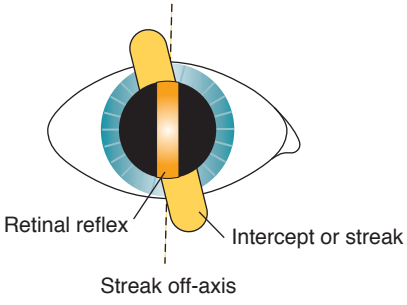


**Figure 4-10** Break. The retinal reflex is discontinuous with the intercept when the streak is off the correct axis (dashed lines). *(Illustration by C. H. Wooley.)*

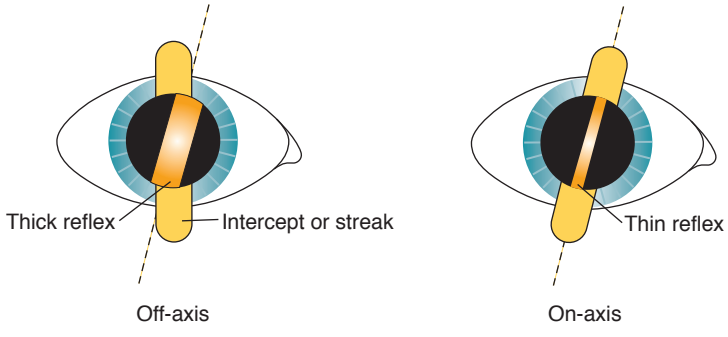


**Figure 4-11** Width, or thickness, of the retinal reflex. The examiner locates the axis where the reflex is thinnest (dashed lines). *(Illustration by C. H. Wooley.)*

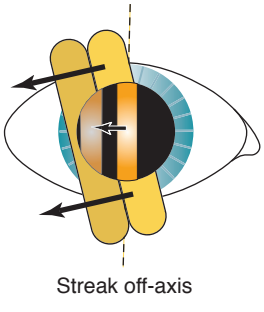


**Figure 4-12** Skew. The *arrows* indicate that movements of the reflex *(single arrow)* and intercept *(2 arrows)* are not parallel. The reflex and intercept do not move in the same direction but are skewed when the streak is off axis. *Dashed lines* indicate the on-axis line. *(Illustration by C. H. Wooley.)*

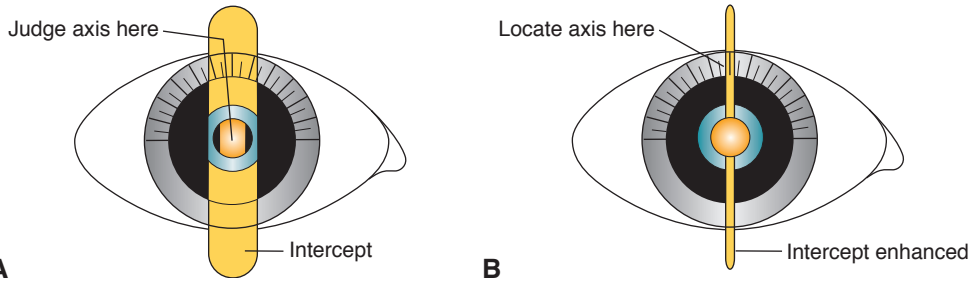


**Figure 4-13** Locating axis on the protractor. **A,** First, determine the astigmatic axis. **B,** Second, adjust the sleeve to enhance the intercept until the filament is observed as a fine line pinpointing the axis. *(Illustration by C. H. Wooley.)*

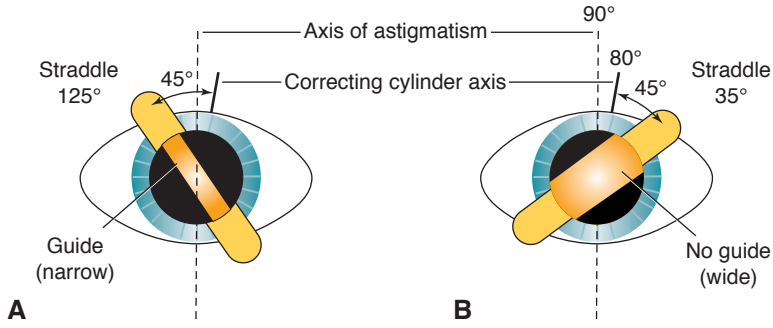


**Figure 4-14** Straddling. The straddling meridians are 45° off the correcting cylinder axis, at roughly 35° and 125°. As the examiner moves back from the eye while comparing the meridians, the reflex at 125° remains narrow **(A)** at the same distance that the reflex at 35° has become wide **(B).** This dissimilarity indicates an axis error; the narrow reflex **(A)** is the guide toward which the examiner must turn the correcting cylinder axis. *(Illustration by C. H. Wooley.)*

This axis can be confirmed through a technique known as *straddling,* which is performed with the estimated correcting cylinder in place (Fig 4-14). The retinoscope streak is turned 45° off-axis in both directions, and if the axis is correct, the width of the reflex should be equal in both off-axis positions. If the axis is not correct, the widths are unequal in these 2 positions. The axis of the correcting plus cylinder should be moved toward the narrower reflex and the straddling repeated until the widths are equal.

### *Finding the cylinder power*

After the 2 principal meridians are identified, the previously explained spherical techniques are applied to each axis:

- *With 2 spheres.* Neutralize 1 axis with a spherical lens; then neutralize the axis 90° away. The difference between these readings is the cylinder power. For example, if the 90° axis is neutralized with a +1.50 sphere and the 180° axis is neutralized with a +2.25 sphere, the gross retinoscopy is +1.50 +0.75 × 180. The examiner's working distance (ie, +1.50) is subtracted from the *sphere* to obtain the final refractive correction: plano +0.75 × 180.
- *With a sphere and cylinder.* Neutralize 1 axis with a spherical lens. To enable the use of *with* reflexes, neutralize the *less plus* axis first. Then, with this spherical lens in place, neutralize the axis 90° away by adding a plus cylindrical lens. The spherocylindrical gross retinoscopy is read directly from the trial lens apparatus.

It is also possible to use 2 cylinders at right angles to each other for this gross retinoscopy. Video 4-2 demonstrates the plus cylinder technique, and Video 4-3 demonstrates the minus cylinder technique.

**VIDEO 4-2** Retinoscopy: plus cylinder technique.
*Animation developed by Thomas F. Mauger, MD.*

**VIDEO 4-3** Retinoscopy: minus cylinder technique.
*Animation developed by Thomas F. Mauger, MD.*