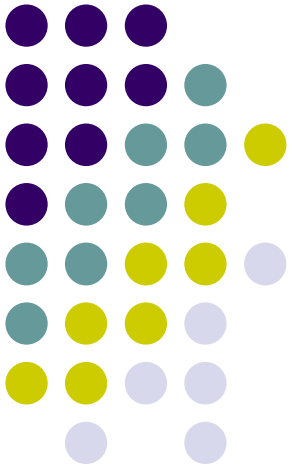
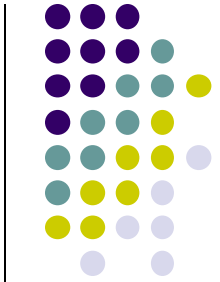
Optics Quiz 1

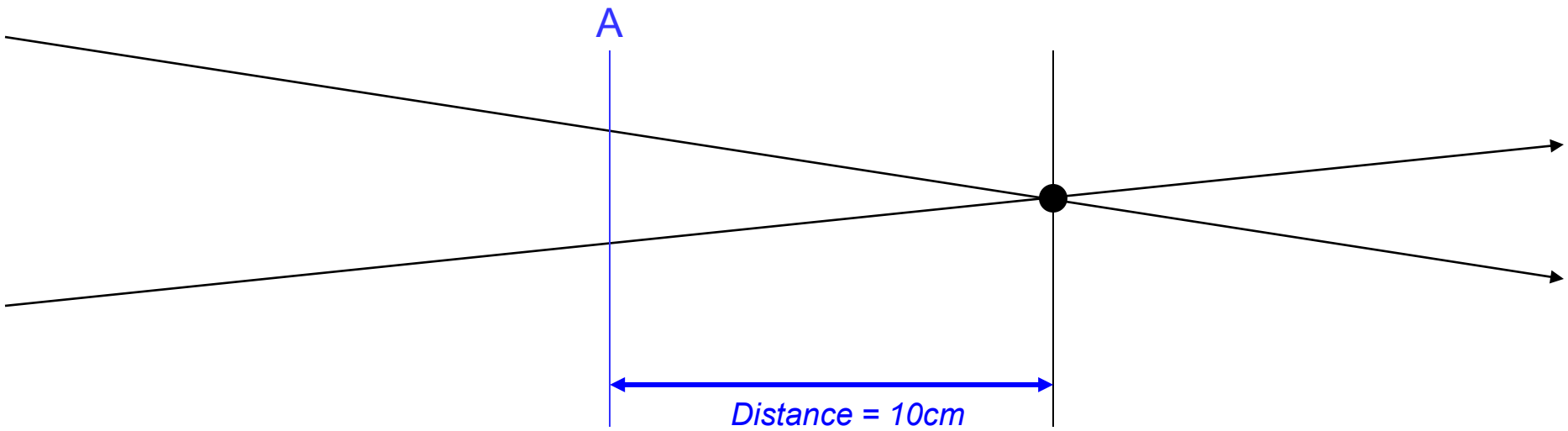
This quiz is intended to be taken after completion of Chapters 1-5





No, you can’t use a calculator (and you don’t need one anyway)

What is the vergence at Point A?



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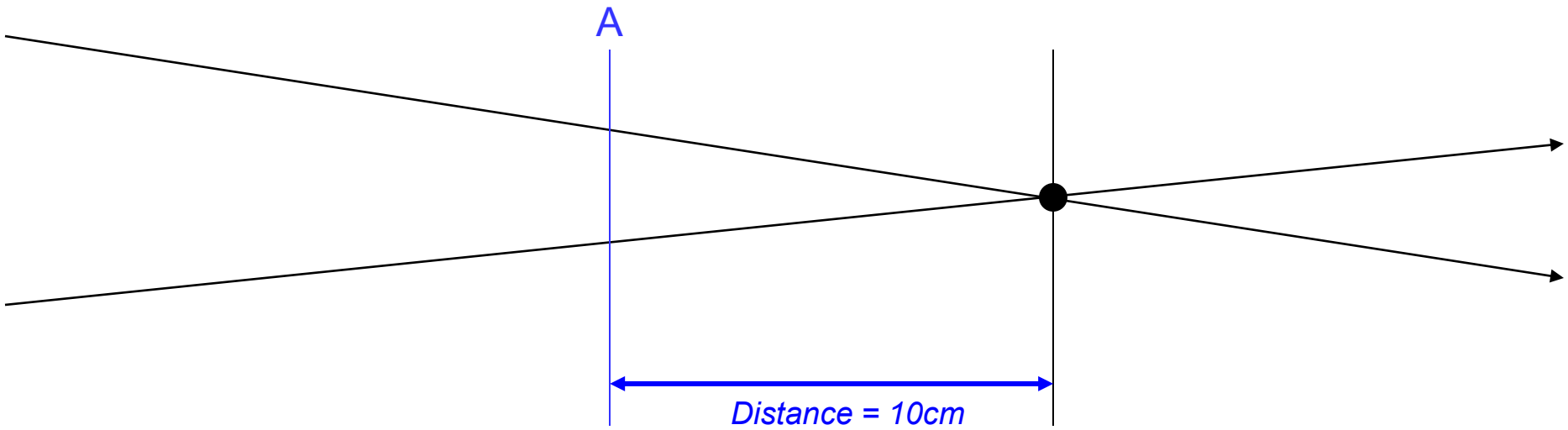
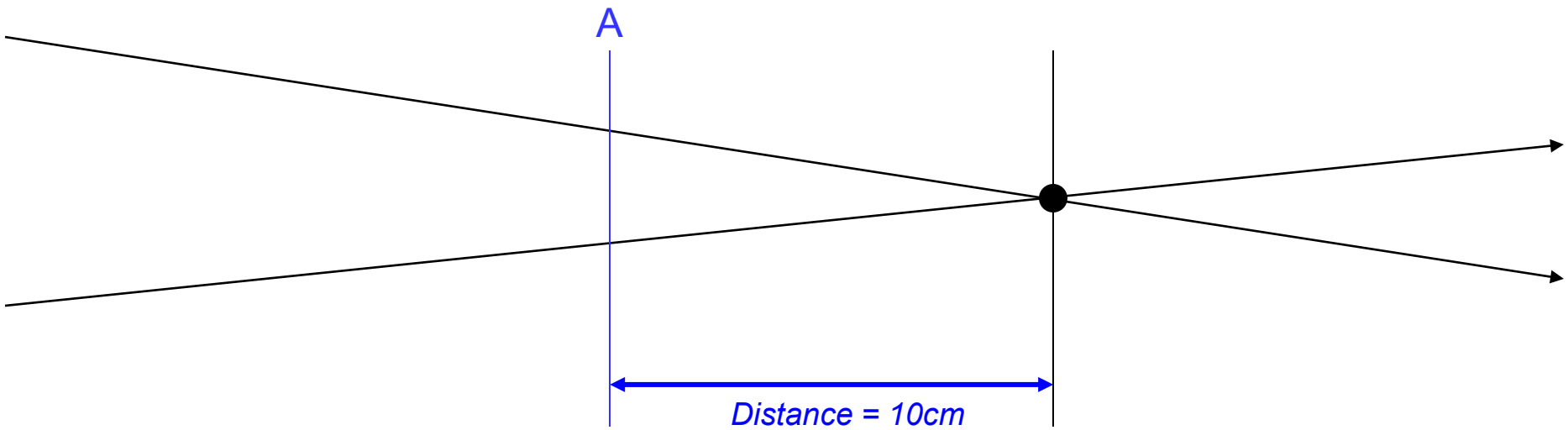


Vergence = 1/distance in meters

What is the vergence at Point A?

