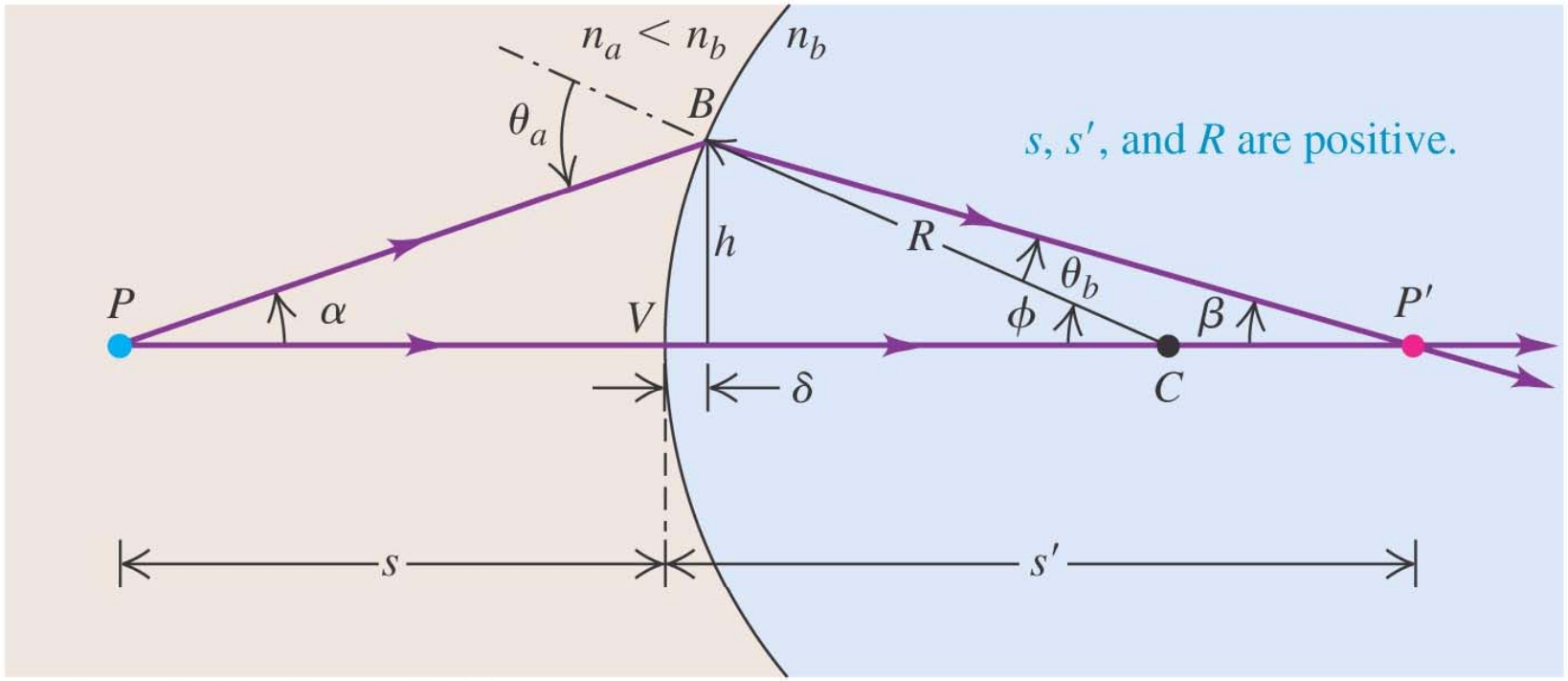
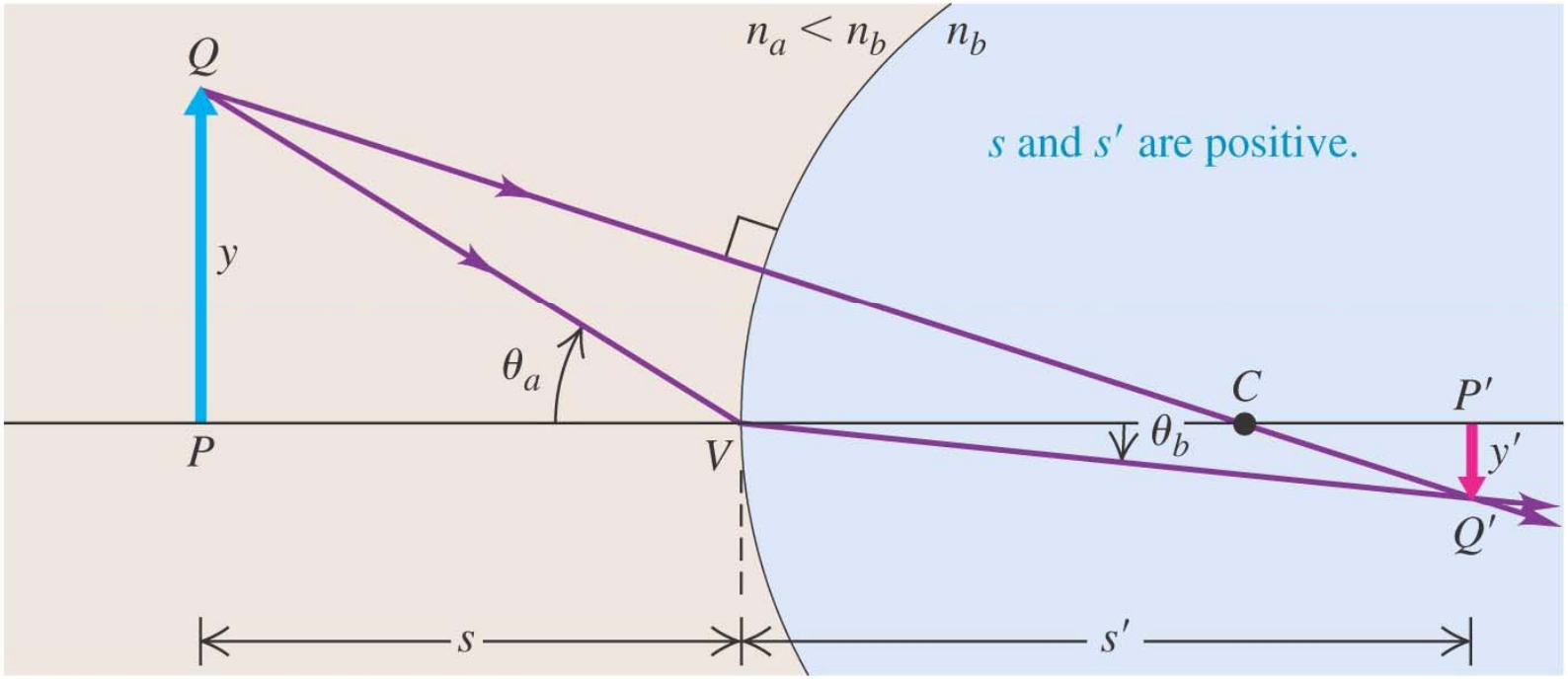
