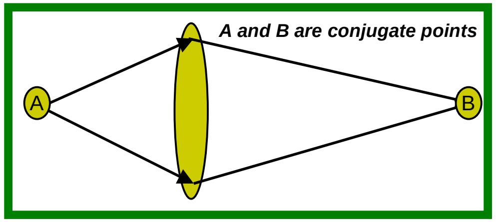
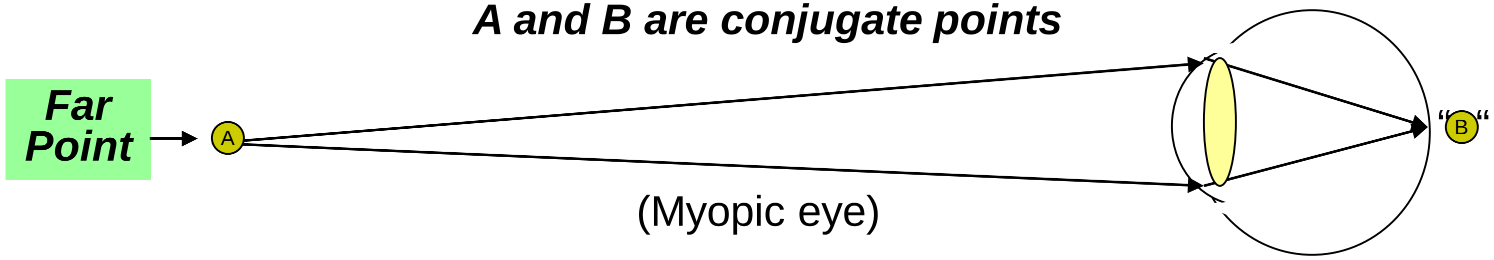
The *Near Point*

Basic Optics, Chapter 9

The Near Point

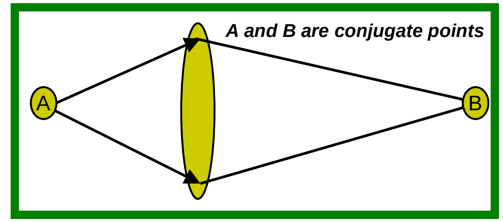


- Far point: *The point in space conjugate to the retina when the eye is* **not accommodated**

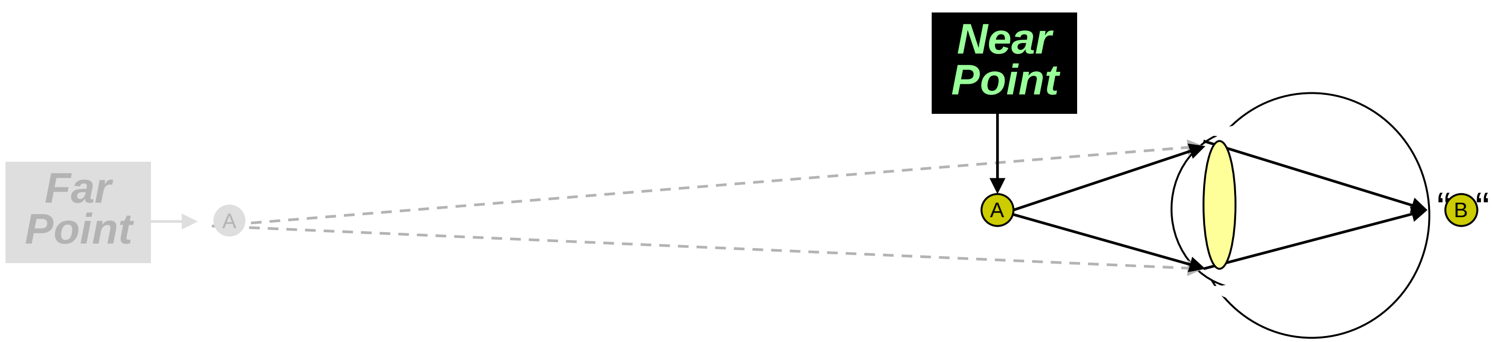


In Chapter 5, we learned that the Far Point is the point in optical space conjugate to the retina when the eye is not accommodating. Likewise…

The Near Point

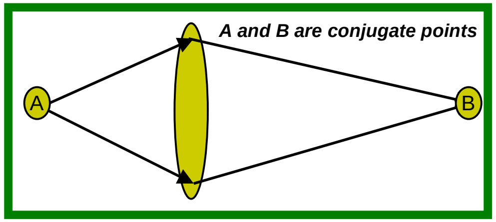


- ~~Far~~ Near point: *The point in space conjugate to the retina when the eye is* ~~**not**~~ fully **accommodated**



In Chapter 5, we learned that the Far Point is the point in optical space conjugate to the retina when the eye is not accommodating. Likewise… The *Near Point* is the point in space conjugate to the retina when the eye is **fully accommodated**.

