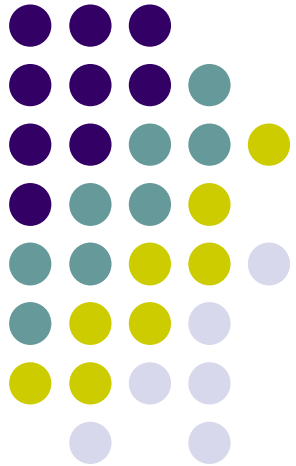
Vergence: Lenses

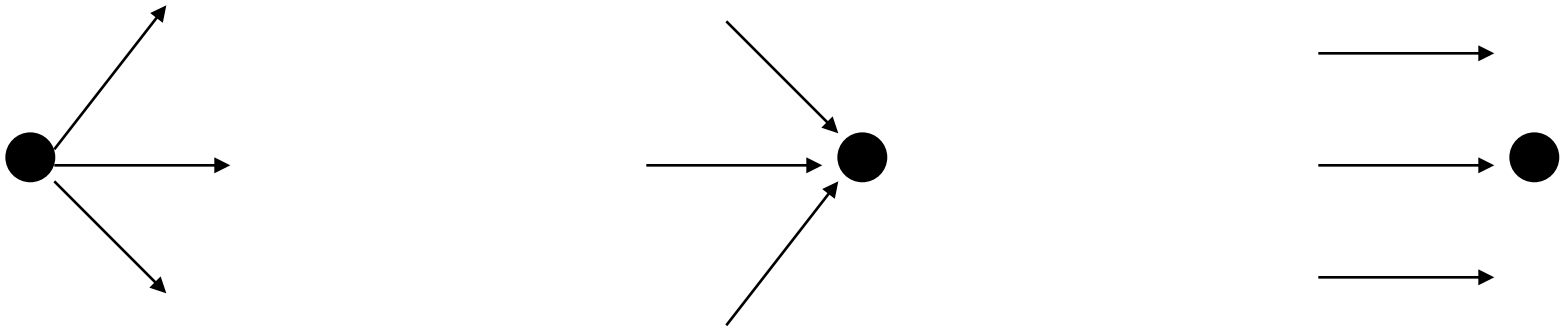
Basic Optics, Chapter 2



Vergence: Lenses

(From the last slide-set)

- The term ***vergence*** describes what light rays are doing in relation to each other
- With respect to a given point, light rays can:
  - spread out (**diverge**)
  - come together (**converge**)
  - run parallel (**vergence = zero**)



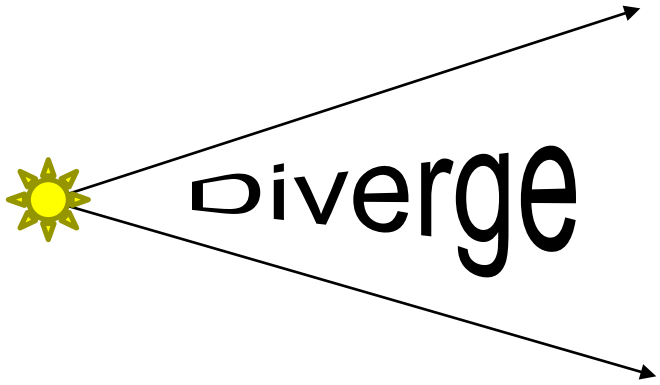
Vergence: Lenses

(From the last slide-set)

- Vergence is measured in *diopters (D)*
  - Dioptric power is defined as the reciprocal of the distance (in meters) to the point where light rays would intersect