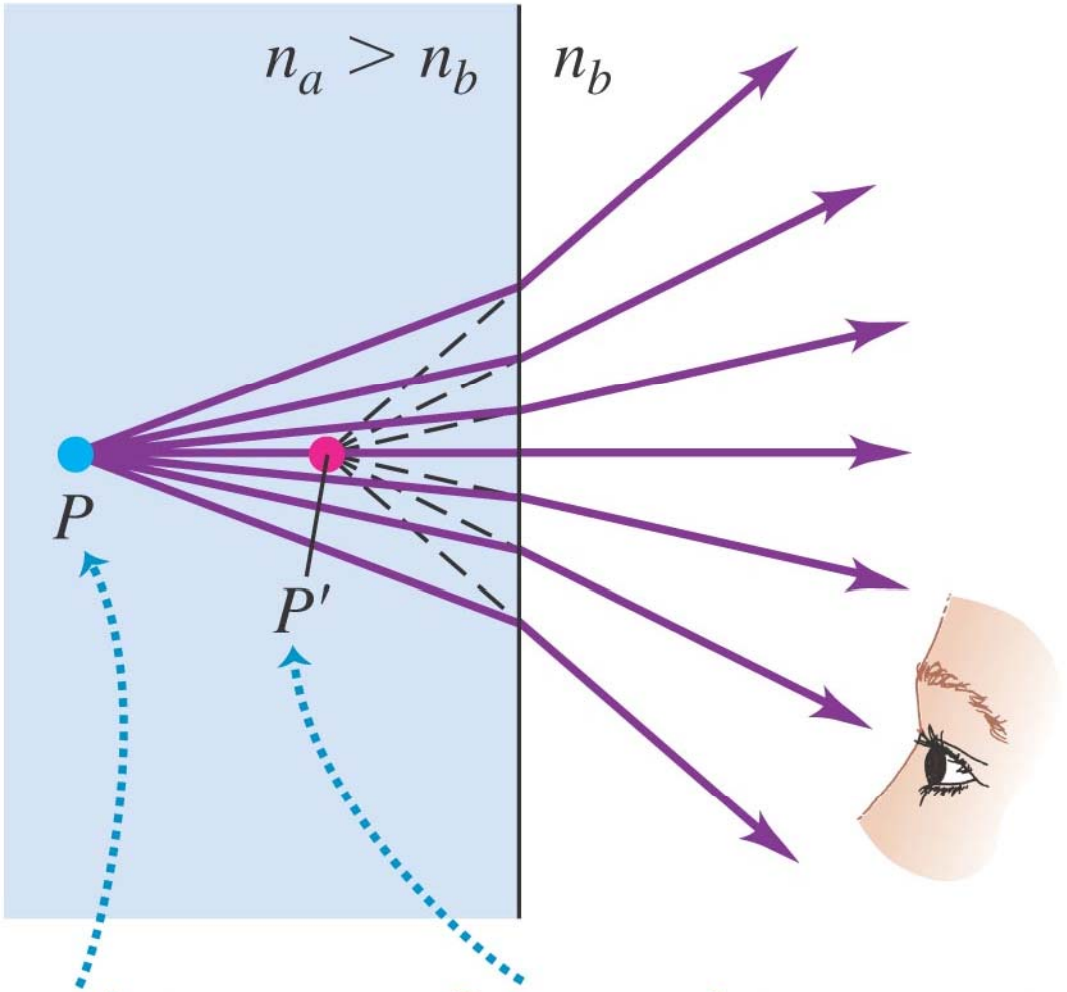
Puzzle: In the demo, an image of the filament is formed on the screen
by the lens. If I cover the bottom half of the lens, does half the image disappear?
If so, which half?