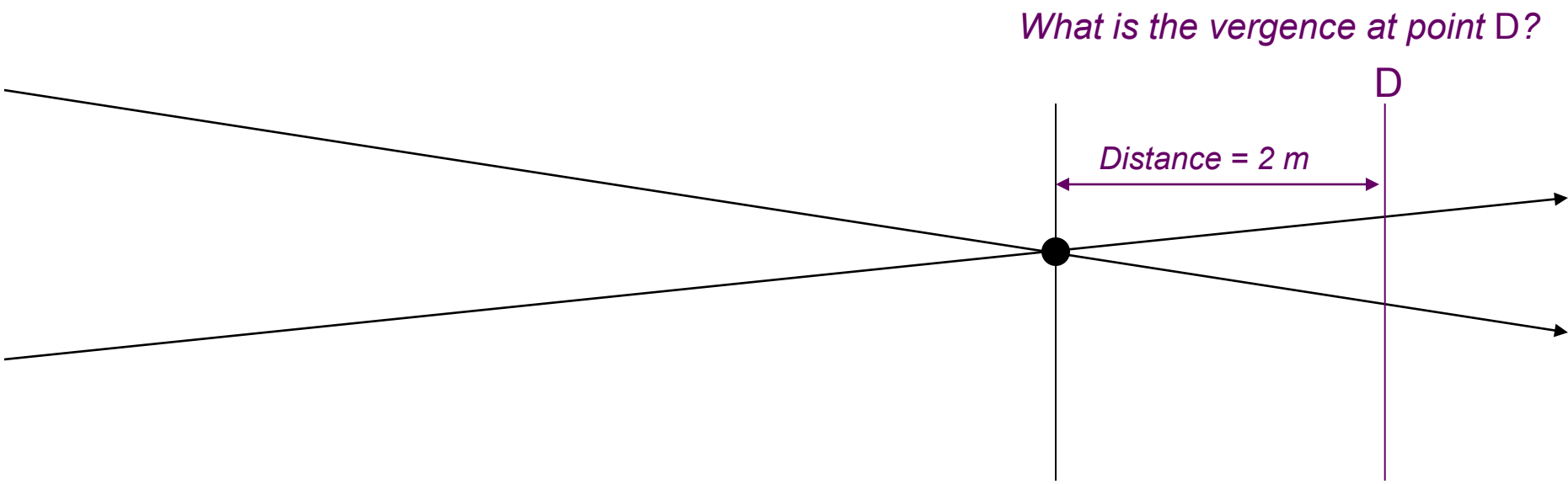


10cm = 0.1m

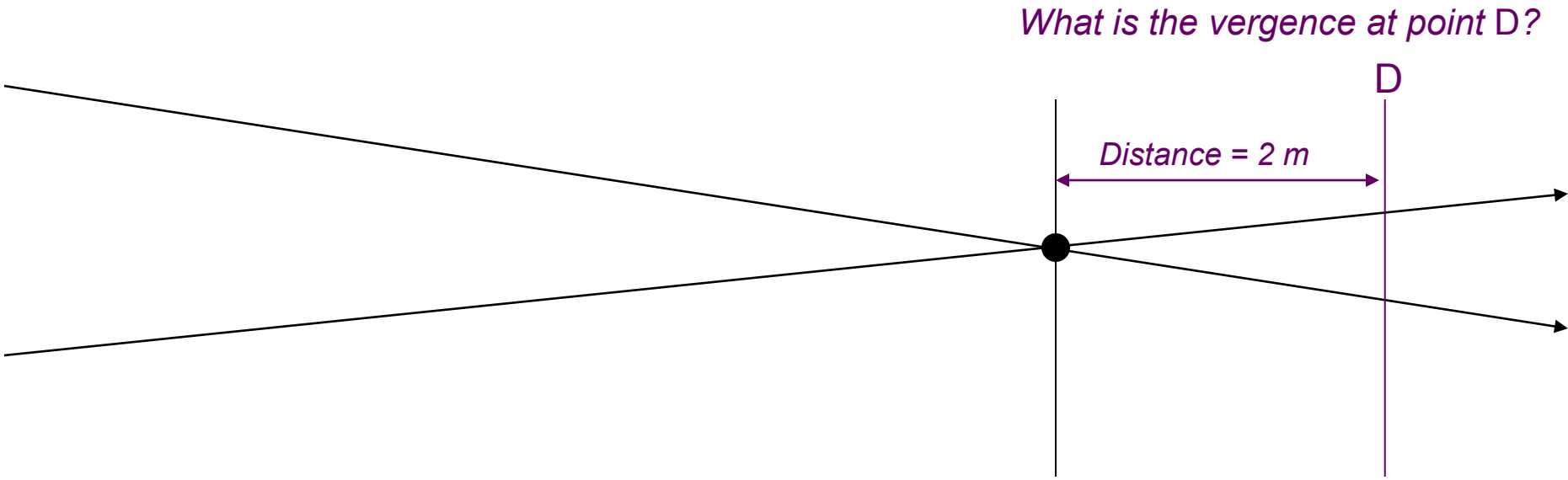
Vergence = 1/distance in meters = **1/0.1 = +10D**

An easy error to make is to fail to convert the distance units to *meters*. Don't make it.

What is the vergence at Point D?



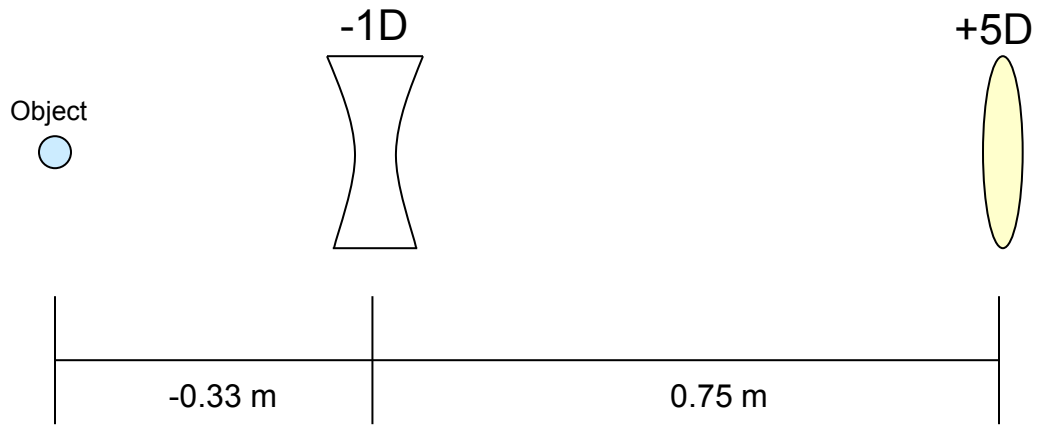
What is the vergence at Point D?



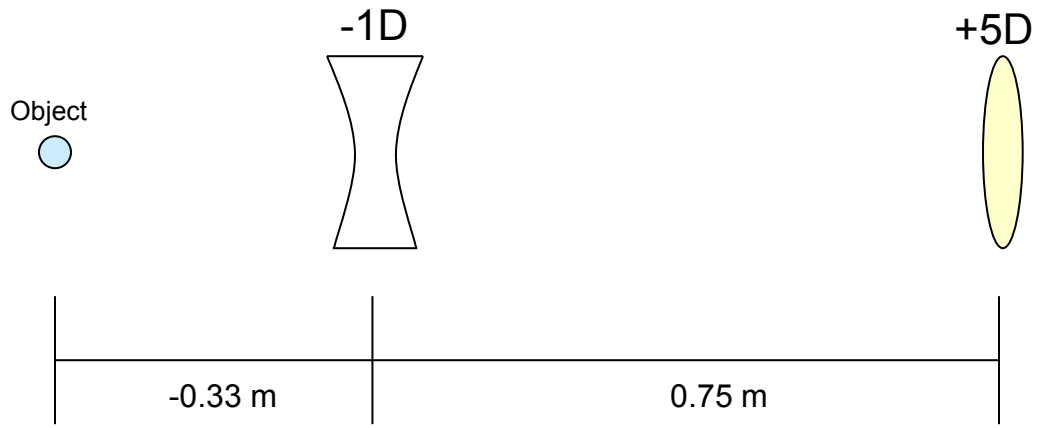
Vergence = 1/distance in meters = 1/2 = -0.5D

The (-) sign is crucial, as it indicates the light is *diverging.*
If you didn't include it, you got the question wrong.

How far apart are the object and the final image?



How far apart are the object and the final image?



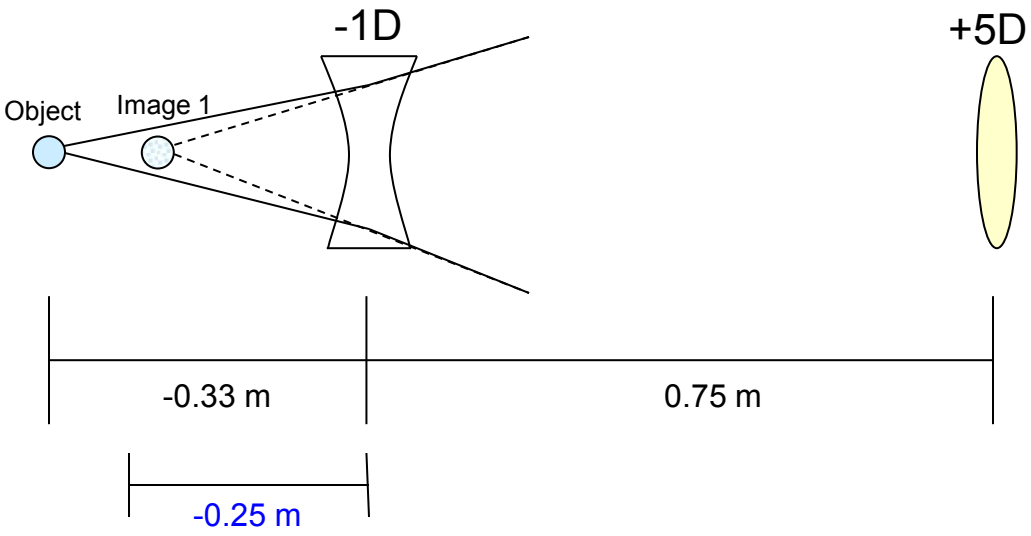
This problem requires a three-step solution:

How far apart are the object and the final image?