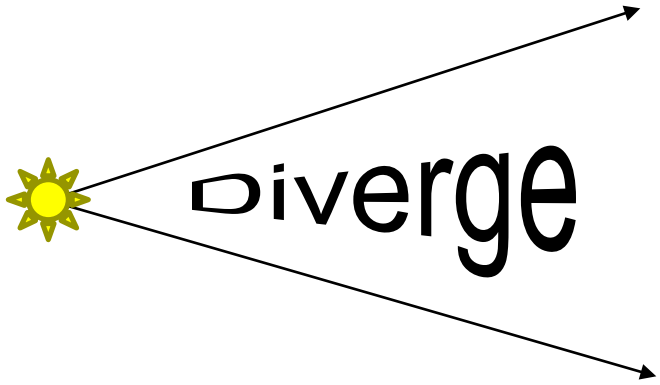
Vergence: Lenses

- Important point: *Light rays emanating from any point are **always divergent!***



Vergence: Lenses

- Important point: *Light rays emanating from any point are **always divergent!***
- For the most part, converging rays rarely appear in the ‘natural world’



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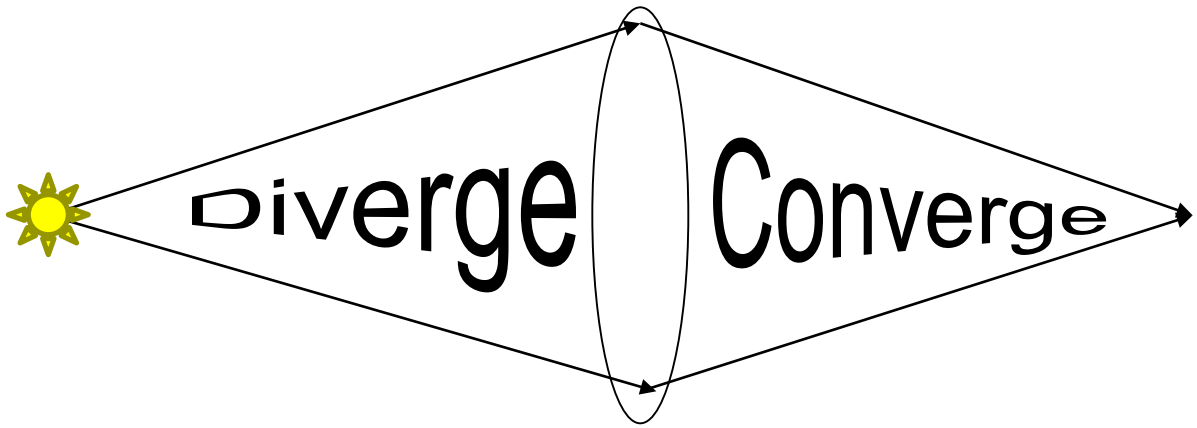
- Important point: *Light rays emanating from any point are **always divergent!***
- For the most part, converging rays rarely appear in the ‘natural world’
- Convergence requires a refracting surface, e.g., a ***lens****



*Or a curved mirror—a subject we’ll get to down the road

Vergence: Lenses

Take note of two conventions used in vergence problems:

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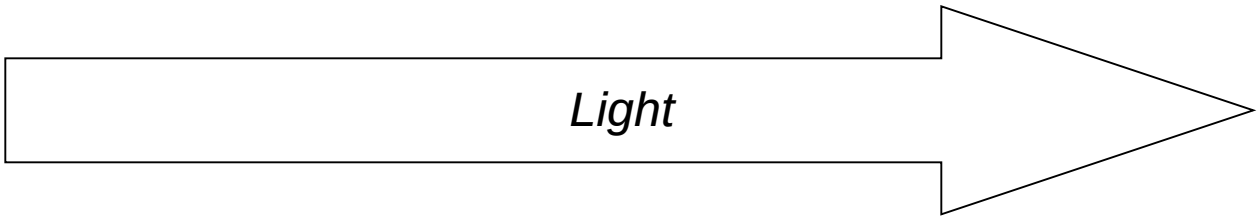
1) Light always moves left to right