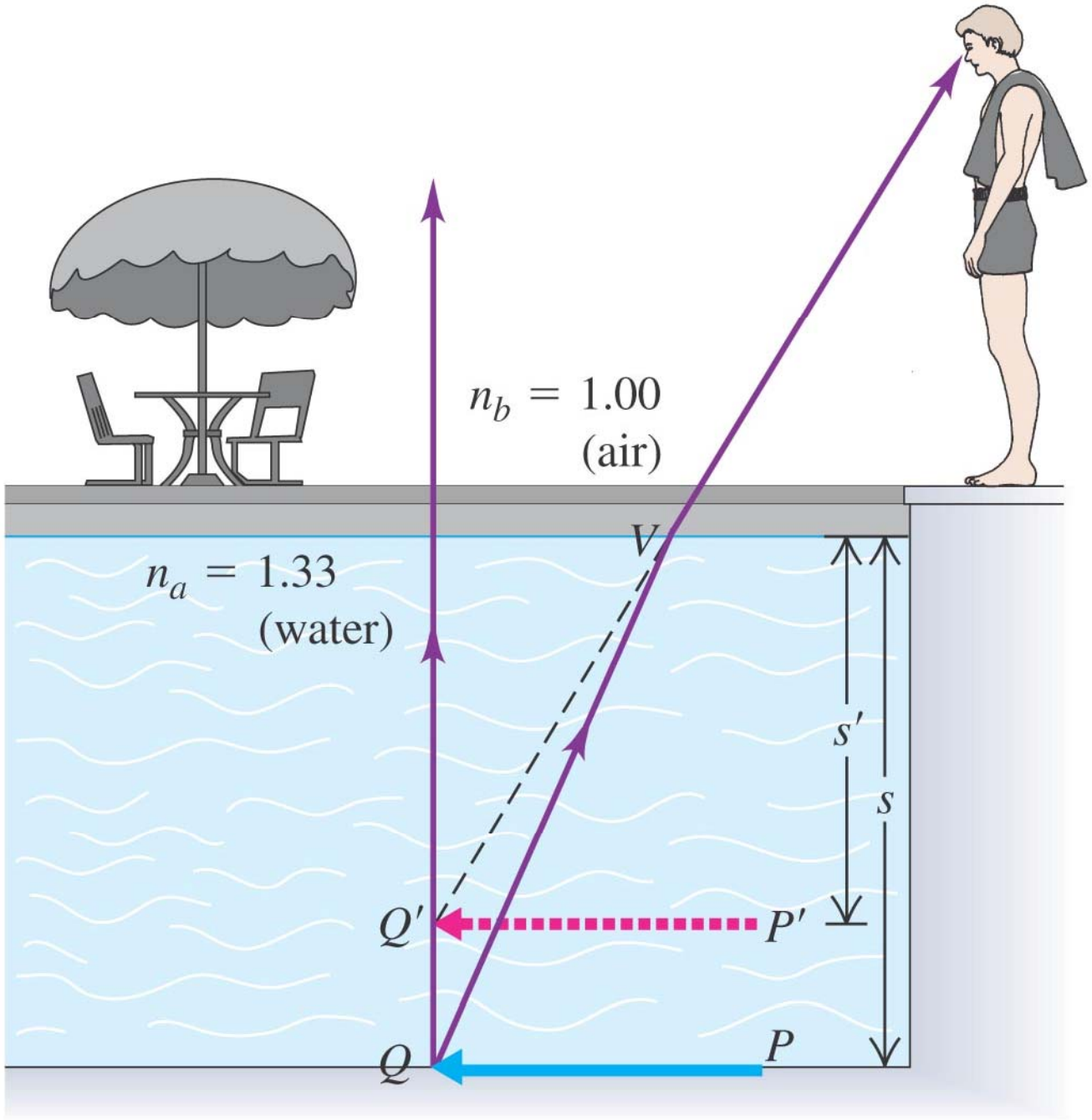


When $n_a > n_b$, P' is closer to the surface than P; for $n_a < n_b$, the reverse is true.



Object point: source of rays

Image point: apparent source of refracted rays



For the curved surface in the demo, the incoming parallel rays will

a) Converge

b) Diverge

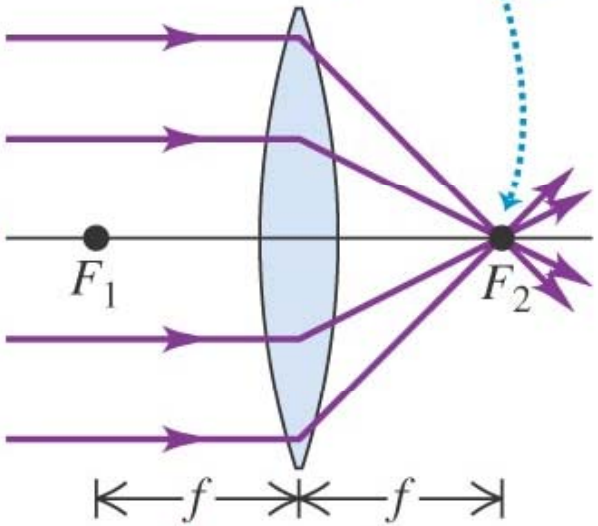
c) Go straight through

D) More information is needed

(a)

Optic axis (passes through centers of curvature of both lens surfaces)