The Near Point



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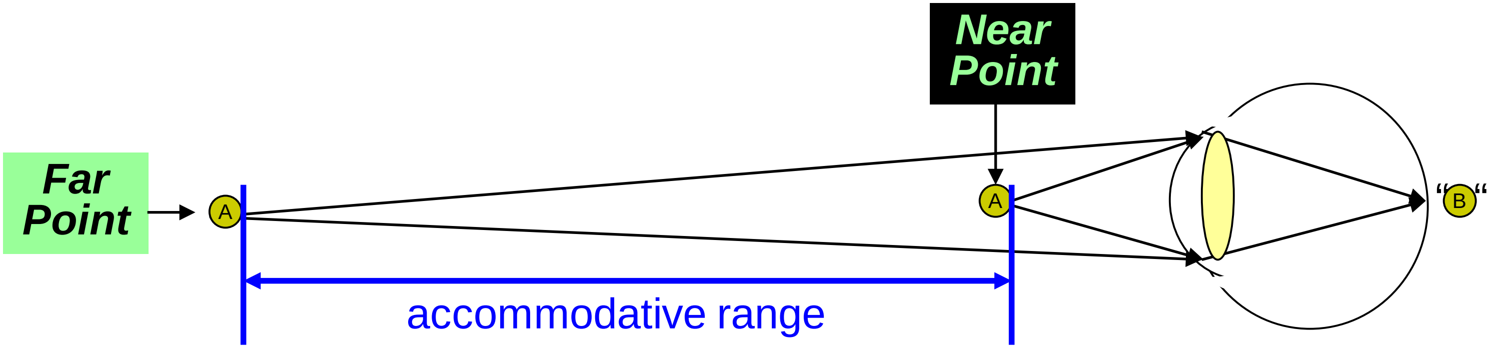
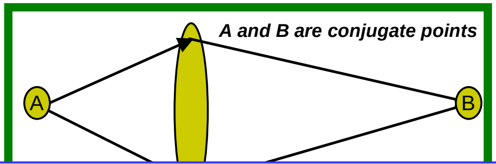
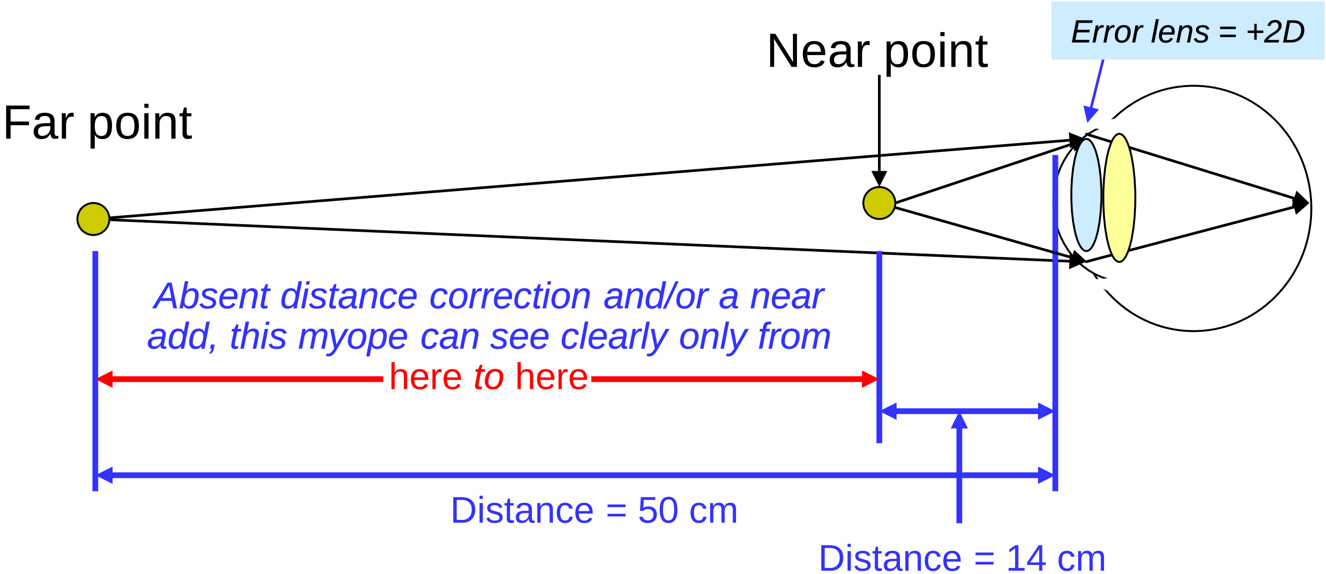


The distance between the far point and the near point is the patient's *accommodative range*.