U + V = P

-3 + (-1) = -4

1/-4 = -0.25 m

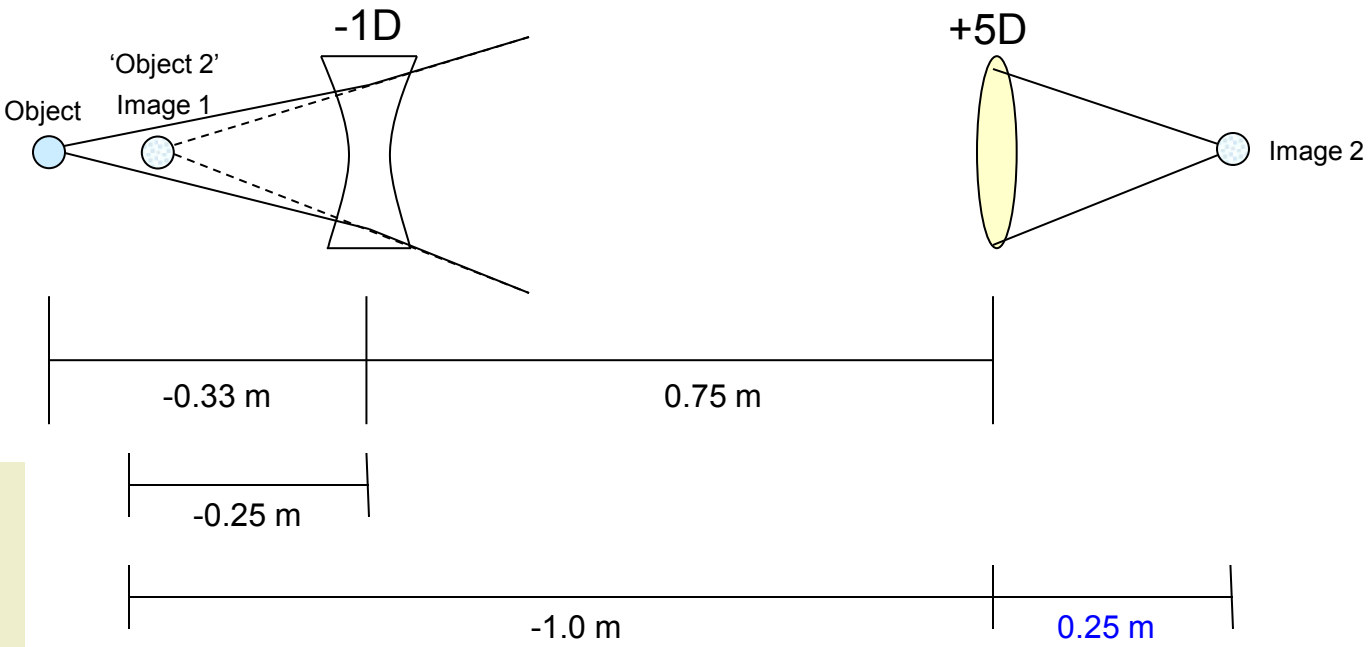


Step 1:
Use the *Vergence Formula* to determine the location of the image formed by the first lens

How far apart are the object and the final image?

U + V = P
-3 + (-1) = -4
1/-4 = -0.25 m

U + V = P
-1 + (+5) = 4D
1/4 = 0.25 m

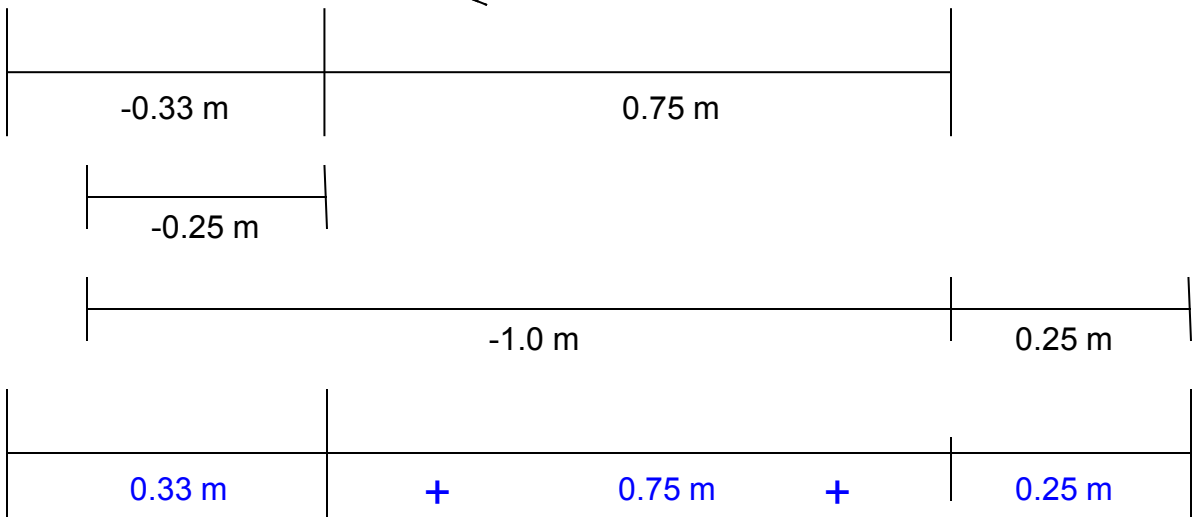


Step 2:
Repeat Step 1 using that image as the object for the second lens

How far apart are the object and the final image?