Second focal point: the point to which incoming parallel rays converge

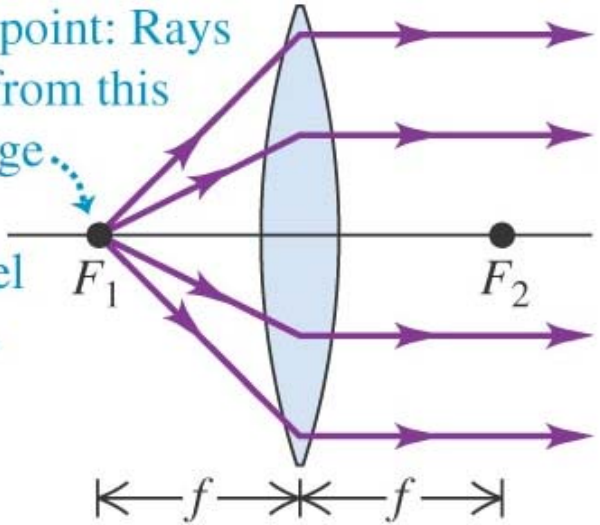


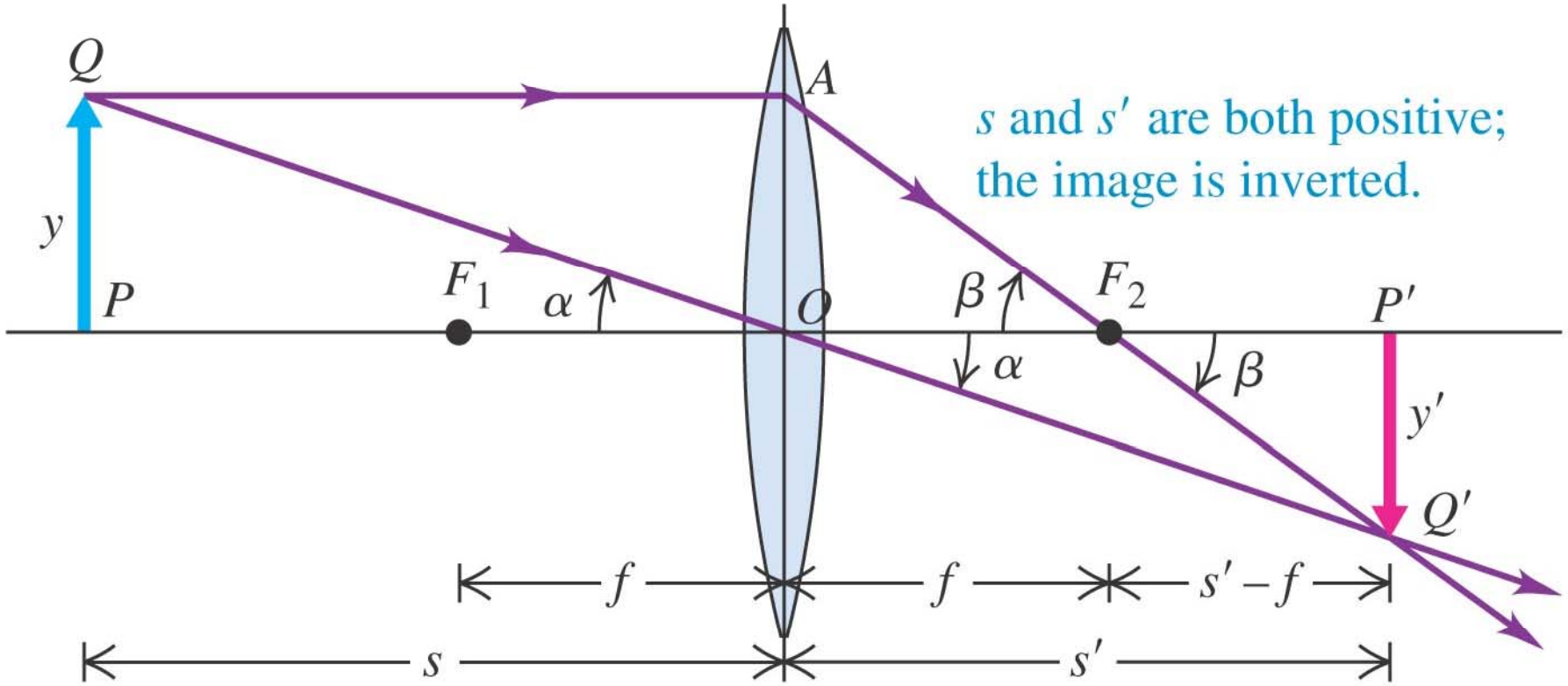
Focal length

- Measured from lens center
- Always the same on both sides of the lens
- Positive for a converging thin lens

(b)