The Near Point



If this patient is a -2D myope, and has a maximal accommodation of 5D, what is her range of uncorrected clear vision?



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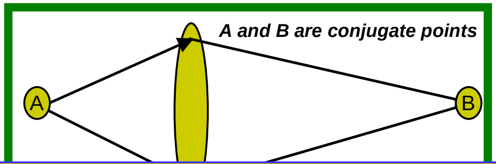
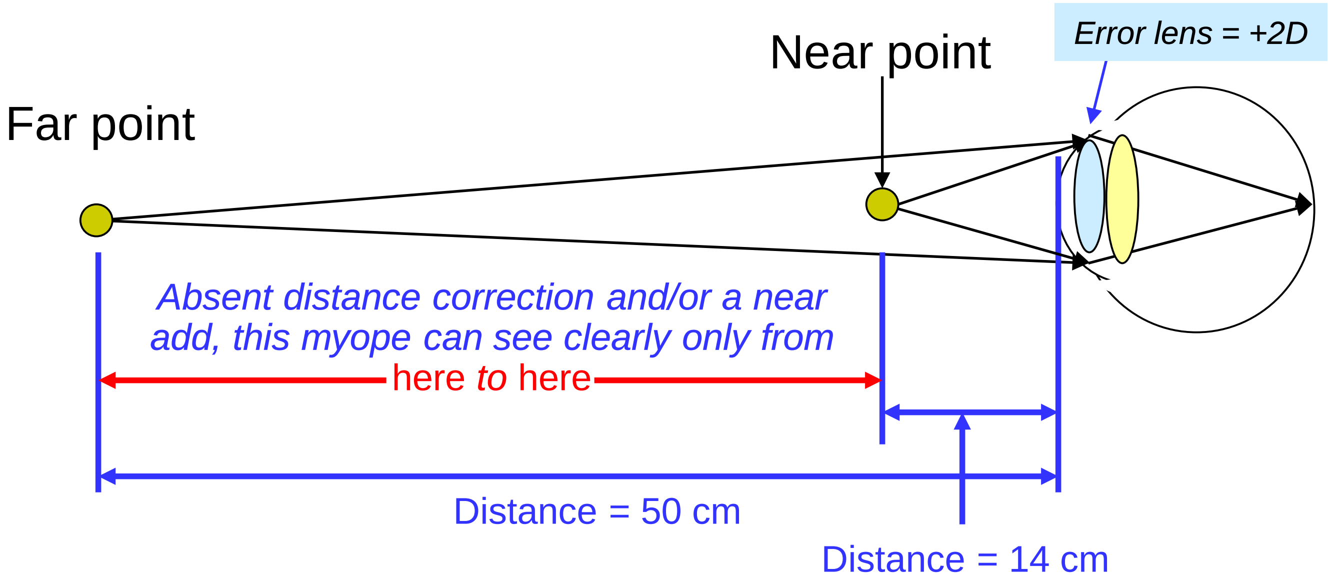


If this patient is a -2D myope, and has a maximal accommodation of 5D, what is her range of uncorrected clear vision?

The far point of a -2D myope is 100/2 = 50 cm anterior to the corneal plane. When she accommodates maximally, she adds another 5D of convergence to the 2D she has 'built in' to her myopic eye, for a total of 7D. This translates to a near point of about 14 cm.



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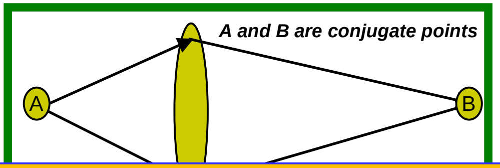