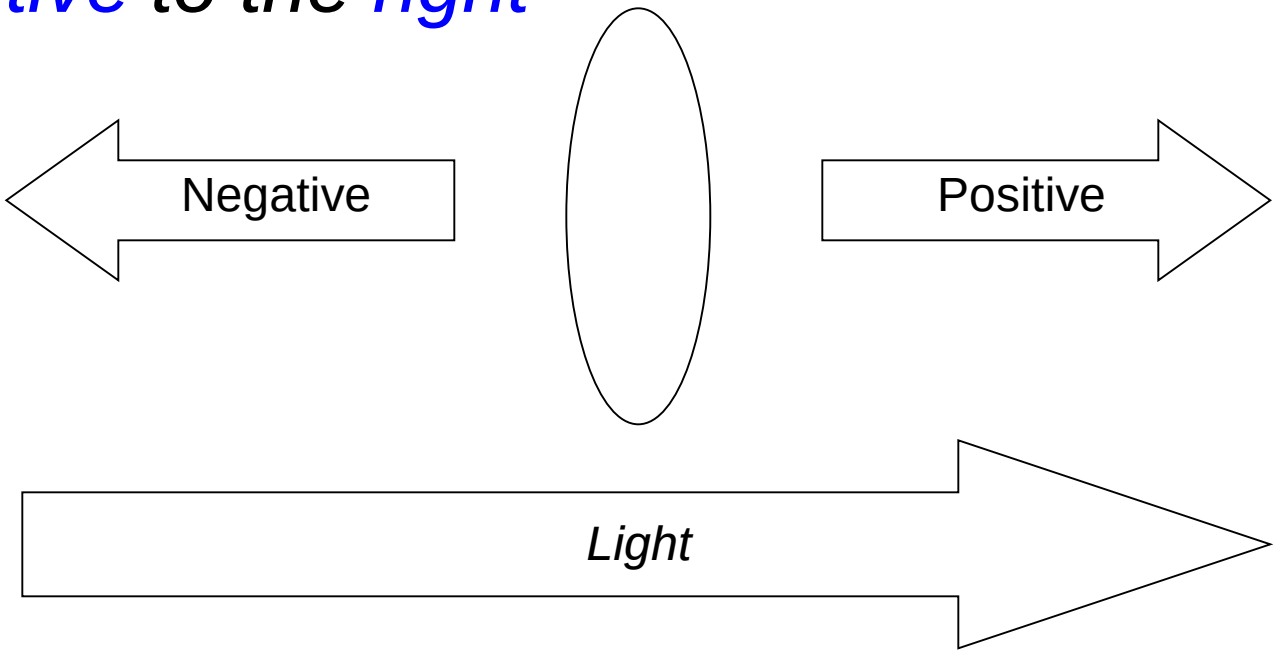


Vergence: Lenses

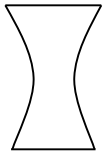
Take note of two conventions used in vergence problems:

1) Light always moves left to right

2) Distances are negative to the left of the lens, positive to the right



Vergence: Lenses

- There are two basic types of spherical lenses:
  - Plus 
  - Minus 

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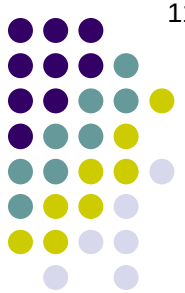
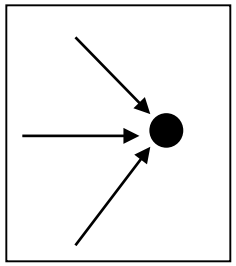


- *Plus* lens: induces convergence



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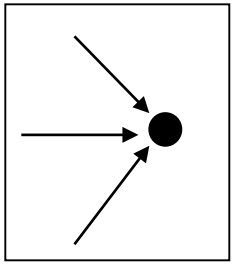