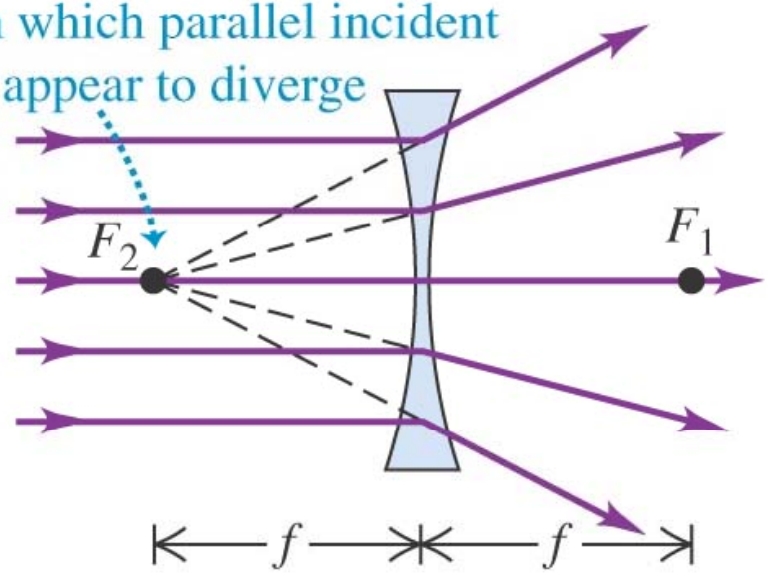
First focal point: Rays diverging from this point emerge from the lens parallel to the axis.





(a)

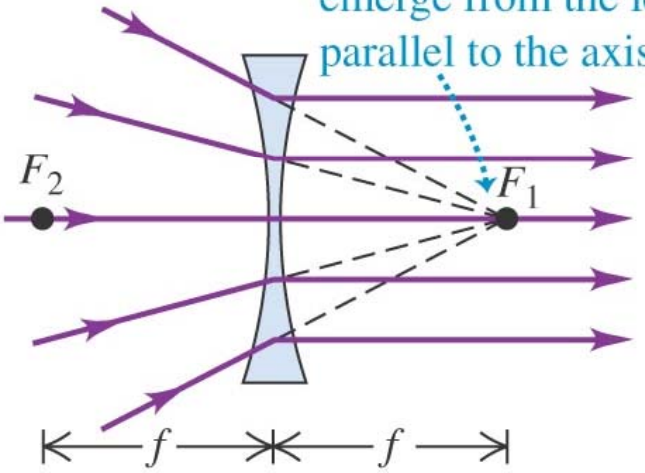
Second focal point: The point from which parallel incident rays appear to diverge



For a diverging thin lens, f is negative.

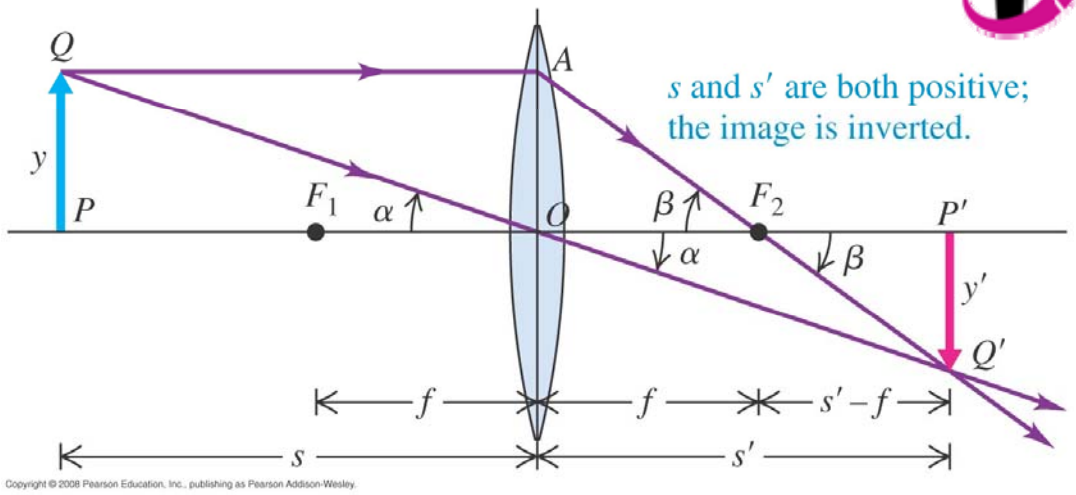
(b)

First focal point: Rays converging on this point emerge from the lens parallel to the axis.