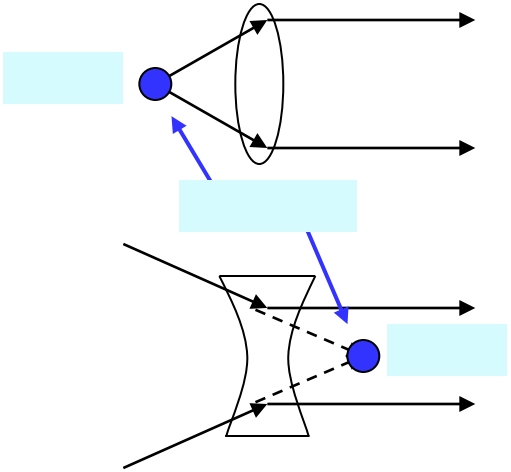
U + V = P
-3 + (-1) = -4
1/-4 = -0.25 m

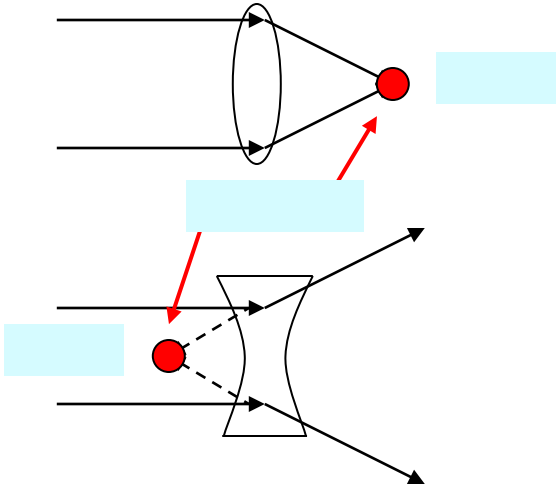
U + V = P
-1 + (+5) = 4D
1/4 = 0.25 m



Step 3:
Determine the distance between the initial object and final image

Fill in the blanks

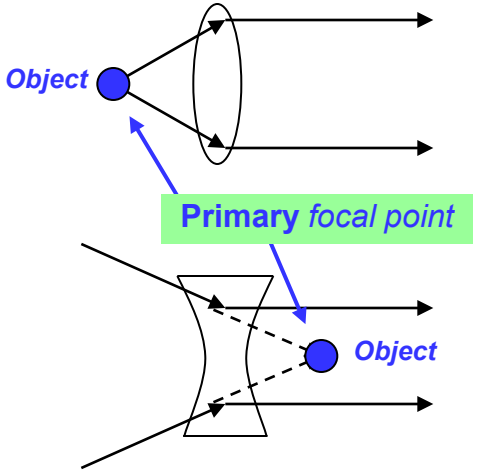


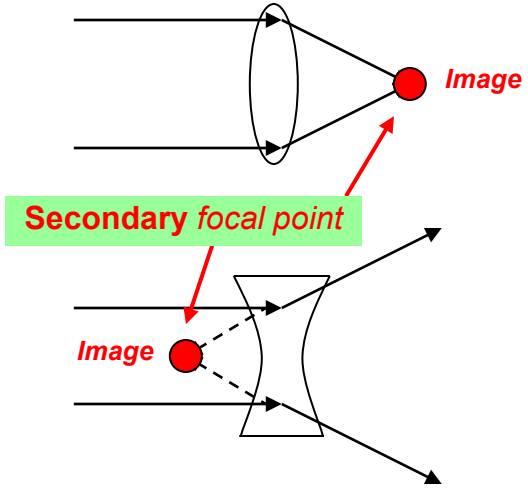


Fill in the blanks

***Primary** focal point*: **Object** location associated with parallel rays **leaving** a lens

***Secondary** focal point*: **Image** location associated with parallel rays **entering** a lens





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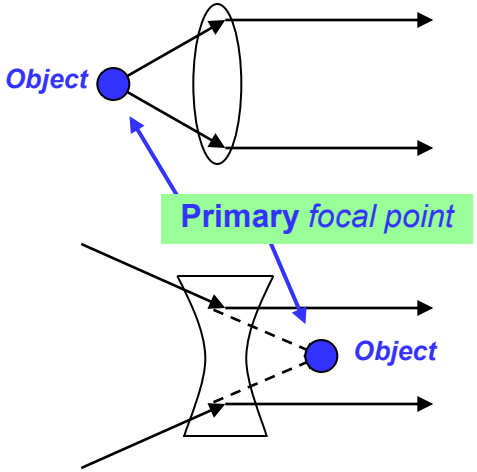
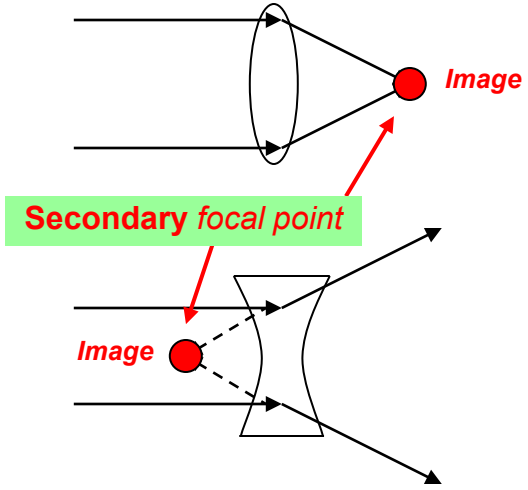


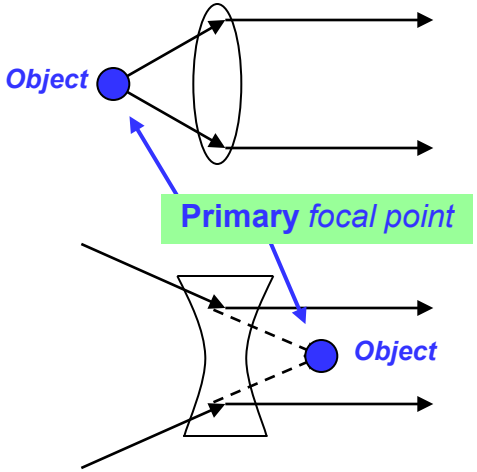


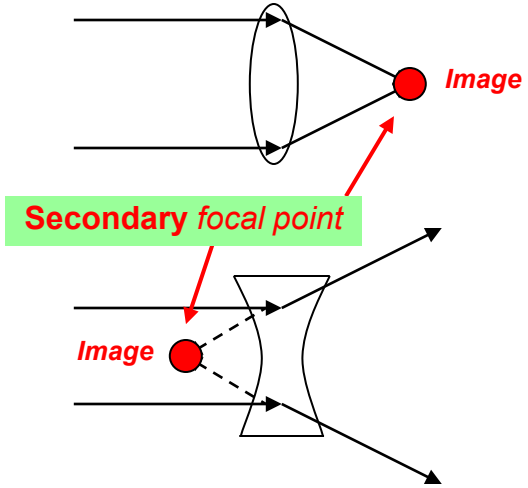
I can't stress enough how important it is to have the definitions pf the *primary* and *secondary focal points* on lock. For example, in the next few tutorial chapters we will see that the *spectacle correction of refractive error* is inextricably linked to the 2ndry focal point.

Fill in the blanks

***Primary** focal point*: **Object** location associated with parallel rays **leaving** a lens

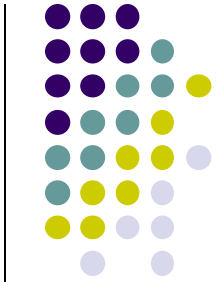
***Secondary** focal point*: **Image** location associated with parallel rays **entering** a lens





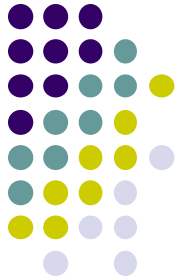
I can't stress enough how important it is to have the definitions pf the *primary* and *secondary focal points* on lock. For example, in the next few tutorial chapters we will see that the *spectacle correction of refractive error* is inextricably linked to the 2ndry focal point. Meaning, if you don't understand the focal points, *you can't understand the correction of refractive error*—which, it's fair to say, is a rather important thing to understand. Get the focal points straight in your head **now**!

Define…



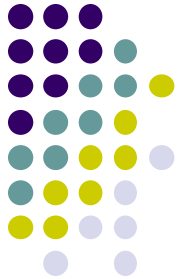
Conjugate points:

Define…



Conjugate points: Two points that are *object* and *image* of one another

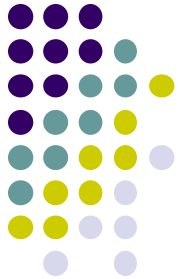
Define…



Conjugate points: Two points that are *object* and *image* of one another

Far point:

Define…



Conjugate points: Two points that are *object* and *image* of one another

Far point: The point in visual space conjugate with the retina when the eye is not accommodating

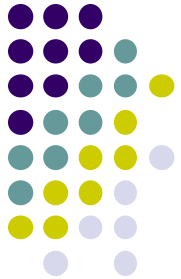
Define…

Conjugate points: Two points that are *object* and *image* of one another

Far point: The point in visual space conjugate with the retina *when the eye is not accommodating*

Too often, first-years omit the qualifier …*when the eye is not accommodating* in defining the far point. It is critical to the definition, so don't forget it.

Define…



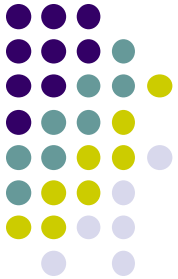
Conjugate points: Two points that are *object* and *image* of one another

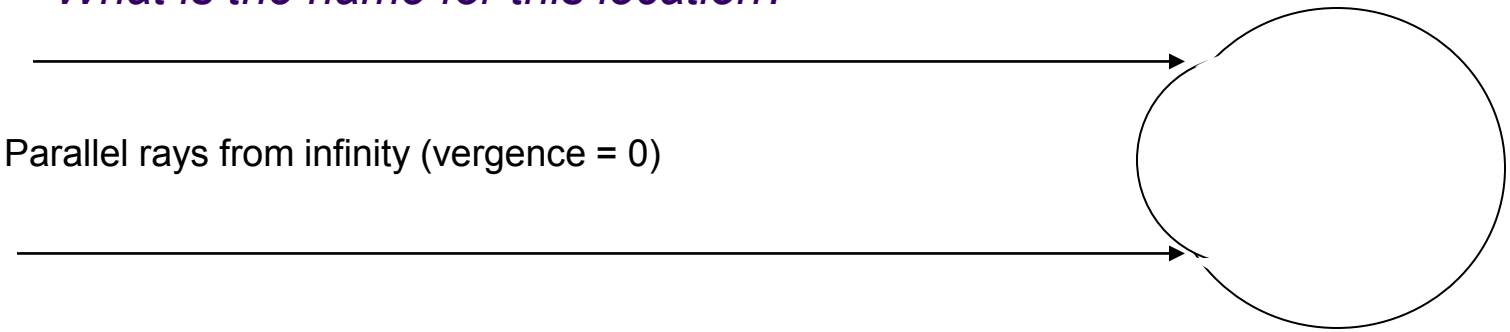
Far point: The point in visual space conjugate with the retina *when the eye is not accommodating*

Too often, first-years omit the qualifier …*when the eye is not accommodating* in defining the far point. It is critical to the definition, so don't forget it.

