



Attempt questions first; check the separate key afterward. Use Cartesian sign convention and $c=3\times 10^8$ m/s. Distances refer to pole or optical centre.

A. Very short answers - 1 mark each

1. State the relation between focal length and radius of curvature of a spherical mirror.
2. Is a convex mirror's focus real?
3. A concave mirror has radius 40 cm. Find focal length with Cartesian sign convention.
4. A convex mirror has radius 30 cm. Find focal length.
5. A concave mirror has $f=-15$ cm, $u=-30$ cm. Find v .
6. Find magnification and image nature.
7. A concave mirror has $f=-10$ cm, $u=-15$ cm. Find v and m .
8. Draw its ray diagram.

B. Short answers / practice - 2 marks each

9. A convex mirror has $f=+15$ cm, $u=-30$ cm. Find v .
10. Find magnification.
11. State Snell's law.
12. Explain refraction in terms of change in light speed.
13. Light travels at 2×10^8 m/s in a medium. Find refractive index; $c=3\times 10^8$ m/s.
14. Does frequency change when light enters another medium?
15. A convex lens has $f=+20$ cm, $u=-30$ cm. Find v .
16. Find magnification and nature.
17. A concave lens has $f=-20$ cm, $u=-30$ cm. Find v .
18. Find magnification.
19. A lens has focal length $+25$ cm. Find power.
20. A lens has power -2 D. Find focal length.

C. Application / reasoning - 3 marks each

21. Two thin lenses in contact have powers $+3$ D and -1 D. Find total power.

22. Find their equivalent focal length.
 23. Does a ray passing normally through a glass slab bend at entry?
 24. Explain why the emergent ray from a parallel-sided slab is parallel to the incident ray.
 25. A concave mirror forms an upright image three times the object at $u=-10$ cm. Find v and f .
 26. Draw the object and image positions.
 27. A concave mirror has $f=-12$ cm and $u=-18$ cm. Find image distance and magnification.
 28. A convex lens has $f=15$ cm and $u=-45$ cm. Find image distance.
 29. Find power of a concave lens of focal length -25 cm.
 30. Light speed in a medium is 2.4×10^8 m/s. Find refractive index.
 31. A convex lens has power $+5$ D. At what distance should an object be placed for an equal-size real image?
- ### D. Extended practice - 5 marks per pair
32. A convex lens forms an image on a screen 40 cm away with object 40 cm away. Find f .
 33. If object height is 3 cm, find image height.
 34. Which mirror is generally used as a vehicle rear-view mirror?
 35. Compare image formation by concave and convex lenses with labelled ray diagrams for a finite object.

ANSWER KEY - Numerical / closed questions

- 1) $f=R/2$. 2) No; virtual. 3) -20 cm. 4) $+15$ cm. 5) -30 cm. 6) -1 ; real, inverted, same size. 7) -30 cm; -2 . 8) $+10$ cm. 9) $+1/3$. 10) $n_1 \sin i = n_2 \sin r$. 11) 1.5. 12) No. 13) $+60$ cm. 14) -2 ; real, inverted, enlarged. 15) -12 cm. 16) $+0.4$. 17) $+4$ D. 18) -0.5 m. 19) $+2$ D. 20) $+0.5$ m. 21) No. 22) $v=+30$ cm; $f=-15$ cm. 23) $v=-36$ cm; $m=-2$. 24) $+22.5$ cm. 25) -4 D. 26) 1.25. 27) 40 cm in front. 28) 20 cm. 29) -3 cm. 30) Convex mirror.