Q34.8

An object *PQ* is placed in front of a converging lens, forming a real image *P ′Q ′*. If you use black paint to cover the lower half of the lens,



A. only the object's upper half will be visible in the image.

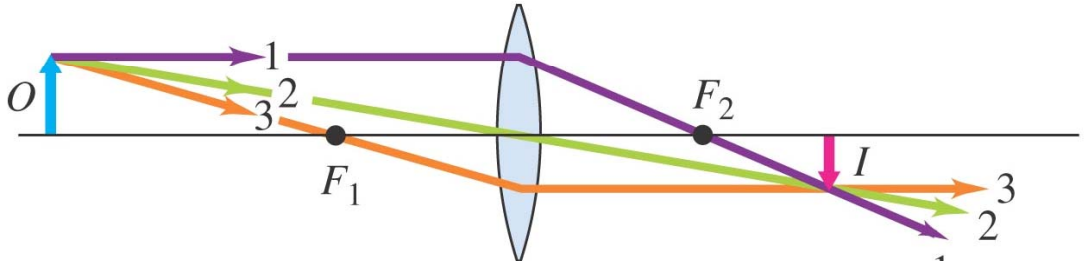
B. only the object's lower half will be visible in the image.

C. only the object's left-hand half will be visible in the image.

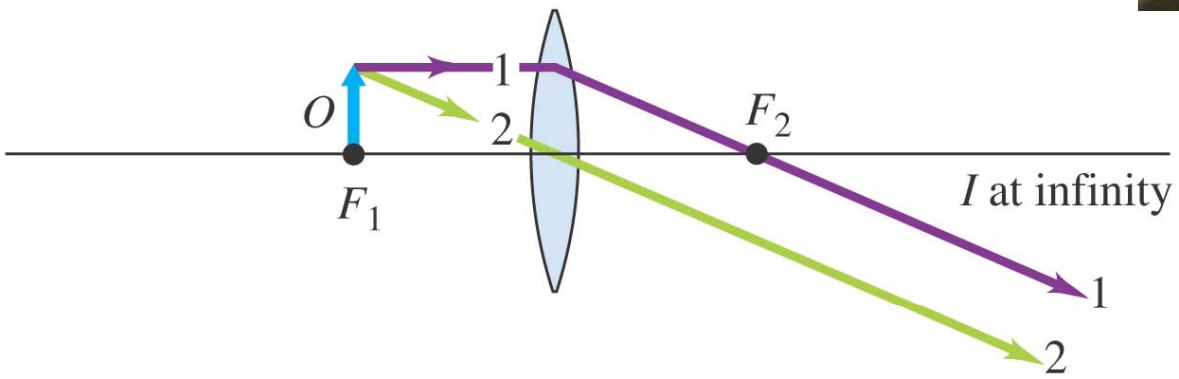
D. only the object's right-hand half will be visible in the image.

E. the entire object will be visible in the image.

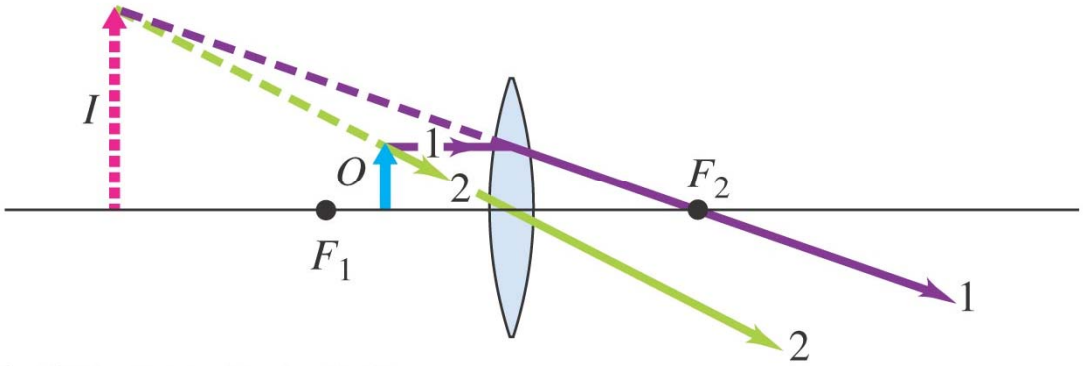
(a) Object O is outside focal point; image I is real.