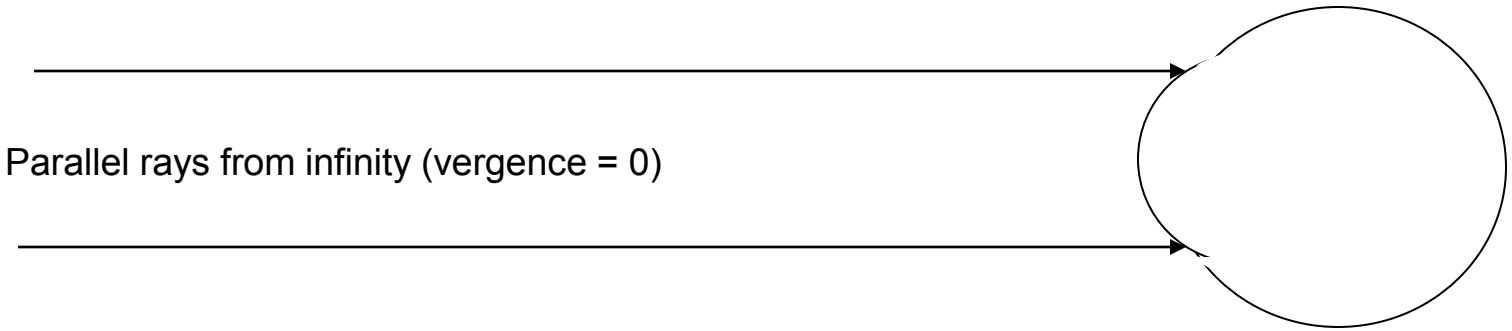
Like the focal points (especially the secondary), the *far point concept* is foundational to anything having to do with refractive error and its correction. I can't stress enough—you must understand the far point in your bones.

--Indicate where the parallel rays will meet for each refractive status by extending the rays.
--What is the name for this location?

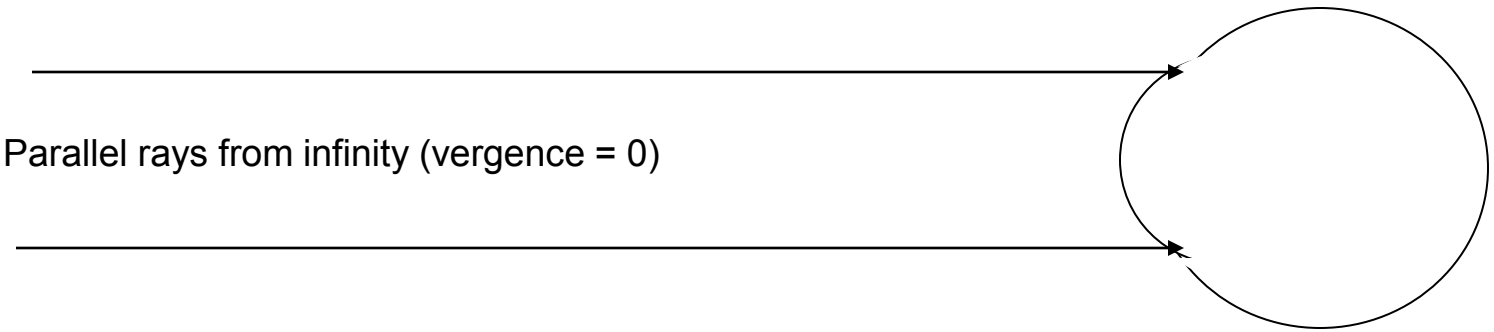




Hyperopic Eye

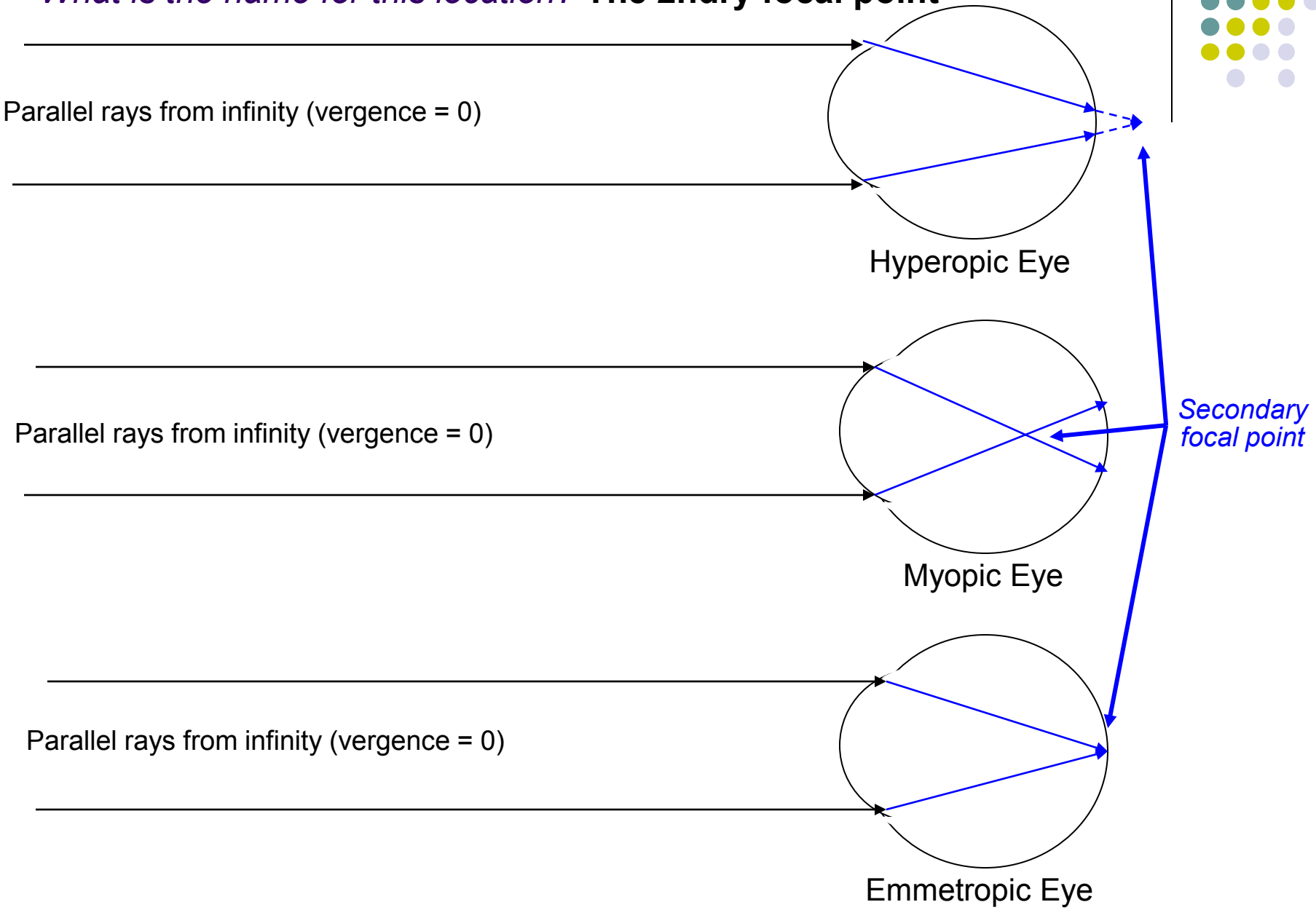


Myopic Eye

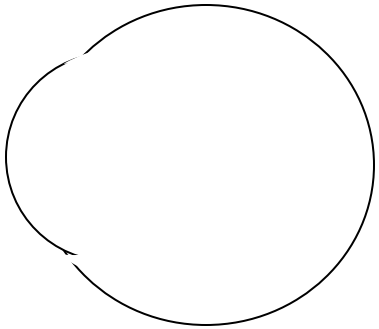


Emmetropic Eye

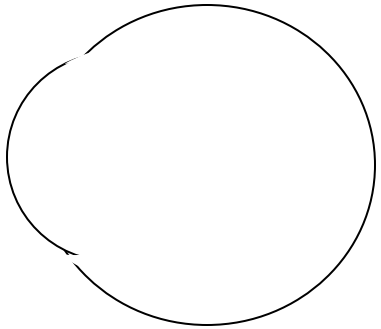
--Indicate where the parallel rays will meet for each refractive status by extending the rays.
--What is the name for this location? **The 2ndry focal point**



--Indicate the location of the **far point** *for each refractive state*
--Draw rays from the far point to where they meet in the eye



Hyperopic Eye



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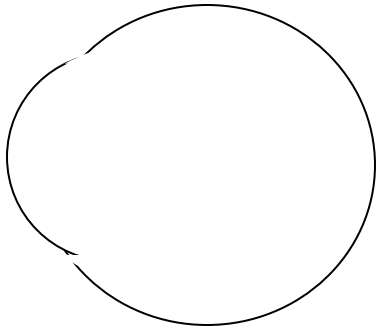

