Physics 102 (F16)

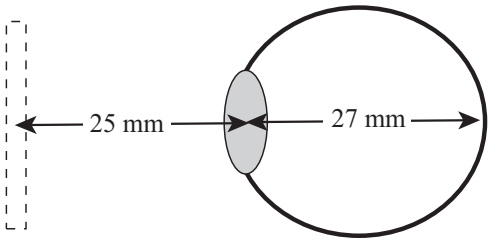
Q11C

Name: _____ **Section:** _____ **Score:** _____/20

1. For a myopic person the distance between the middle of her lens and her retina is 27 mm as illustrated below.

(1) To read a book held 25 cm away from her own eyes, she must wear a pair of glasses with the focal length −11 cm, if the lenses of the glasses are held 2.5 cm from her own lenses. Where is her uncorrected near point from her own lenses? [5]

Principle of eye correction =
place virtual image
where you can see it clearly



f = -110 mm
She must hold the book 250 - 25 = 225 mm
from the lenses to place its virtual image at her uncorrected near point.
1/(-110) = 1/225 + 1/x -> 1/x = -1/110 -1/225 = -1/73.9.
That is, the virtual image is 7.4 cm in front of the glasses. That is, the virtual image is 7.4 cm left of the glasses -> 9.9 cm from the eyes.
This is her uncorrected near point.

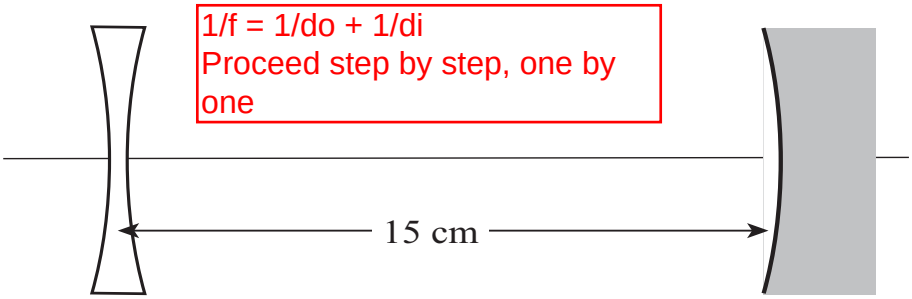
(2) Prescribe her contact lenses for reading. [5]

Contact lens is in contact (of course) with the eyes.

The book must be 25 cm from the contact lens, and the virtual image must be at the uncorrected near point 9.9 cm from her eyes.
do = 250 mm, di = -94 mm, so
1/f = 1/250 -1/99 = -1/164 -> 16.4 cm concave lens.

2. A concave lens of focal length $|f_1| = 5$ cm is 15 cm in front of a concave mirror of focal length $|f_2| = \cancel{15}$ cm.

1/f = 1/do + 1/di
Proceed step by step, one by one



(1) An object of height 2 cm is placed 2 cm to the left to the concave lens. Where is the final image? You must tell whether the image is real or virtual. [You must solve this problem step by step, starting from the lens.] [5]

For the lens: f = -50 mm, do = 20 mm
1/(-50) = 1/20 + 1/di -> 1.di = -1/50 -1/20 = -70/1000 = -1/14.3 -> 14.3 mm virtual image.

That is, this image is 16.4 cm in front of the mirror. The virtual image is located by extrapolating back the outgoing rays. Therefore, the image acts as a real object for the mirror.

For the mirror: f = +50 mm, d0 = +164 mm.
1/di = 1/f - 1/do = 1/50 - 1/164 = 1/71.9. That is the image is real and 7.2 cm in front of the mirror.

(2) What is the size of the image? Is it upright or inverted?[5]

m = -di/do
compute this for each element and multiply all.

Lens: m = - (-14.3)/20 = 0.715.
Mirror: m = -71.9/164 = - 0.438
Therefore, the overall magnification is
0.715 x (-0.438) = -0.313.

0.6 mm inverted.