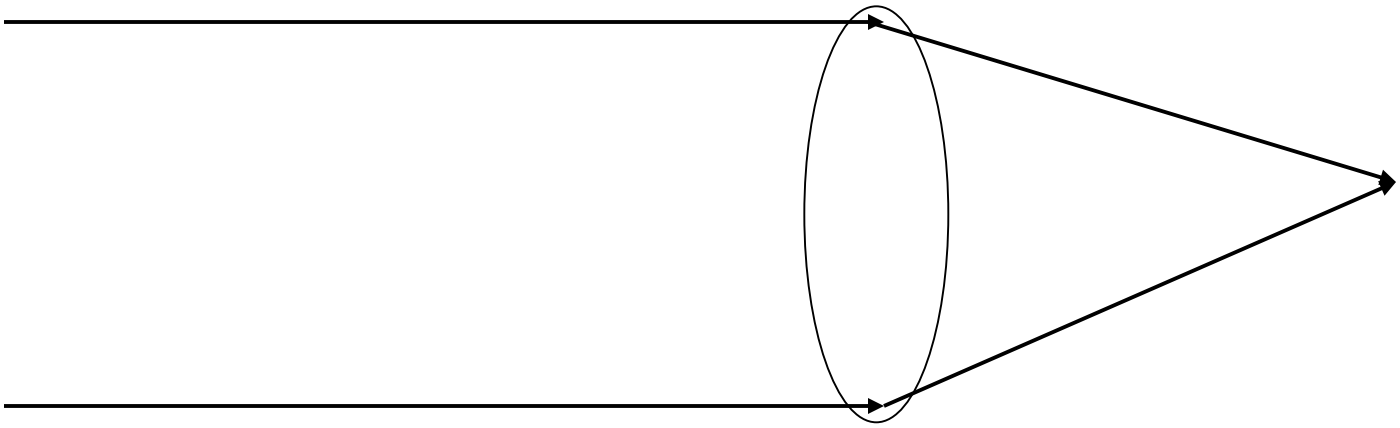

In this example, a plus lens causes previously parallel rays to converge to a point

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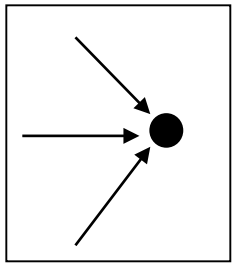
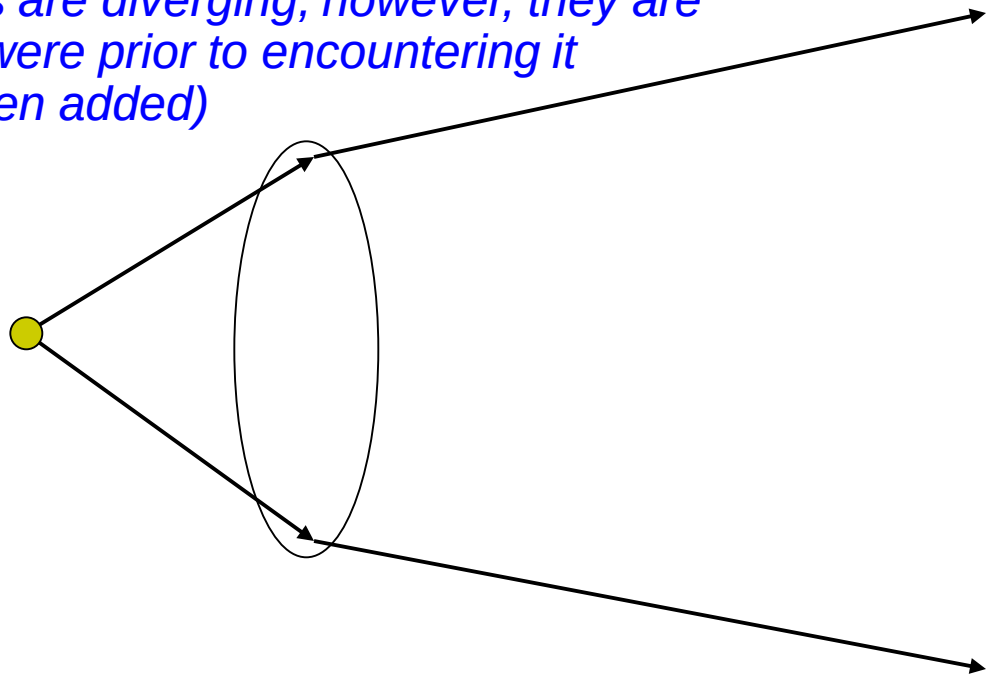