Myopic Eye

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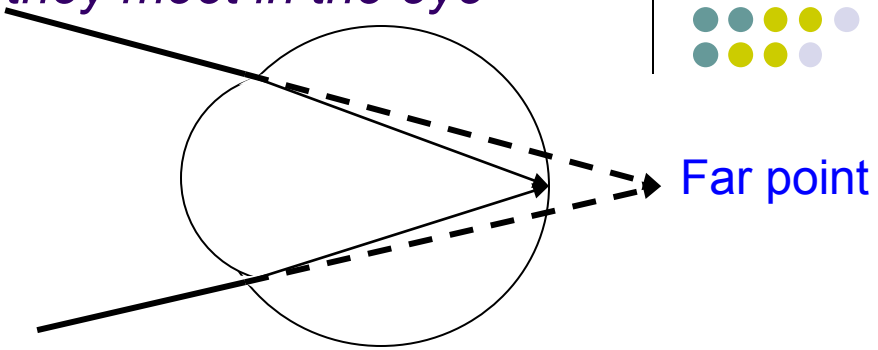
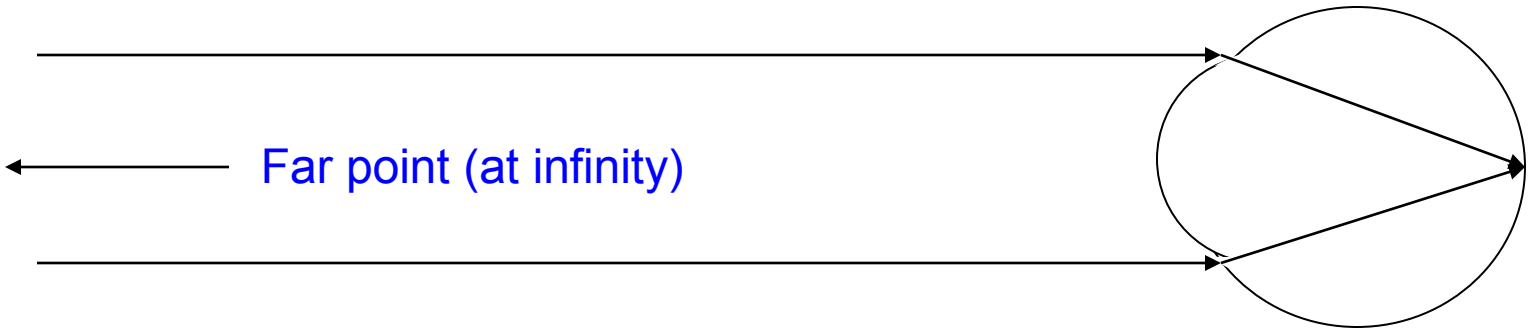
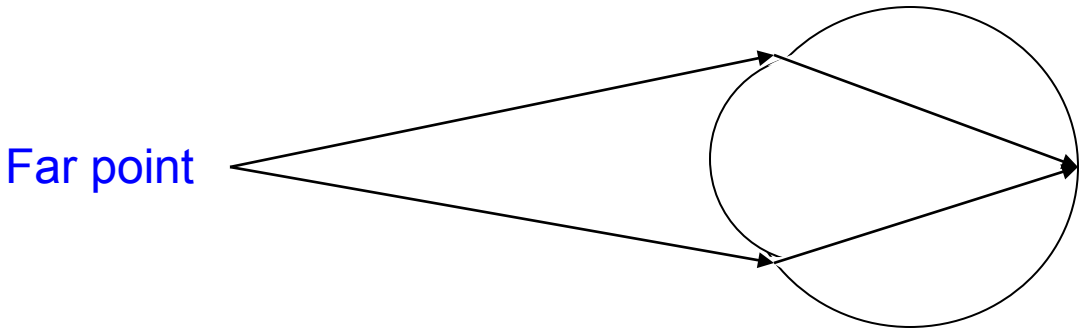


Hyperopic Eye

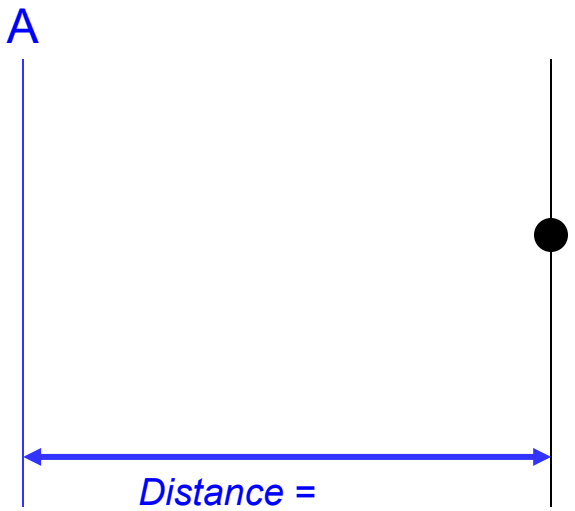


Emmetropic Eye



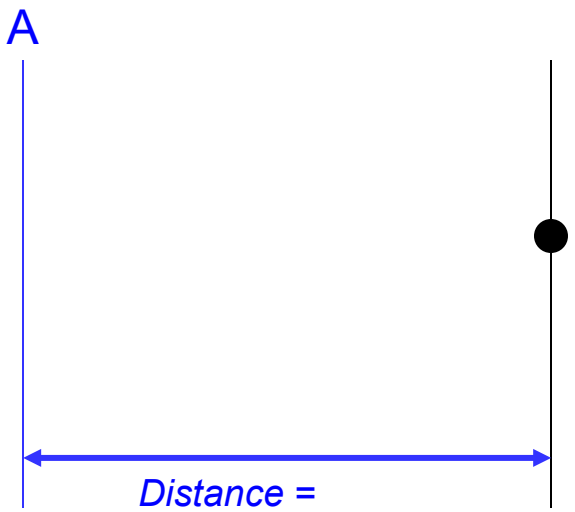
Myopic Eye

The vergence at A is +5D. Draw the rays (ie, lines which have an arrow at one end), and indicate the distance between A and the focal point.



The vergence at A is +5D. Draw the rays (ie, lines which have an arrow at one end), and indicate the distance between A and the focal point.

First things first. Note:
--Unless otherwise specified, in optics problems light always travels *left to right*.
--The (+) in the vergence (+%) tells us the light is *converging.*



The vergence at A is +5D. Draw the rays (ie, lines which have an arrow at one end), and indicate the distance between A and the focal point.

First things first. Note:
--Unless otherwise specified, in optics problems light always travels *left to right*.
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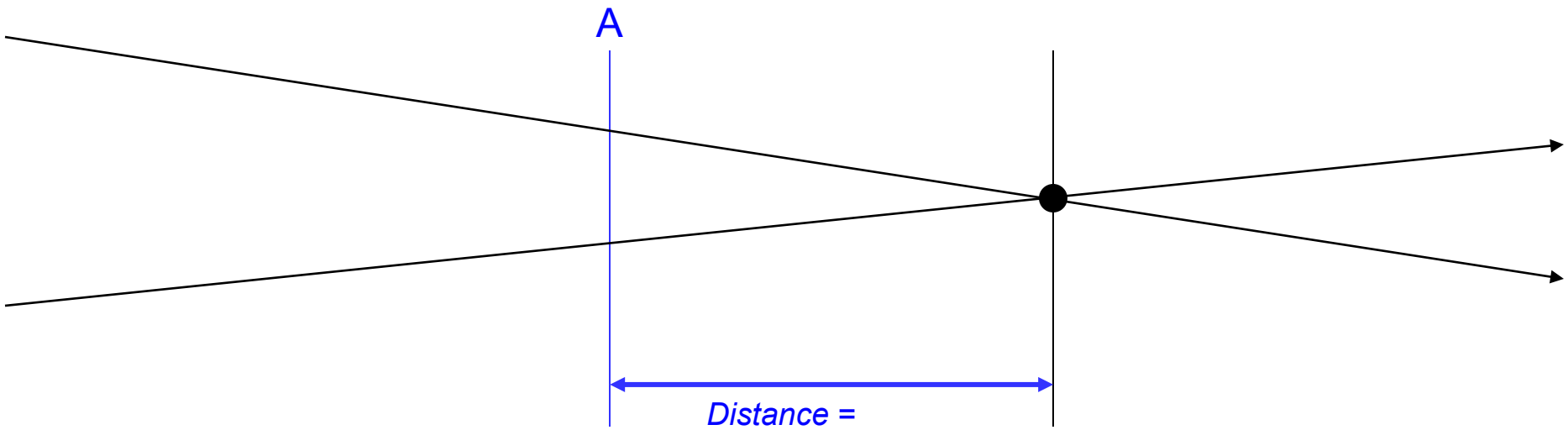
We now know to set up the problem thusly:



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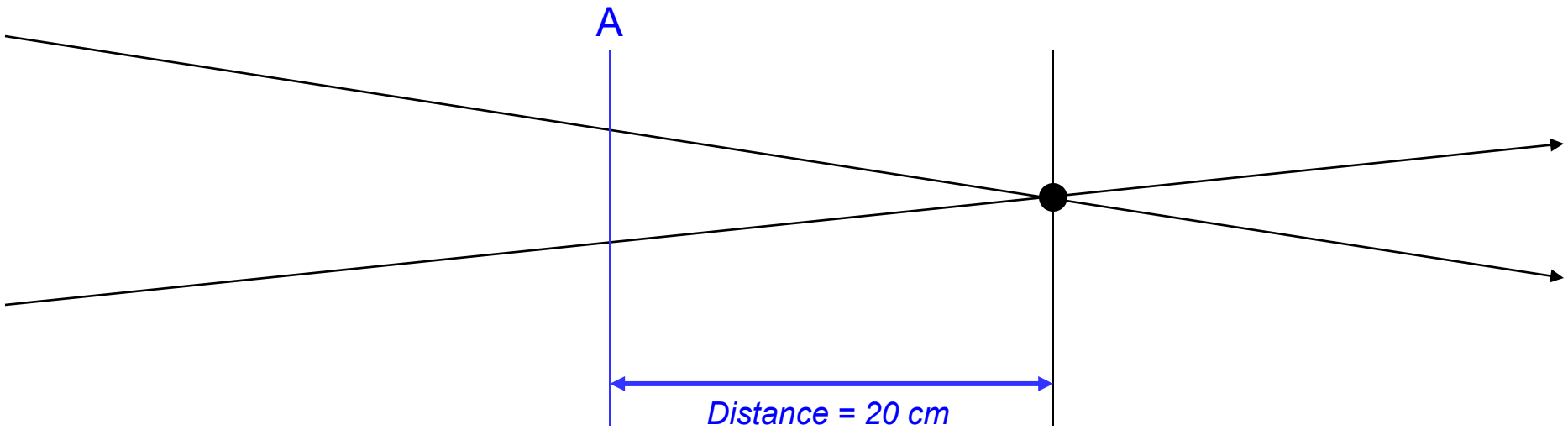
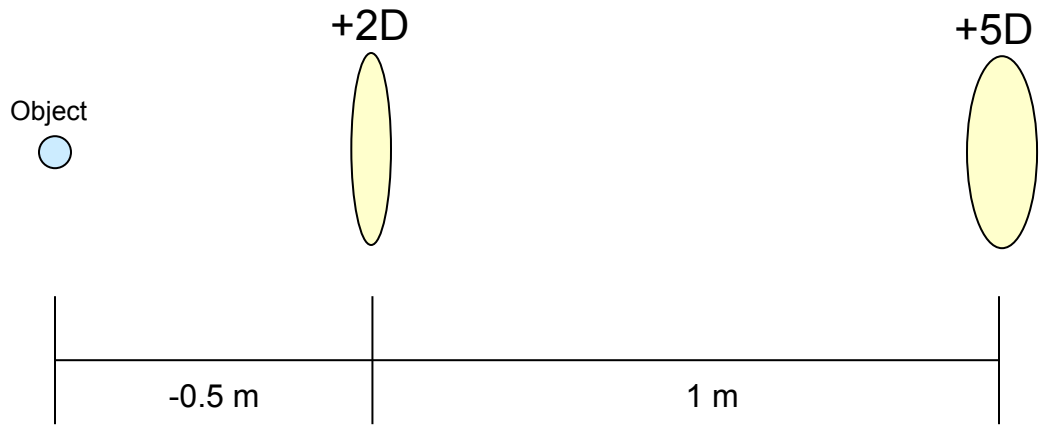


Solving:

Vergence = 1/distance in meters

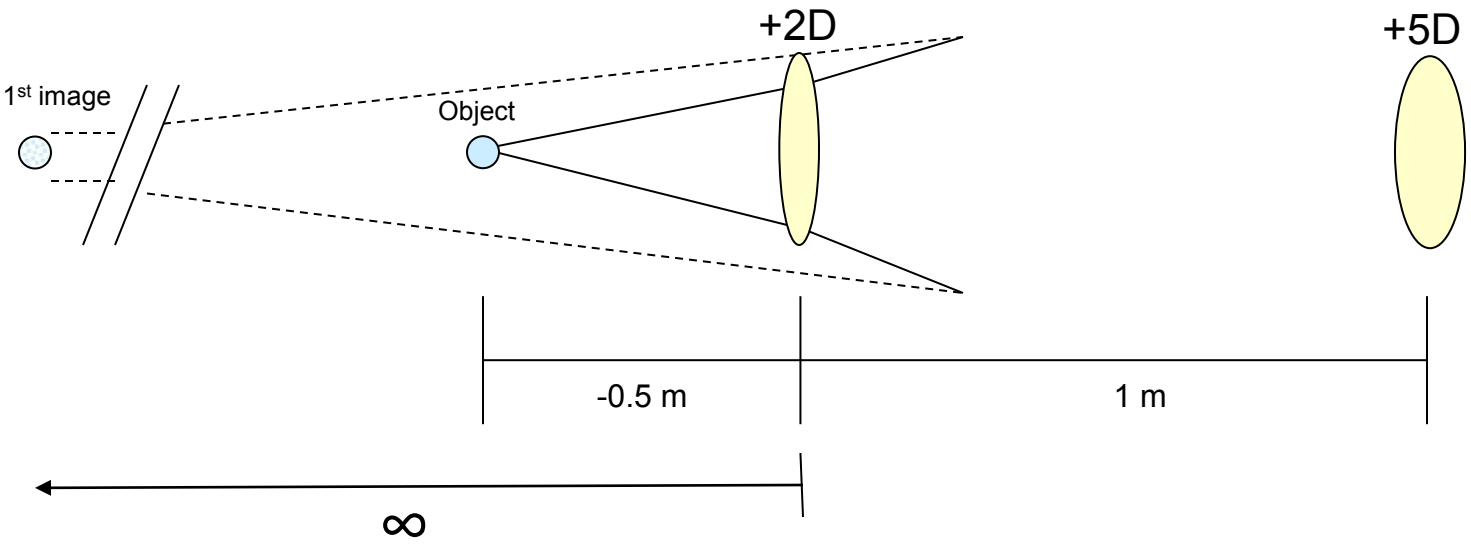
5 = 1/distance in meters = 1/.2 m = 20 cm

How far apart are the object and the final image?



How far apart are the object and the final image?

$$U + V = P$$
$$-2 + (+2) = 0$$



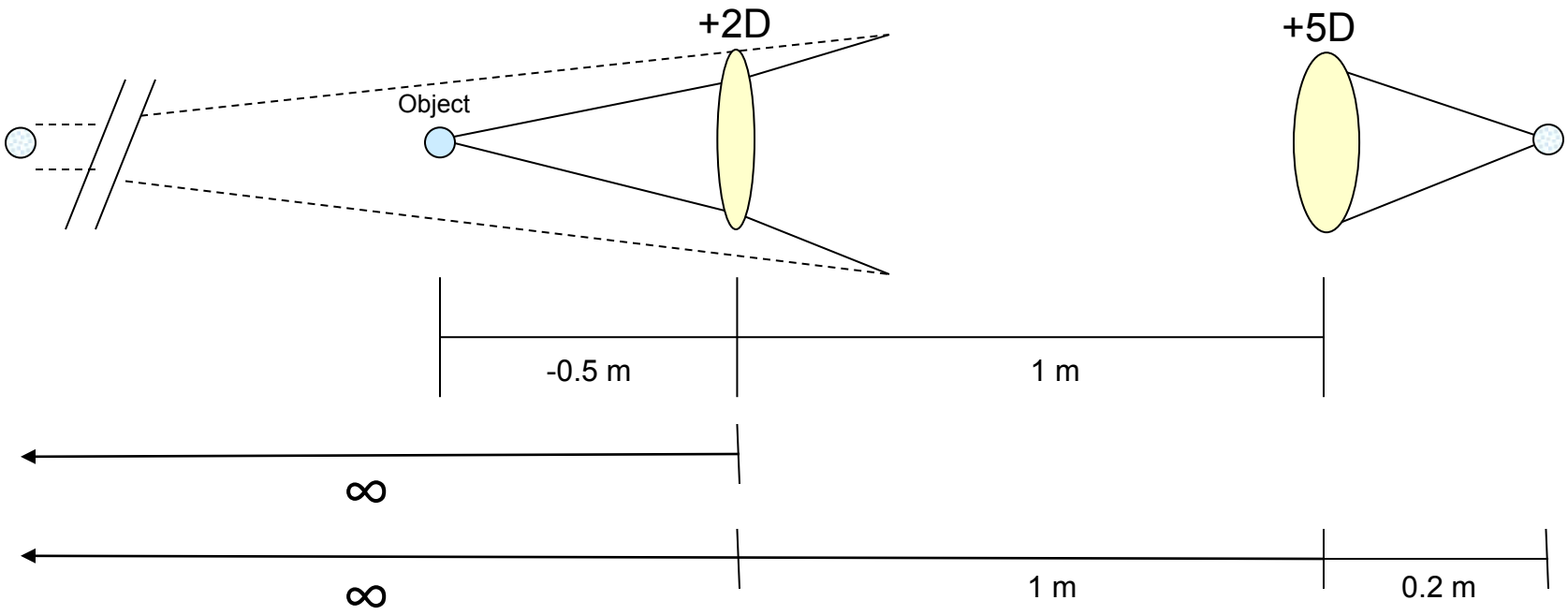
The first image is located at *optical infinity*

How far apart are the object and the final image?

