Optics Quiz 3

This quiz is intended to be taken after completion of Chapters 10-15

Note: Some questions herein may have appeared first in a copyrighted source. If you own the copyright to a question and would like an acknowledgement or to have the question removed, please contact me EyeDentistAAO@gmail.com
No, you can’t use a calculator (and you don’t need one anyway)

Note that some questions are callbacks from previous quizzes
Draw the appropriate error lens (if any) within each eye

The Hyperopic Eye

The Emmetropic Eye

The Myopic Eye
Draw the appropriate error lens (if any) within each eye

The Hyperopic Eye

The Emmetropic Eye

The Myopic Eye
A pt is a +2 hyperope. He is capable of a total of 6D of accommodation. Absent corrective lenses or surgery:

a) Where is his near point relative to the corneal plane?

b) His range of clear vision is from where to where?
A pt is a +2 hyperope. He is capable of a total of 6D of accommodation. Absent corrective lenses or surgery:

a) Where is his near point relative to the corneal plane?

b) His range of clear vision is from where to where?

a) To see clearly at distance, this +2 hyperope must first employ 2D of accommodation. To focus at his near point, he will crank in the remaining 4D of accommodation. Thus he will be focused at $1/4 = .25 \text{m} \ (25 \text{ cm})$ anterior to the corneal plane.
A pt is a +2 hyperope. He is capable of a total of 6D of accommodation. Absent corrective lenses or surgery:
a) Where is his near point relative to the corneal plane?
b) His range of clear vision is from where to where?

a) To see clearly at distance, this +2 hyperope must first employ 2D of accommodation. To focus at his near point, he will crank in the remaining 4D of accommodation. Thus he will be focused at $1/4 = .25m$ (25 cm) anterior to the corneal plane.
b) His range of clear vision is from infinity to 25 cm anterior to the corneal plane.
A pt is a -2 myope. She is capable of a total of 3D of accommodation. Absent corrective lenses or surgery:

a) Where is her near point relative to the corneal plane?

b) Her range of clear vision is from where to where?
A pt is a -2 myope. She is capable of a total of 3D of accommodation. Absent corrective lenses or surgery:

a) Where is her near point relative to the corneal plane?
b) Her range of clear vision is from where to where?

a) This pt has a +2 error lens. When she cranks in her 3D of accommodative ability, she has a total of +5D in play. This puts her near point at $1/5 = 0.20\text{m (20 cm)}$ anterior to the corneal plane.
A pt is a -2 myope. She is capable of a total of 3D of accommodation. Absent corrective lenses or surgery:

a) Where is her near point relative to the corneal plane?
b) Her range of clear vision is from where to where?

a) This pt has a +2 error lens. When she cranks in her 3D of accommodative ability, she has a total of +5D in play. This puts her near point at $1/5 = 0.20\text{m} (20\text{ cm})$ anterior to the corneal plane.
b) Because of her error lens, this pt cannot see clearly at distance. The farthest point at which she can see clearly is her far point, which is located at $1/2 = 0.50\text{m} (50\text{ cm})$ anterior to the corneal plane. As noted above, her near point is at 20 cm. Therefore, her range of clear vision is from 50 to 20 cm anterior to the corneal plane.
Complete the drawing to indicate how the point-at-infinity would be imaged by the cylinder.
Complete the drawing to indicate how the point-at-infinity would be imaged by the cylinder...

Parallel rays from a point at infinity

...the point-source is focused as a line parallel to the axis of the cylinder.
One of these cylinders has a dioptric power of +2; the other, +1.
a) Which is which?
b) How can you tell?
c) For each, label the **axis** of power and the **meridian** of power
One of these cylinders has a dioptric power of +2; the other, +1.

a) Which is which?
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One of these cylinders has a dioptric power of +2; the other, +1.
a) Which is which?
b) How can you tell?
c) For each, label the axis of power and the meridian of power.

b) The more steeply curved cylinder must be the higher-power one.
One of these cylinders has a dioptric power of +2; the other, +1.

a) Which is which?
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b) The more steeply curved cylinder must be the higher-power one. Another way to know: The one with the shorter radius-of-curvature is more plus.
One of these cylinders has a dioptric power of +2; the other, +1.

a) Which is which?
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b) The more steeply curved cylinder must be the higher-power one. Another way to know: The one with the shorter radius-of-curvature is more plus.
Complete the drawing by sketching the Conoid of Sturm. Indicate:
a) The locations of the focal lines (make sure you’re clear re the orientation of each)
b) The lens<->line distance for each focal line
c) The location of the Circle of Least Confusion (CoLC)
d) The lens<->CoLC distance
e) What is the spherical equivalent for this lens?  
(Note: The arrows are pointing to the **meridia** of power, not the axes)
Complete the drawing by sketching the Conoid of Sturm. Indicate:

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d) The lens<->CoLC distance
e) What is the spherical equivalent for this lens?

(Note: The arrows are pointing to the meridia of power, not the axes)
Complete the drawing by sketching the Conoid of Sturm. Indicate:

a) The locations of the focal lines (make sure you’re clear re the orientation of each)
b) The lens<>line distance for each focal line
c) The location of the Circle of Least Confusion (CoLC)
d) The lens<>CoLC distance
e) What is the spherical equivalent for this lens?

(Note: The arrows are pointing to the **meridia** of power, not the axes)
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e) What is the spherical equivalent for this lens?

(Note: The arrows are pointing to the **meridia** of power, not the axes)

Remember, the CoLC is located at the **dioptic** midpoint of the conoid, not the **geometric** midpoint.

\[ SE = \frac{(+4) + (+2)}{2} = +3 \]
Complete the drawing by sketching the Conoid of Sturm. Indicate:

a) The locations of the focal lines (make sure you’re clear re the orientation of each)
b) The lens<->line distance for each focal line
c) The location of the Circle of Least Confusion (CoLC)
d) The lens<->CoLC distance
e) What is the spherical equivalent for this lens?