Rays exiting this plus lens are diverging; however, they are **less** *divergent than they were prior to encountering it (i.e., convergence has been added)*



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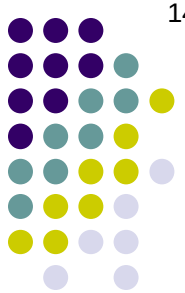
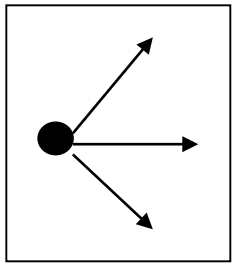


- *Minus* lens: induces divergence



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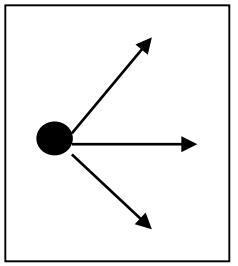

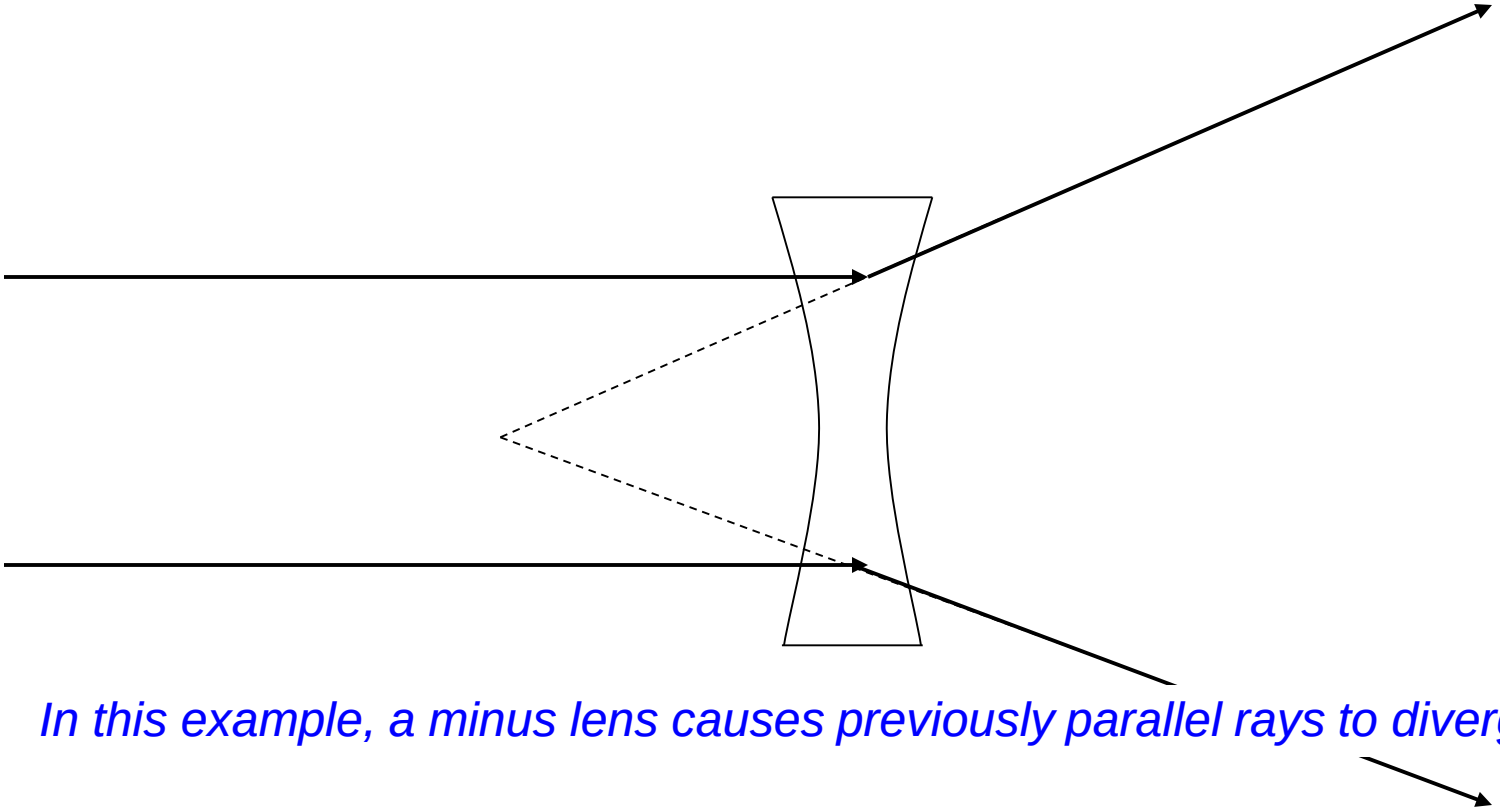

In this example, a minus lens causes previously parallel rays to diverge from a point

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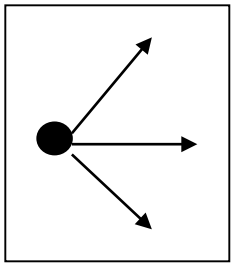