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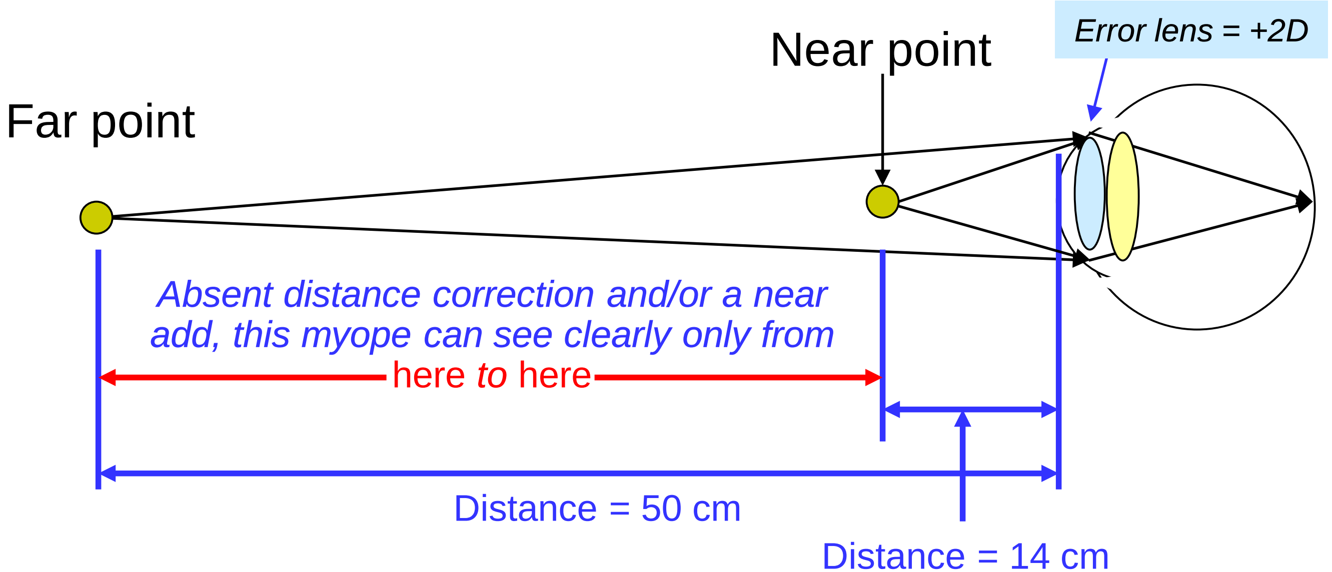
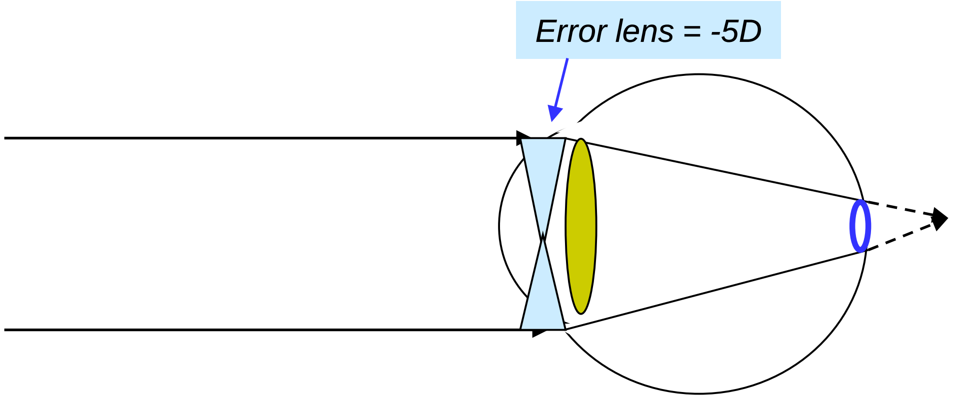
Think about that—this patient’s entire clear vision space consists of an area about 18 inches from her nose (i.e., 20 inches in front of her eye) to about 3 inches from her nose (5 inches from her eye)!

