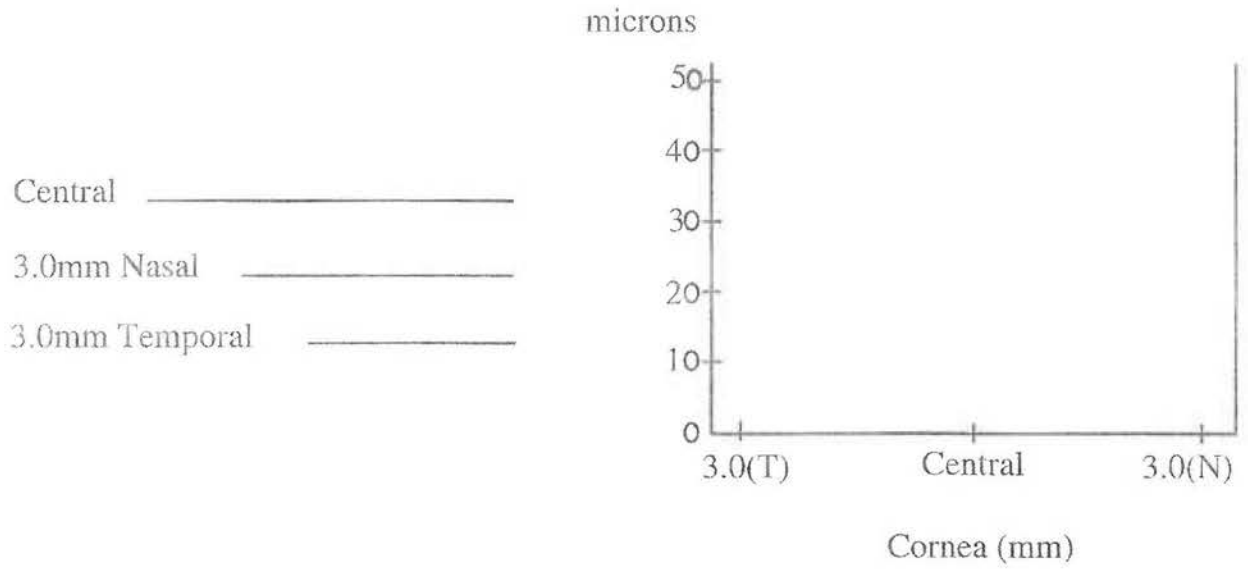
7a:

1. Draw the Flourescein Pattern of a lens fitted "on-K".

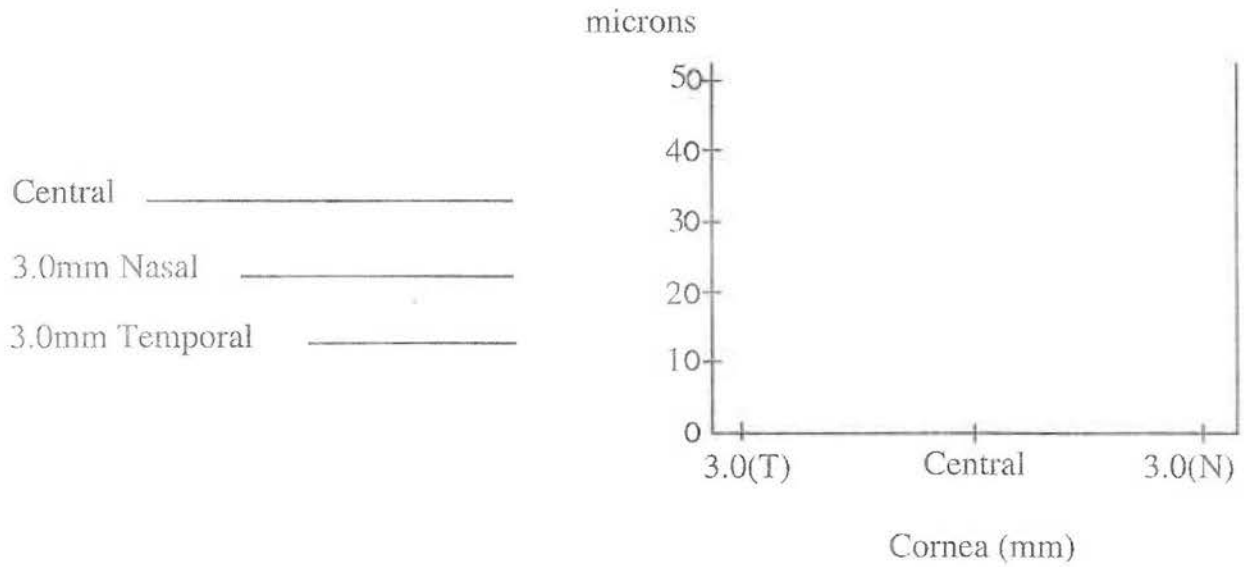


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted "on-K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

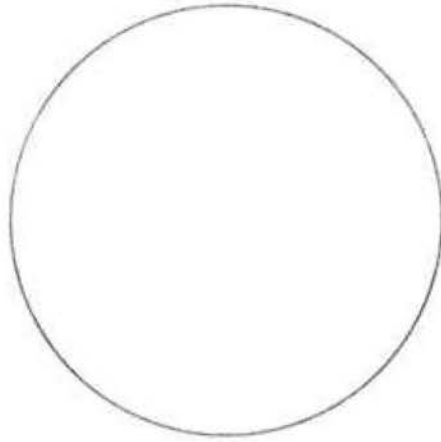


C. Moderate Astigmatism

K's: 45.37/44.25 @ 076

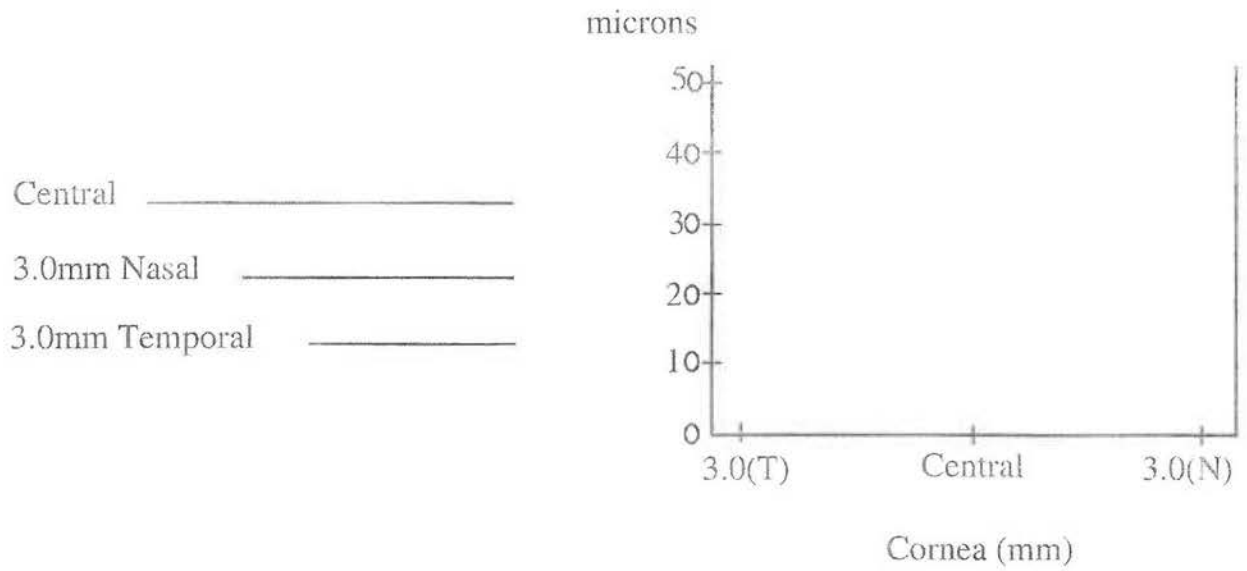
7a:

1. Draw the Flourescein Pattern of a lens fitted 0.50 D steeper than "K".

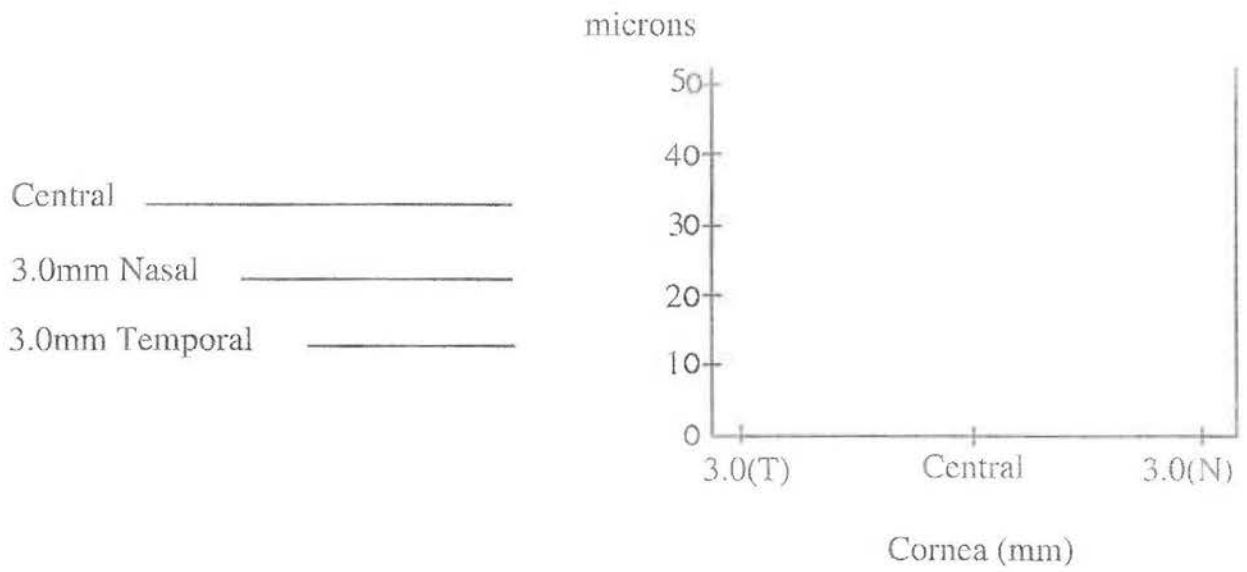


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted 0.50 D steeper than "K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

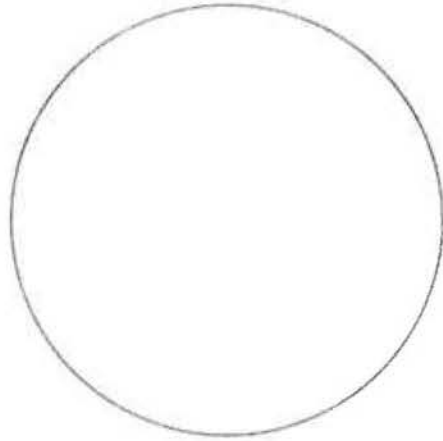
b) Describe the change.