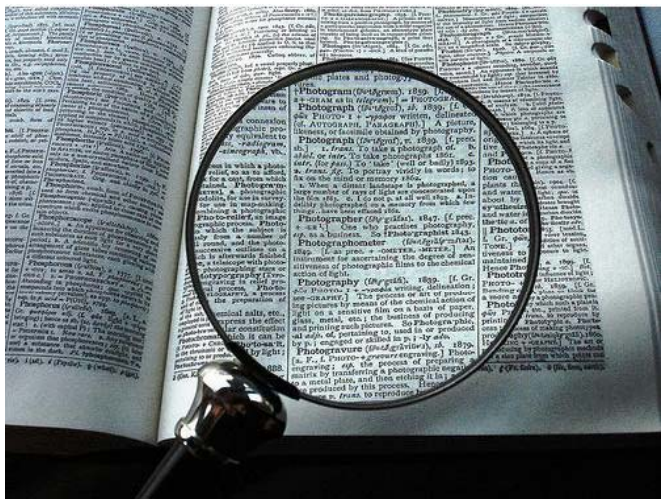


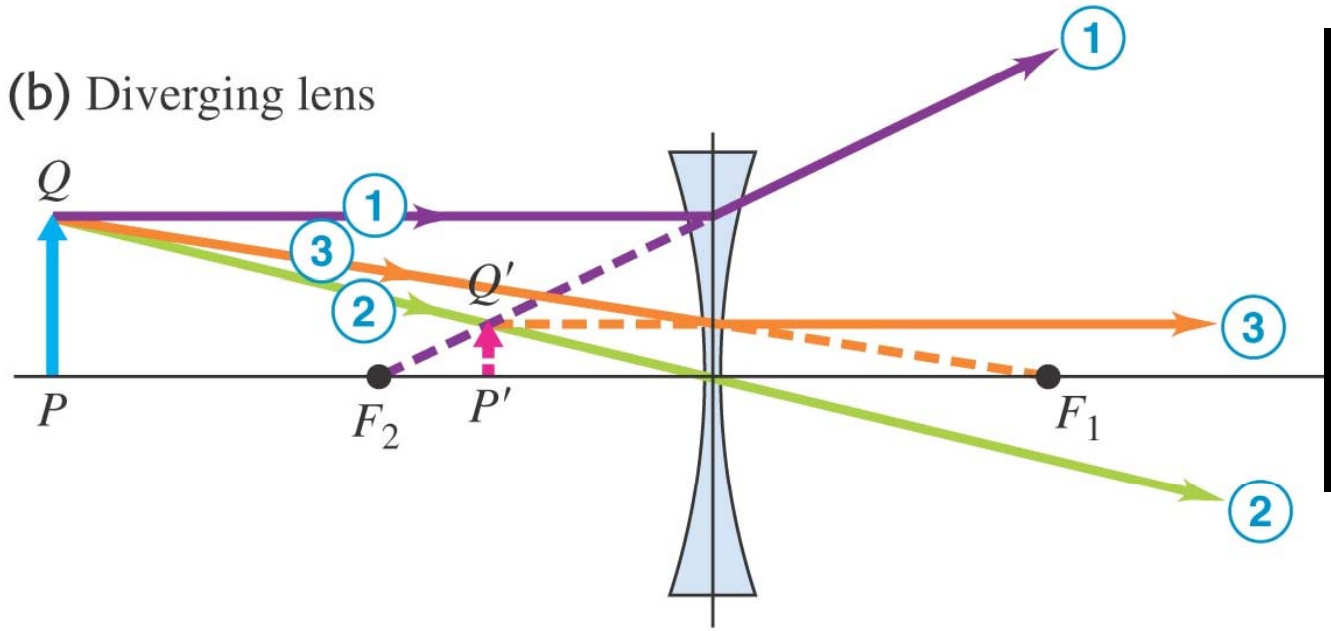
(d) Object O is at focal point; image I is at infinity.



(e) Object O is inside focal point;
image I is virtual and larger than object.







1. Parallel incident ray appears after refraction to have come from the second focal point F_2.
2. Ray through center of lens does not deviate appreciably.
3. Ray aimed at the first focal point F_1 emerges parallel to the axis.