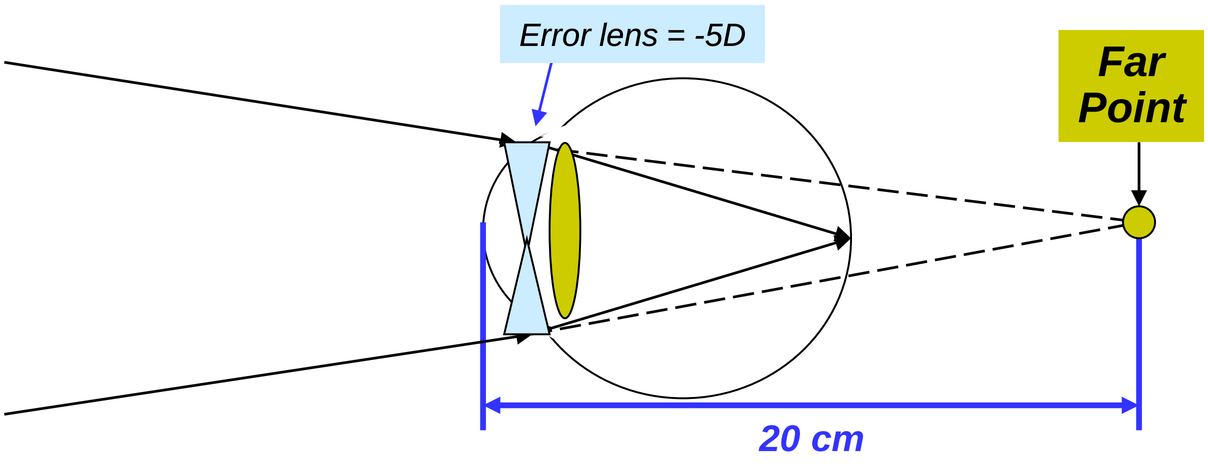


If this patient is a 5D hyperope, where is her far point?



If this patient is a 5D hyperope, where is her far point?

20 cm **behind** the corneal plane



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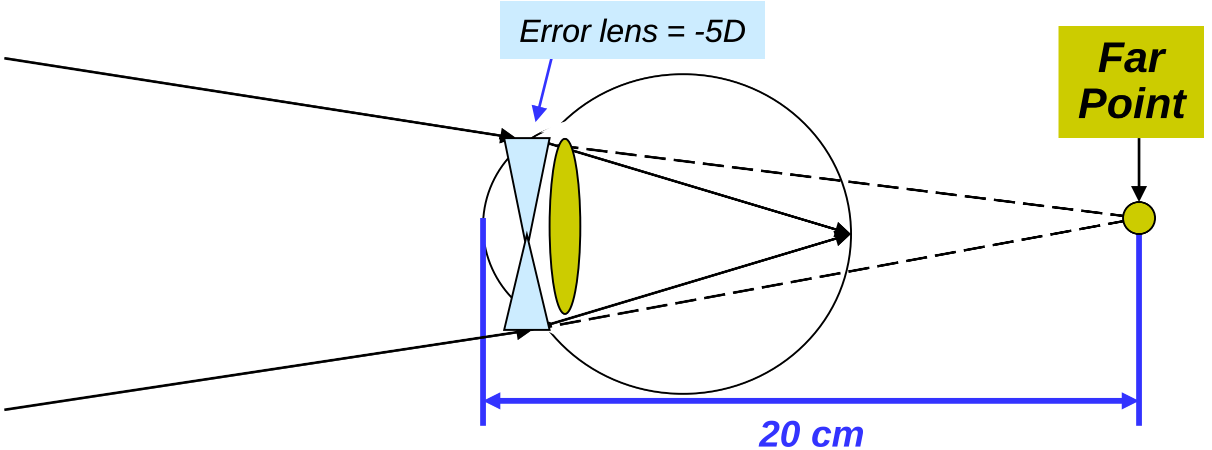
If she has 6D of accommodation available, where is her near point without benefit of glasses?



