1. Chromatic and Spherical Aberrations
2. Human Eye: 2 problems
3. Lens Power / Diopters

Chromatic aberration:
- Blue light is dispersed more than orange light.

Spherical aberration:
- The focus is not well-defined for all wavelengths.
- Parabola: Perfect focus
- Sphere: F not well-defined
2. Human Eye - 2 Problems

Near-sighted (myopia)

\[ s < \infty \] (myopic)

Goal: Take an obj. @ \( \infty \) and have its image be @ far point.

Far-sighted (hyperopia)

\[ s > 25\text{cm} \] (hyperopic)

Goal: Circle

"Presbyopia": age-related

Need converging lenses

"Normal" people: Can see any object between

\[ s = \infty \] and \[ s = 25\text{cm} \]

Near point

Far point

Need diverging lens to "spread out" light
Myopic

Image

Far point

Hyperopic

25cm

Near point

---

Lenses: Power $P = \frac{1}{f}$

SI Units: Diopeters (D)

$1D = \frac{1}{1m}$

e.g. Mr. Shatwell

has prescription $-1.25D \rightarrow f = \frac{1}{-1.25D}$

What's Shatwell's far-point? $80cm$ $-0.80m$

\[
\frac{1}{s} + \frac{1}{s'} = \frac{1}{f} = -1.25D = \frac{1}{-0.80m}
\]

Take obj. @ $s = \infty$ and place @ far point

Solve for $s'$

$\text{Therefore } s' = -0.80m$
Grandma Shotwell’s near point is at 100 cm. She buys glasses so that she can take an object _____ and instead have its image at _____.

A) at infinity, 25 cm
B) at her near point, 25 cm
C) at 25 cm, infinity
D) at 25 cm, her near point

Which of the following is the best option for Grandma Shotwell?

A) +1.50
B) +2.00
C) +2.50
D) +3.00

Take obj @ 25 cm, image @ near point.

\[
\frac{1}{s} + \frac{1}{s'} = \frac{4 - 1}{100 cm} = \frac{3}{100 cm} = +3.00 D
\]
STOP TO THINK 35.3 You need to improvise a magnifying glass to read some very tiny print. Should you borrow the eyeglasses from your hyperopic friend or from your myopic friend?

(a) The hyperopic friend  b. The myopic friend
c. Either will do.  d. Neither will work.

Test Your Understanding of Section 34.6 A certain eyeglass lens is thin at its center, even thinner at its top and bottom edges, and relatively thick at its left and right edges. What defects of vision is this lens intended to correct? (i) hyperopia for objects oriented both vertically and horizontally; (ii) myopia for objects oriented both vertically and horizontally; (iii) hyperopia for objects oriented vertically and myopia for objects oriented horizontally; (iv) hyperopia for objects oriented horizontally and myopia for objects oriented vertically.

Table 34.1 Receding of Near Point with Age

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Near Point (cm)</th>
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<tbody>
<tr>
<td>10</td>
<td>7</td>
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<td>20</td>
<td>10</td>
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<td>50</td>
<td>40</td>
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<td>60</td>
<td>200</td>
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</table>
A person can see clearly up close but cannot focus on objects beyond 75.0 cm. She opts for contact lenses to correct her vision. (a) Is she nearsighted or farsighted? (b) What type of lens (converging or diverging) is needed to correct her vision? (c) What focal length contact lens is needed, and what is its power in diopters?

**34.56** IDENTIFY and SET UP: For an object very far from the eye, the corrective lens forms a virtual image at the far point of the eye. \( \frac{1}{s} + \frac{1}{s'} = \frac{1}{f} \). \( P \) (in diopters) = \( \frac{1}{f} \) (in m).

**EXECUTE:** (a) The person is nearsighted. (b) A diverging lens is needed. (c) \( \frac{1}{s} + \frac{1}{s'} = \frac{1}{f} \), \( s \to \infty \), so \( f = s' = -75.0 \) cm. The power is \( \frac{1}{-0.750 \text{ m}} = -1.33 \) diopters.

**EVALUATE:** A diverging lens is needed to form a virtual image of a distant object. A converging lens could not do this since distant objects cannot be inside its focal point.