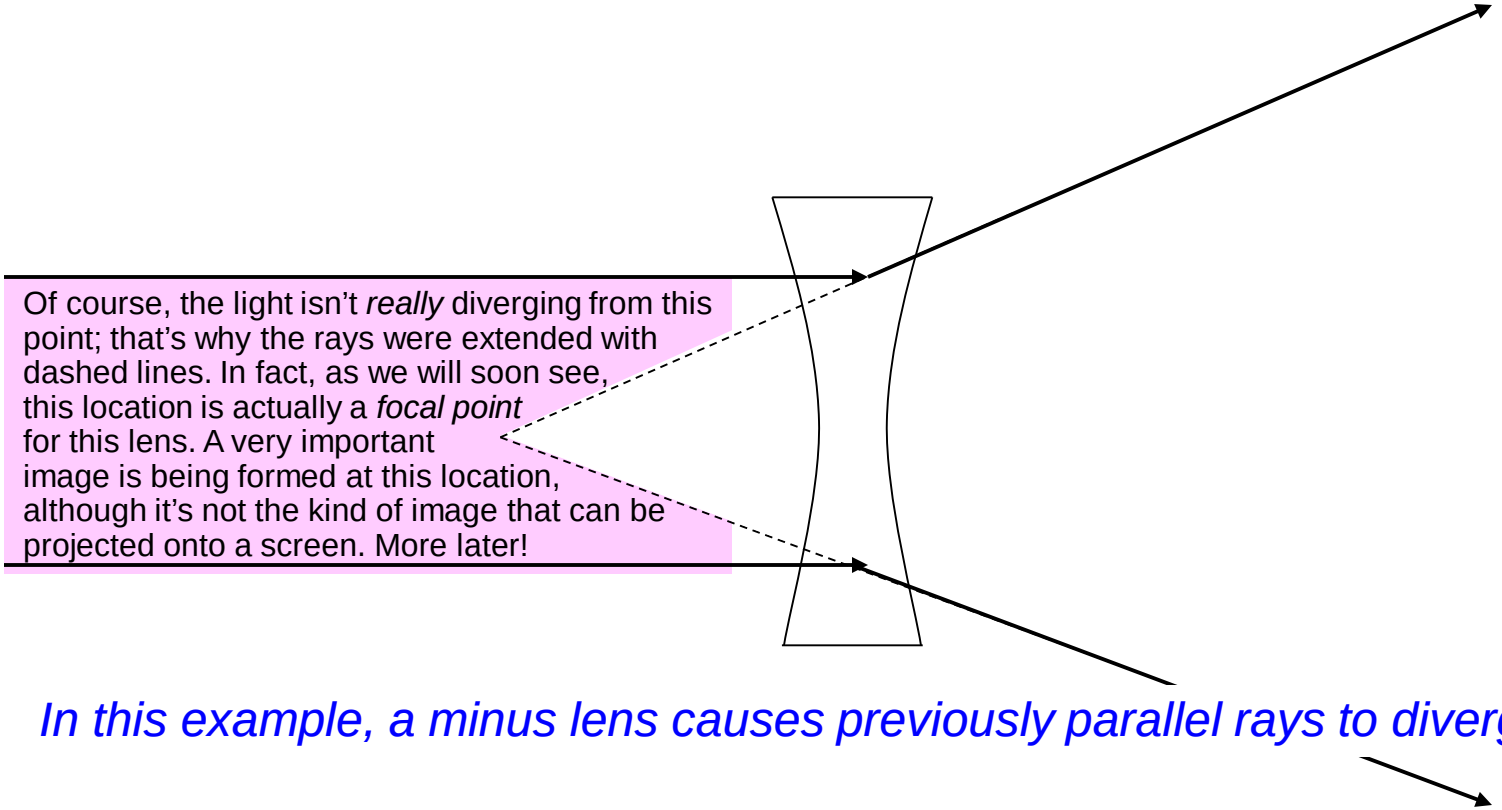

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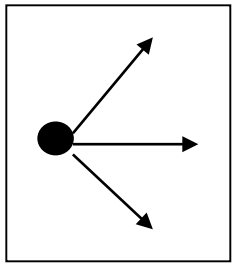