III: A. High Astigmatism

K's: 47.25/44.87 @ 106

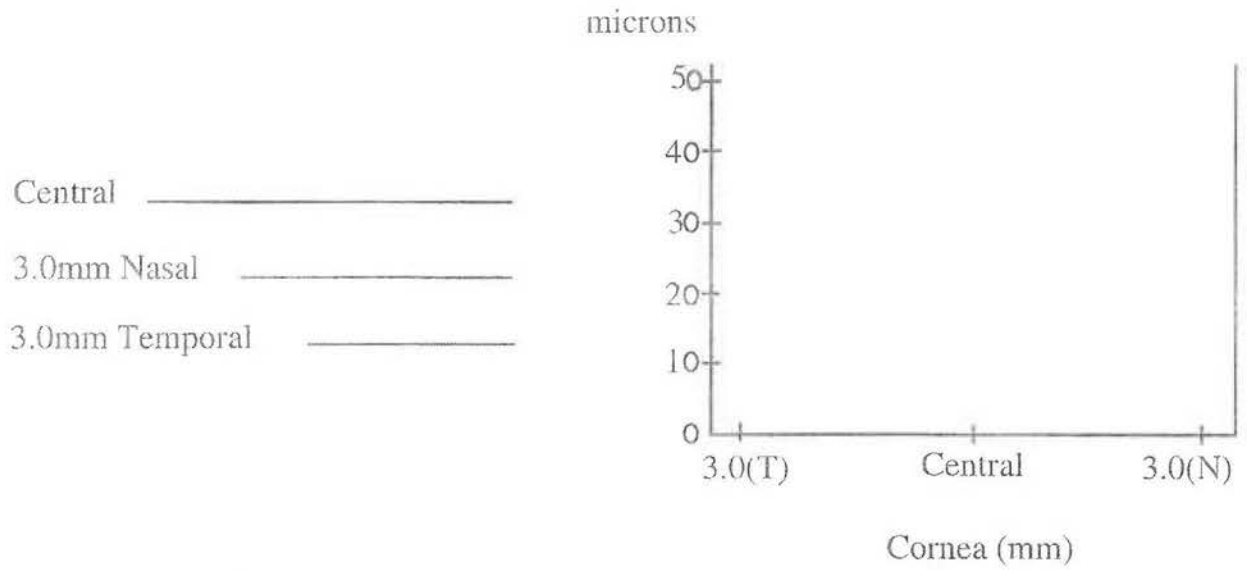
7a:

1. Draw the Flourescein Pattern of a lens fitted 0.50 D flatter than "K".

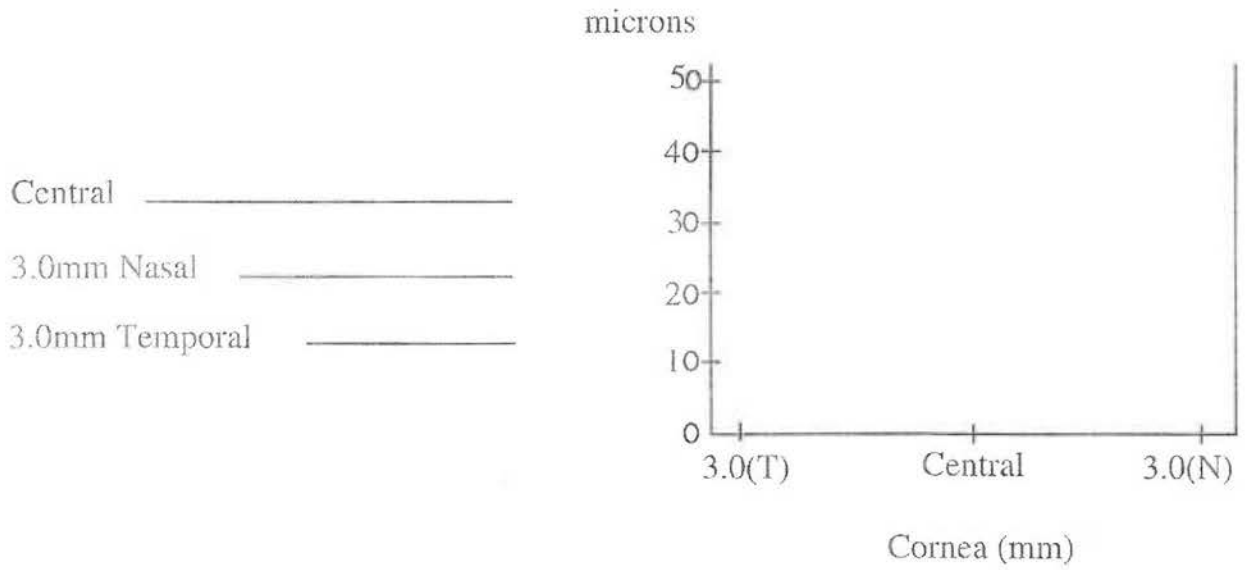


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted 0.50 D flatter than "K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