If this patient is a 5D hyperope, where is her far point?
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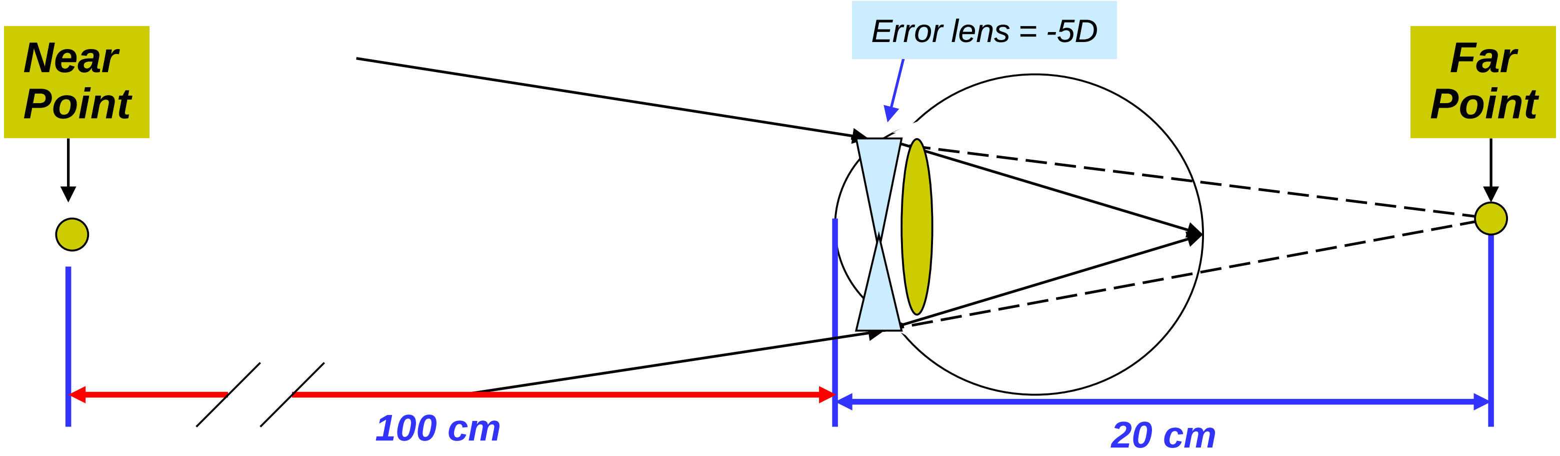
If she has 6D of accommodation available, where is her near point without benefit of glasses?
She must use 5 of the 6 available diopters of accommodation to offset her hyperopia and see clearly at infinity. (In eye error terms, she has a 5D minus error lens in her eye, and she has to employ 5D of accommodation to overcome it.) This leaves 1D available for near. This 1D brings her in focus at 1 meter—her uncorrected near point. That means the closest she can see clearly is at arm's length or so.



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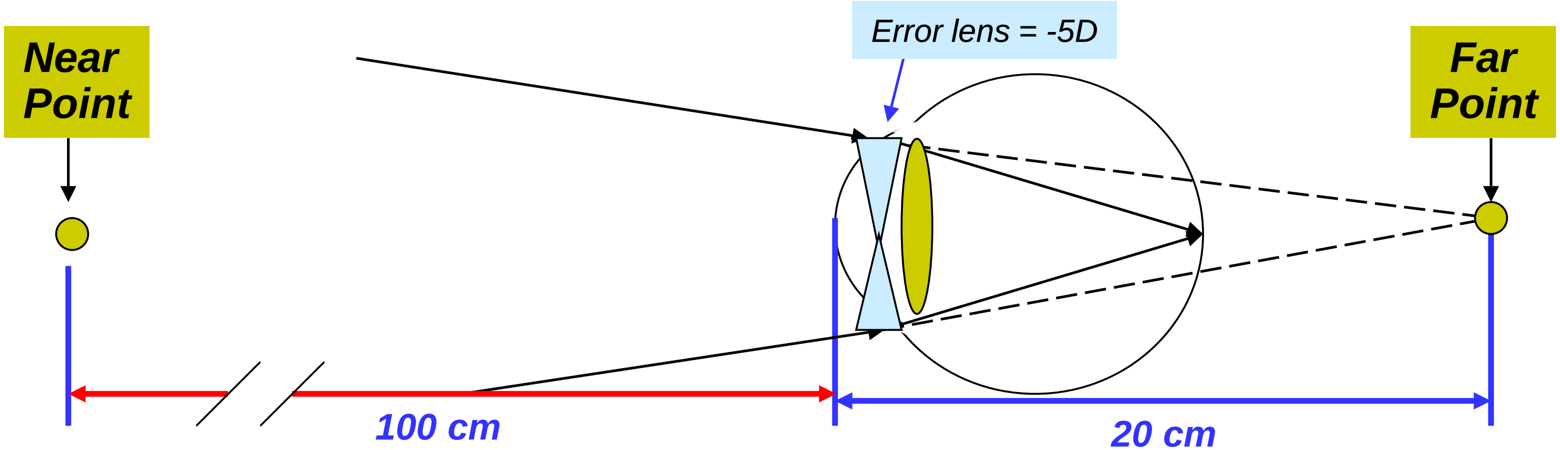
What is her proper distance correction at a vertex distance of 15 mm?