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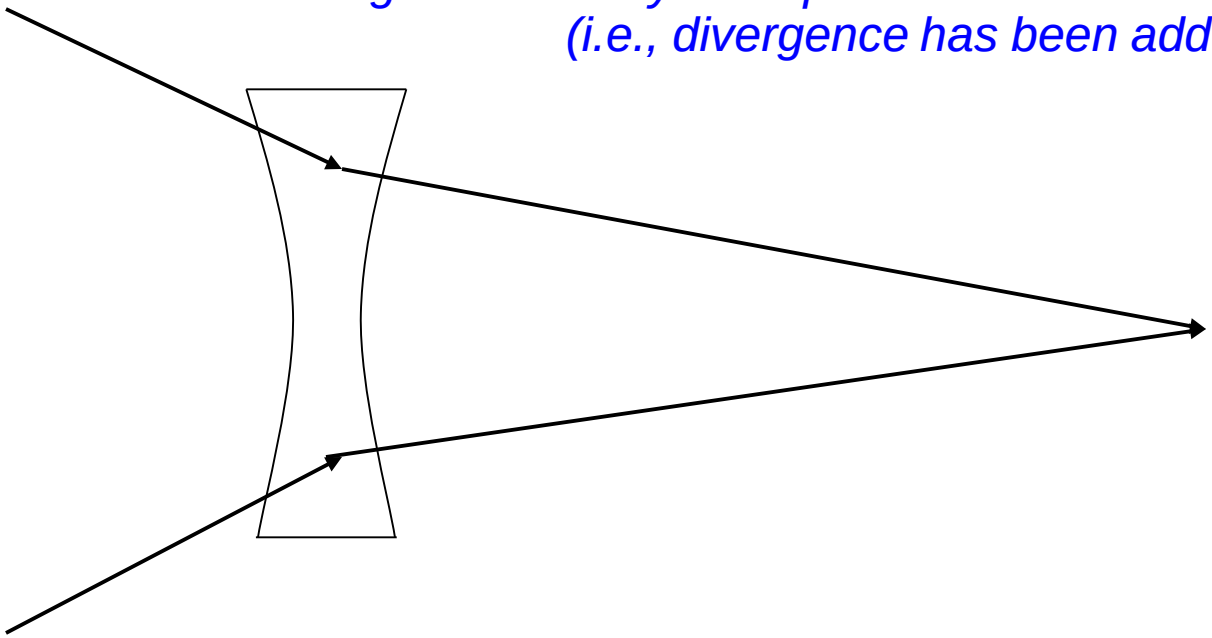