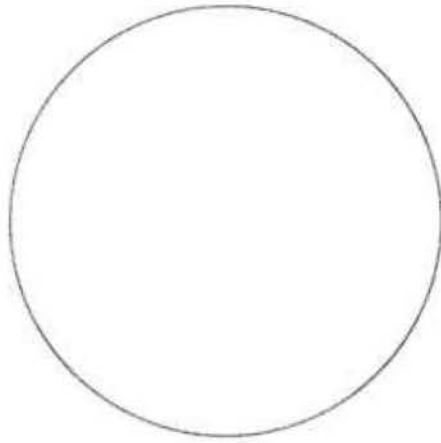
b) Describe the change.

B. High Astigmatism

K's: 47.25/44.87 @ 106

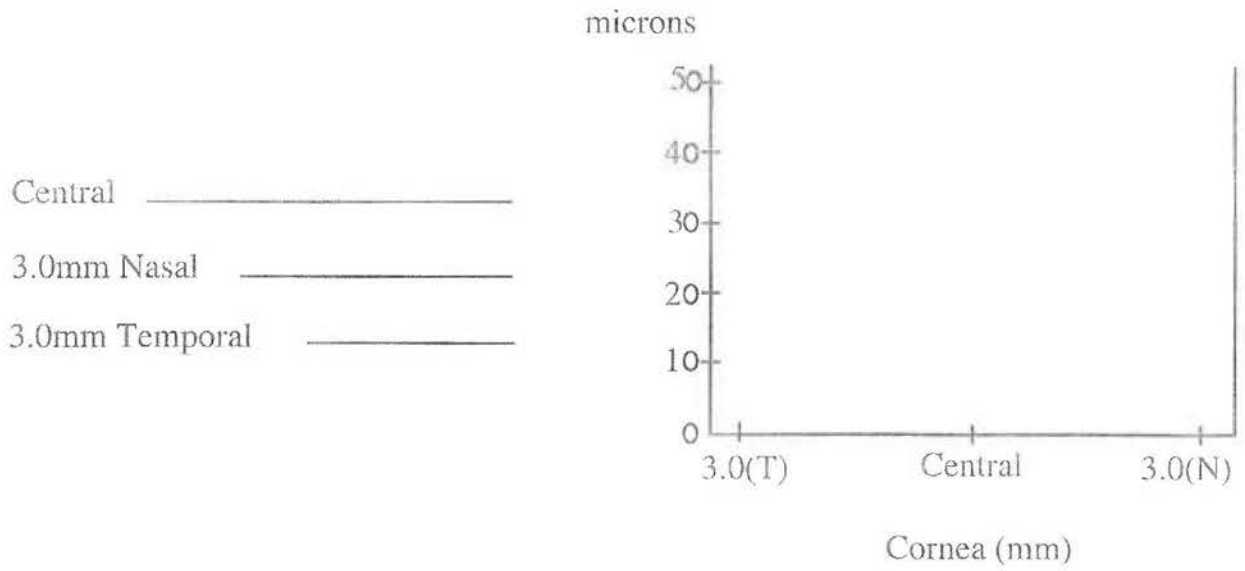
7a:

1. Draw the Flourescein Pattern of a lens fitted "on-K".

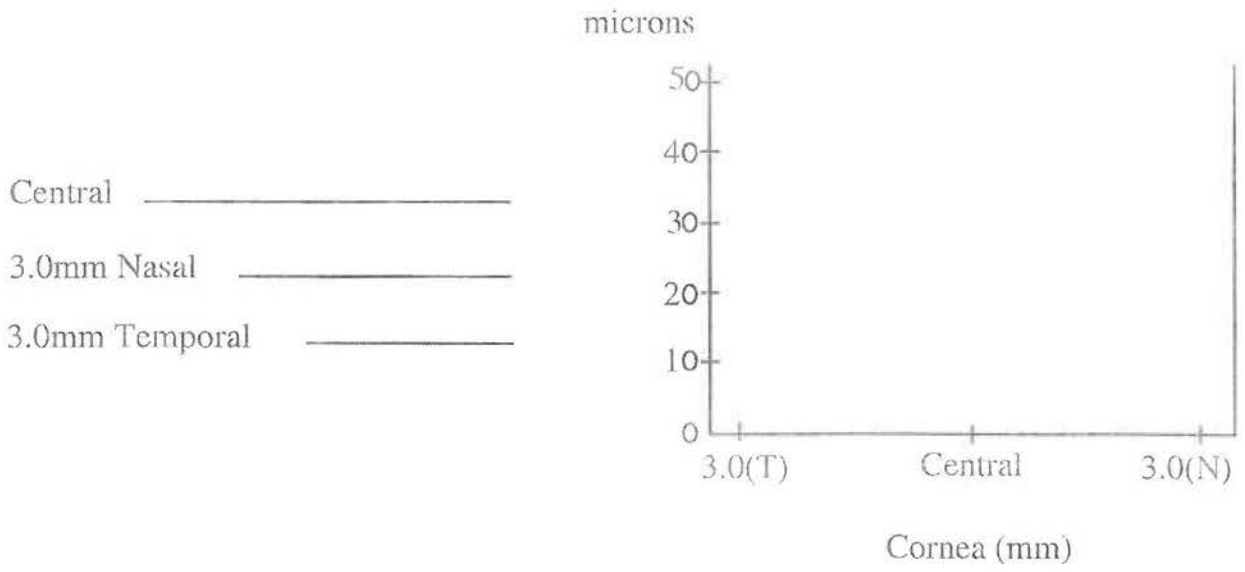


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian





3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted "on-K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

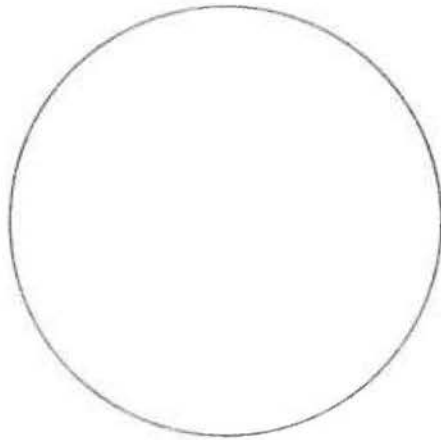
b) Describe the change.

C. High Astigmatism

K's: 47.25/44.87 A 106

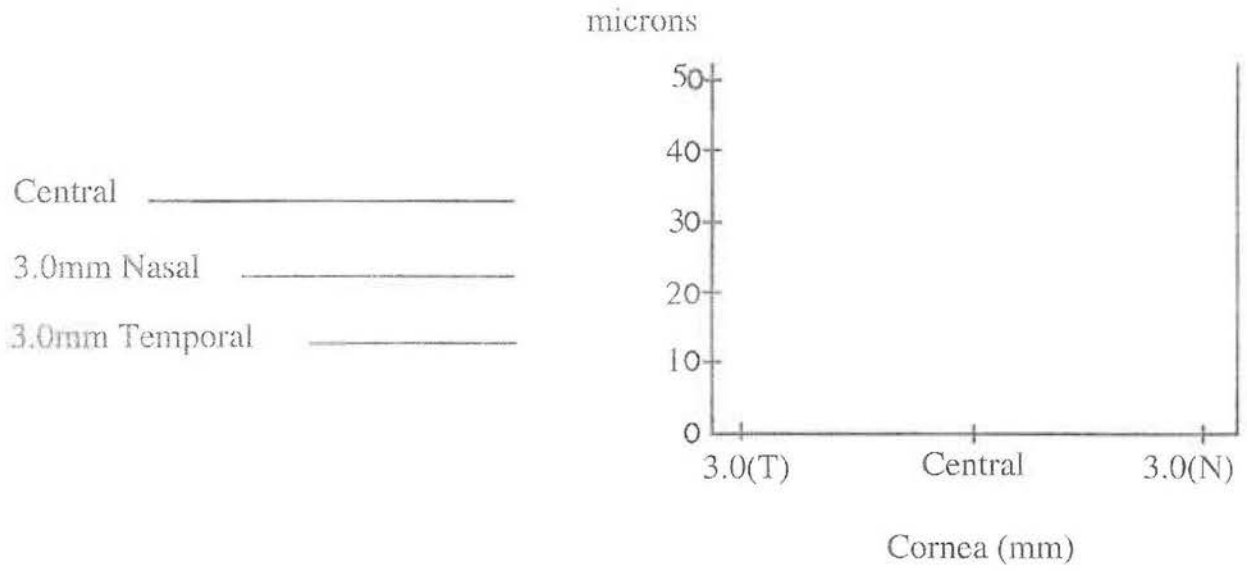
7a:

1. Draw the Flourescein Pattern of a lens fitted 0.50 D steeper than "K".

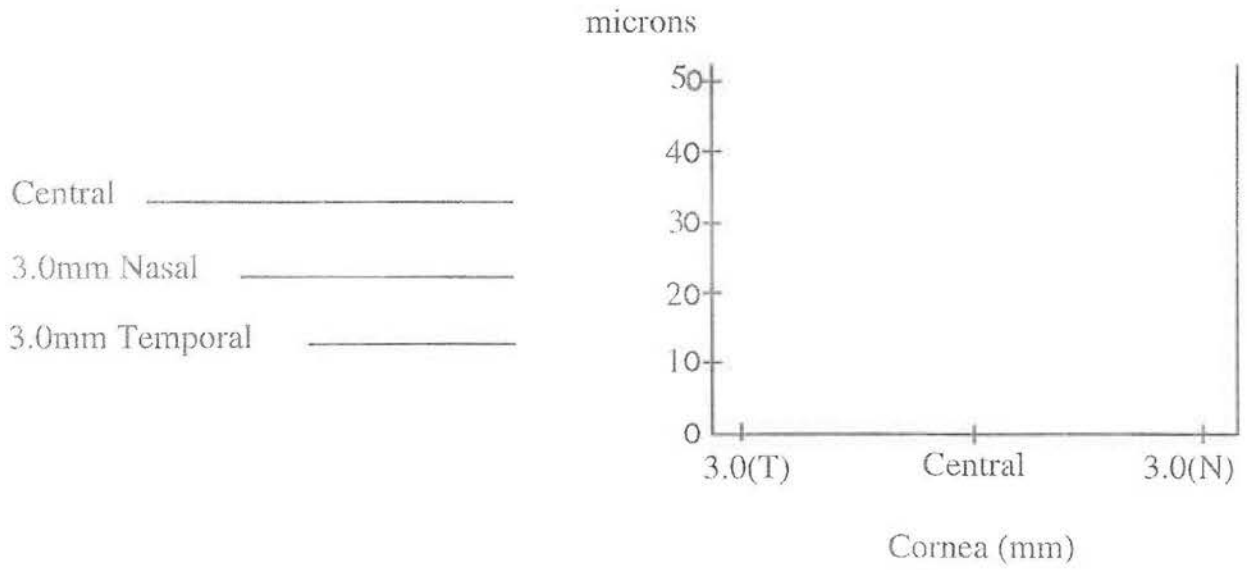


2. Tear Layer Depth in Microns:

Horizontal Meridian



Vertical Meridian



3. What is the final lens power? \_\_\_\_\_

4. With the lens fitted 0.50 D steeper than "K", decrease the posterior optical zone diameter by 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.

5. Increase the posterior optical zone diameter 0.4 mm.

a) Does the central lens/cornea relationship steepen or flatten?

b) Describe the change.