(Note: The arrows are pointing to the meridia of power, not the axes)

Remember, the CoLC is located at the dioptric midpoint of the conoid, not the geometric midpoint, and that ‘spherical equivalent’ is just another way of saying ‘dioptric midpoint.’

\[ SE = \frac{(+4) + (+2)}{2} = +3 \]
Identify the types of astigmatism

Types of Astigmatism
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Types of Astigmatism

Compound Myopic
Simple Myopic
Mixed

Simple Hyperopic
Compound Hyperopic
A Jackson cross lens is a spherocylindrical lens containing __________ cylinders of _______________ powers oriented __________

When placed before an astigmatic eye, what effect does a Jackson cross lens have on the location of the Circle of Least Confusion? None (ie, the CoLC will not move)
--A Jackson cross lens is a spherocylindrical lens containing plus and minus cylinders of equal-but-opposite powers oriented 90° apart.

Fill in the blanks
Fill in the blanks

--A Jackson cross lens is a spherocylindrical lens containing plus and minus cylinders of equal-but-opposite powers oriented \( 90^\circ \) apart

--A Jackson cross lens has a spherical equivalent power of ____
--A Jackson cross lens is a spherocylindrical lens containing plus and minus cylinders of equal-but-opposite powers oriented 90° apart.

--A Jackson cross lens has a spherical equivalent power of zero.
--A Jackson cross lens is a spherocylindrical lens containing plus and minus cylinders of equal-but-opposite powers oriented 90° apart.

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--When placed before an astigmatic eye, what effect does a Jackson cross lens have on the location of the Circle of Least Confusion?
A Jackson cross lens is a spherocylindrical lens containing plus and minus cylinders of equal-but-opposite powers oriented 90° apart.

A Jackson cross lens has a spherical equivalent power of zero.

When placed before an astigmatic eye, what effect does a Jackson cross lens have on the location of the Circle of Least Confusion? None (ie, the CoLC will not move).
Fill in the blanks

<table>
<thead>
<tr>
<th></th>
<th><strong>Retinoscopic</strong></th>
<th><strong>Jackson Cross</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Use sphere to place _______ on the retina</td>
<td>Use sphere to place the _______ on the retina</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Use cylinder to place the _______ on the retina</td>
<td>Use cross to simultaneously _______</td>
</tr>
<tr>
<td><strong>Result</strong></td>
<td>_______</td>
<td>_______</td>
</tr>
</tbody>
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Fill in the blanks

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<tr>
<td><strong>Step 1</strong></td>
<td>Use sphere to place <strong>one focal line</strong> on the retina</td>
<td>Use sphere to place the <strong>Circle of Least Confusion</strong> on the retina</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Use cylinder to place the <strong>other focal line</strong> on the retina</td>
<td>Use cross to simultaneously <strong>collapse both focal lines</strong></td>
</tr>
<tr>
<td><strong>Result</strong></td>
<td>Conoid collapsed to a point <strong>on the retina</strong></td>
<td>Conoid collapsed to a point <strong>on the retina</strong></td>
</tr>
</tbody>
</table>
Determine the type of astigmatism present for each of the following refractions:

+3.0 -2.0 x 080

+1.0 -4.0 x 080

-5.0 +9.0 x 090

-2.5 +1.5 x 120
Determine the type of astigmatism present for each of the following refractions:

+3.0 -2.0 x 080  
In plus cylinder: +1.0 +2.0 x 170. The spherical component is plus in both plus- and minus-cylinder formats; therefore, it is compound hyperopia.

+1.0 -4.0 x 080  
In plus cylinder: -3.0 +4.0 x 170. The spherical component is minus in plus-cyl but plus in minus-cyl formats; therefore, it is mixed astigmatism.

-5.0 +9.0 x 090  
In minus cyl: +4.0 -9.0 x 180. The spherical component is minus in plus-cyl but plus in minus-cyl formats; therefore, it is mixed astigmatism.

-2.5 +1.5 x 120  
In minus cyl: -1.0 -1.5 x 030. The spherical component is minus in both plus- and minus-cyl formats; therefore, it is compound myopia.


--With-the-rule astigmatism: Cornea is shaped like a football ________________

--Against-the-rule astigmatism: Cornea is shaped like a football ________________
Fill in the blanks

--With-the-rule astigmatism: Cornea is shaped like a football **lying on the ground**

--Against-the-rule astigmatism: Cornea is shaped like a football **standing on a tee**
--With-the-rule astigmatism: Cornea is shaped like a football **lying on the ground**

--Against-the-rule astigmatism: Cornea is shaped like a football **standing on a tee**

--Which is more common in…

  a) Young people?
  b) The elderly?
With-the-rule astigmatism: Cornea is shaped like a football lying on the ground.

Against-the-rule astigmatism: Cornea is shaped like a football standing on a tee.

Which is more common in...

a) Young people? With-the-rule
b) The elderly? Against-the-rule
Fill in the blanks

What’s the difference between a power cross and a prescription?

A prescription is written in spherocylindrical form, whereas a power cross is written in cylinder form.
What’s the difference between a power cross and a prescription?

A prescription is written in spherocylindrical form, whereas a power cross is written in cylinder form.
When performing retinoscopy in *plus* cyl, most will first get to a state of __________________ before introducing the correcting cylinder.

(fill in the blank with a type of astigmatism)
When performing retinoscopy in **plus** cyl, most will first get to a state of **simple hyperopic astigmatism** before introducing the correcting cylinder.

*(fill in the blank with a type of astigmatism)*