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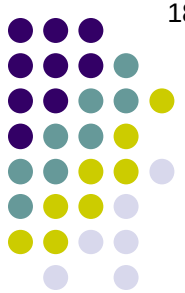

- The ability of a lens to induce vergence is expressed in diopters
  - Dioptric power of a lens: The reciprocal of the distance (in meters) to the point where incoming parallel light rays would intersect after passing through the lens

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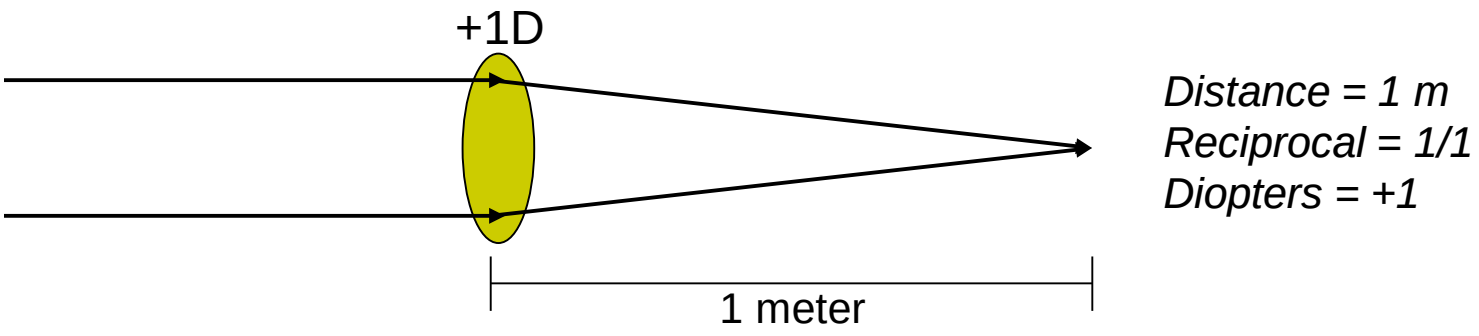
    - A +1D lens will focus parallel rays at 1m



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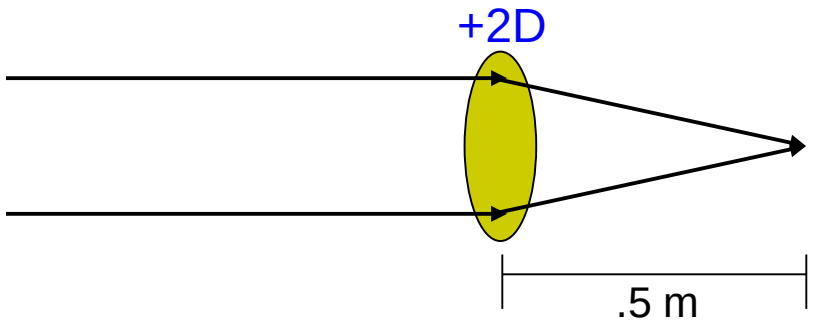
- The ability of a lens to induce vergence is expressed in diopters
  - Dioptric power of a lens: The reciprocal of the distance (in meters) to the point where incoming parallel light rays would intersect after passing through the lens
    - A **+2D** lens will focus parallel rays at 1/2 m



Distance = .5 m
Reciprocal = 1/.5
Diopters = +2

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  - Dioptric power of a lens: The reciprocal of the distance (in meters) to the point where incoming parallel light rays would intersect after passing through the lens
    - A **-1D** lens will ‘focus’ parallel rays at 1 m to the left of the lens