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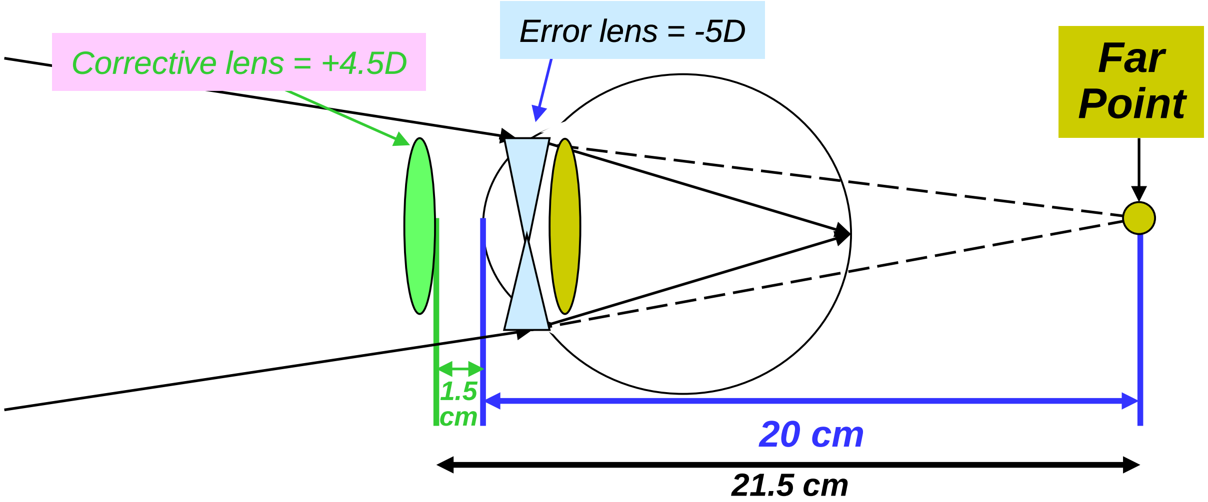
What is her proper distance correction at a vertex distance of 15 mm?
At a vertex distance of 1.5 cm, her lenses are 1.5 + 20 = 21.5 cm from her far point. This requires that the lenses have a secondary focal point at 21.5 cm. The proper dioptric power for this is 100/21.5 = 4.65D, which will be rounded to 4.5D (lenses are ground in .25D increments).



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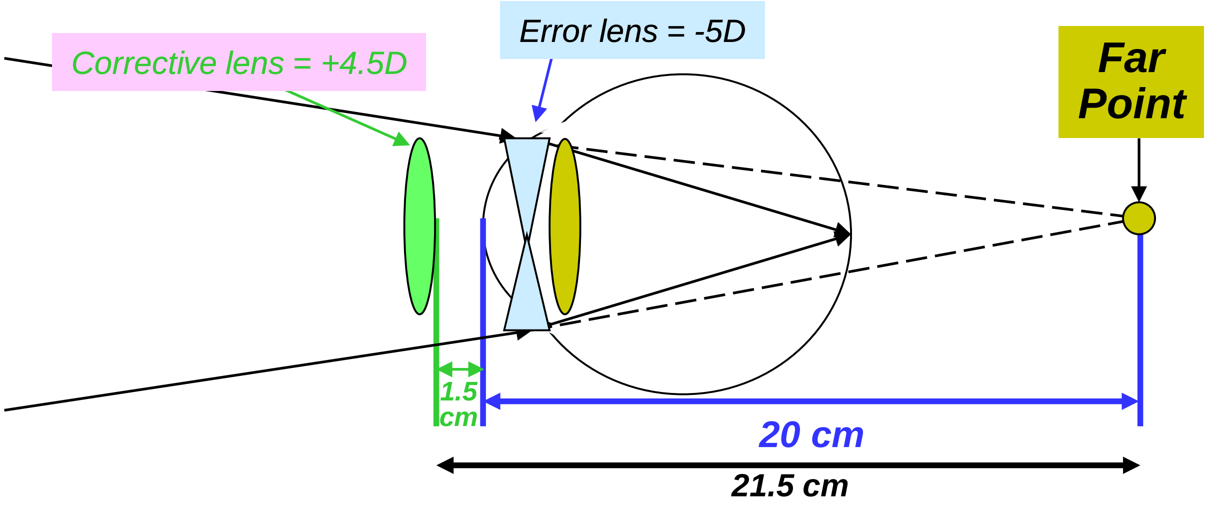
Once she is fully corrected for distance, where will her near point be?