Light rays from an object (the 1st image in this case) at infinity are all parallel to one another, ie, they have *zero vergence*

$$U + V = P$$
$$-2 + (+2) = 0$$

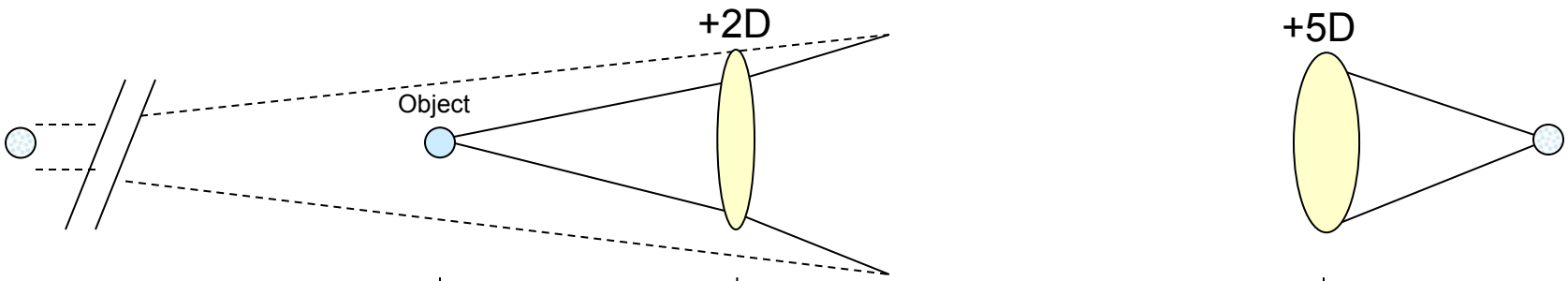
$$U + V = P$$
$$0 + (+5) = +5D$$
$$1/5 = 0.2\ m$$

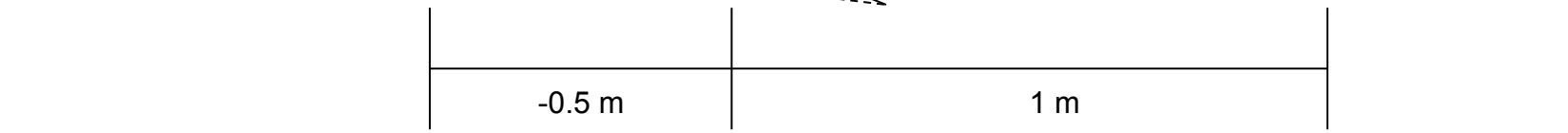


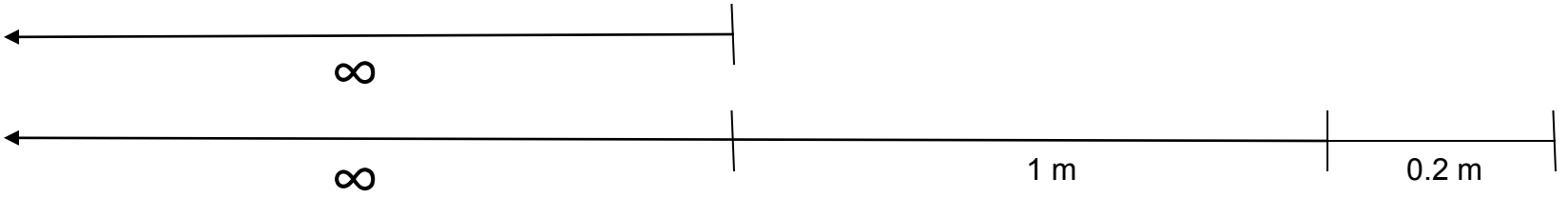
How far apart are the object and the final image?

U + V = P
-2 + (+2) = 0

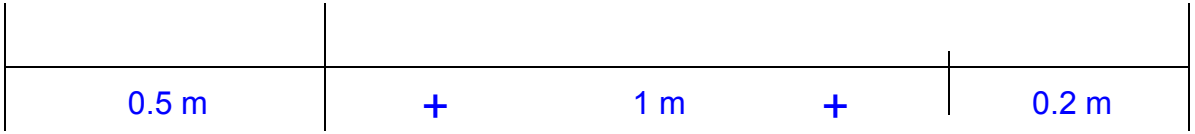
U + V = P
0 + (+5) = +5D
1/5 = 0.2 m





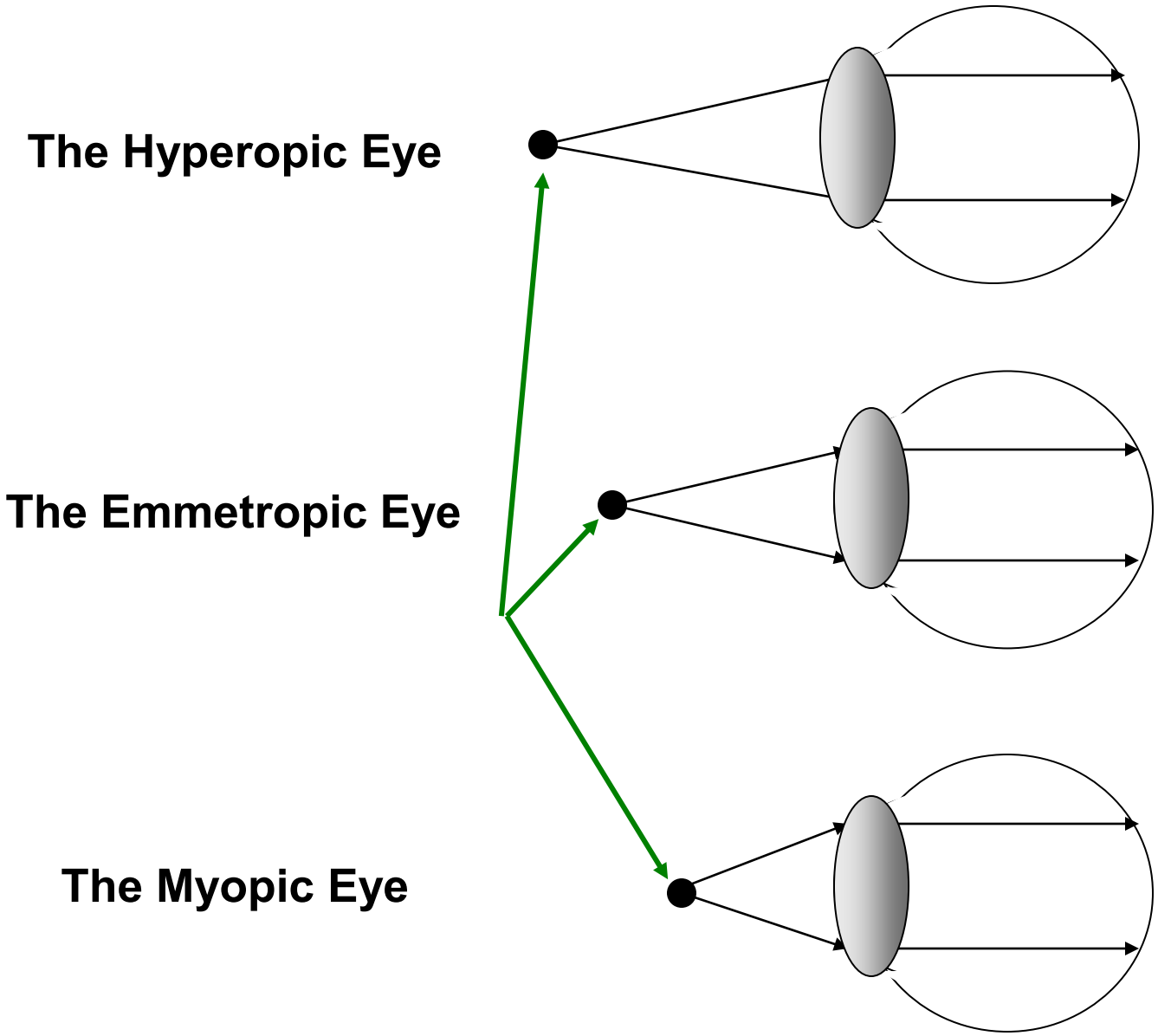


Doan fogit to answer the question asked!



= 1.7 m

What is the name of the indicated point?



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