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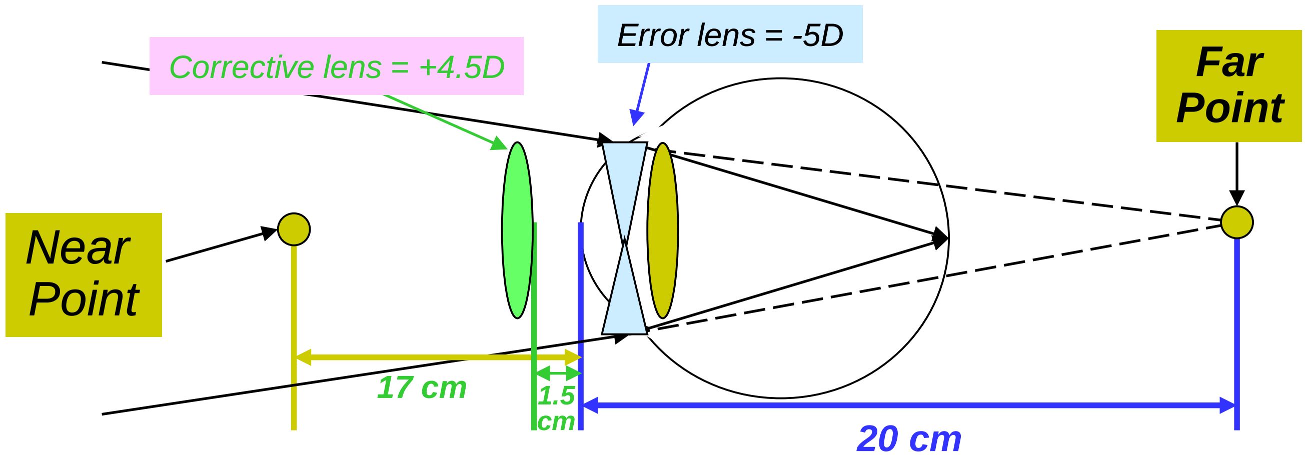
Once she is fully corrected for distance, where will her near point be?
With her distance correction in place, she will have no accommodative demand at distance, and her full accommodative reserve will be available for near. 6D of accommodation give her a near point of 100/6 ≈ 17 cm.



If this patient is a 5D hyperope, where is her far point?
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But 4.65 is closer to 4.75 than it is to 4.5—why not round to 4.75? (Ignore the fact that refraction lanes are only 6 m long.)

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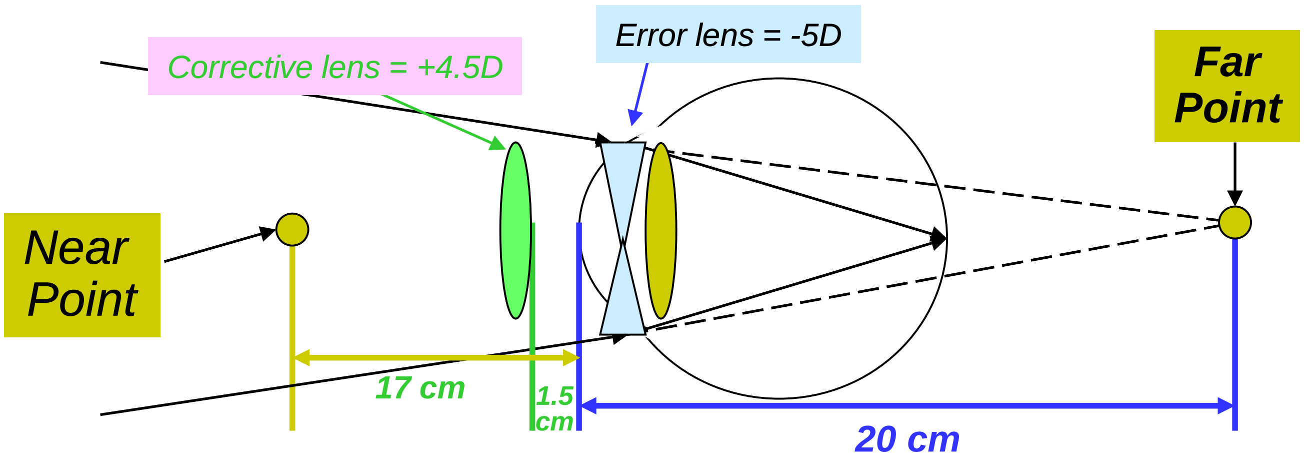

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4.65D is needed to pull this hyperopic image forward onto the retina. A power of 4.50D will leave the image 0.15D behind the retina. This would not be a problem, however, as the patient's accommodative mechanisms can easily make up for the shortfall in accommodation. On the other hand, rounding to 4.75 would overplus the patient, thereby pulling the image into the vitreous slightly. While an eye can accommodate to pull an image *forward* onto the retina, it has no mechanism by which to push an image *back* onto the retina. Thus, when faced with such a choice, it is best to err on the side of too little plus rather than too much.

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