Physics 261: Physics for Life Sciences 2
Exam 1: Solutions

Section A

1. D	5. B	9. B	13. D	17. D	21. B
2. A	6. C	10. B	14. B	18. B	22. D
3. C	7. C	11. B	15. C	19. A	23. C
4. A	8. D	12. D	16. C	20. A	

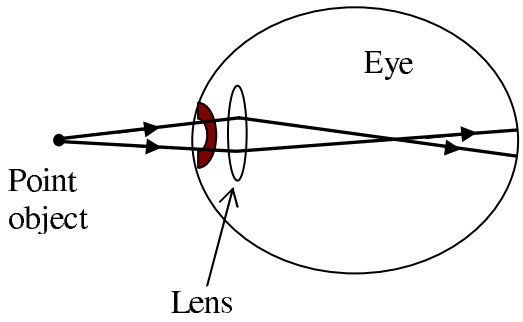
Section B

(a) When her vision is **uncorrected**, she looks at an point object that is 0.5 m away from her eye. Sketch (at least two) light rays that emanate from the object and enter her eye in this situation. [10 points]

(b) What power lens should she use, so that she can clearly see objects very far away? (Make sure you include the correct sign in your answer.) [10 points]

Answers

(a)



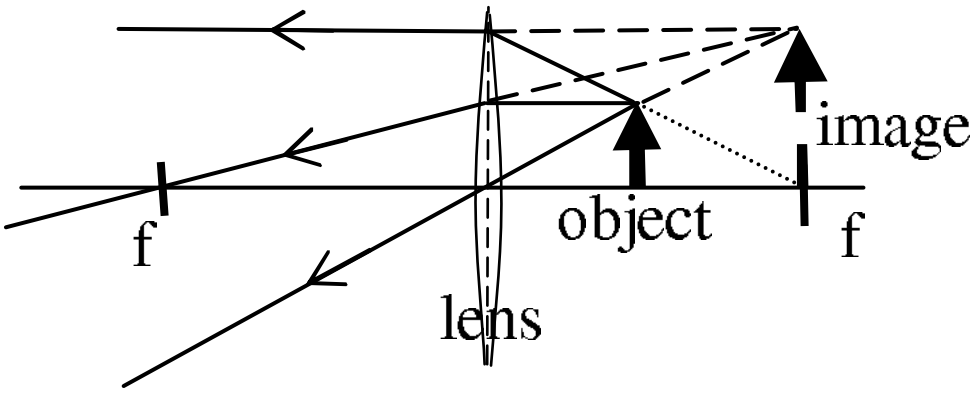
(b) You need to put the images of objects that are very far away ($d_{\text{object}} = \infty$) at a distance $d_{\text{image}} = -0.2\,\text{m}$ (negative because the image is virtual), because that's the farthest the woman can see. Substituting these into the thin-lens equation,

$$\frac{1}{f} = \frac{1}{d_{\text{object}}} + \frac{1}{d_{\text{image}}}$$

gives a lens power of

$$\frac{1}{f} = \frac{1}{\infty} + \frac{1}{-0.2\,\text{m}} = \boxed{-5\,\text{D}}.$$

2. The diagram below represents an object that is 1 m away from an a convex (converging) lens with focal length of magnitude 2 m.



(a) Draw the ray diagram (include at least 2 rays) for the above situation. Indicate where the image is. (If you don't have a ruler, you can use the edges of a sheet of paper to draw straight lines.) The focal points are labelled f. [10 points]

(b) *Calculate* where the image should be. Include the correct sign. [7 points]

(c) What is the linear magnification factor of this image? (Include the correct sign.) [3 points]

Answers

(a) See ray diagram above.

(b) Here, $d_{\text{object}} = 1\,\text{m}$ and $f = 2\,\text{m}$. Therefore, using the thin lens formula,

$$\frac{1}{d_{\text{image}}} = \frac{1}{f} - \frac{1}{d_{\text{object}}} = \frac{1}{2\,\text{m}} - \frac{1}{1\,\text{m}} = -\frac{1}{2\,\text{m}} \quad \Rightarrow \quad \boxed{d_{\text{image}} = -2\,\text{m}}.$$

(c) The linear magnification is

$$M = -\frac{d_{\text{image}}}{d_{\text{object}}} = -\frac{-2\,\text{m}}{1\,\text{m}} = \boxed{(+)2}.$$

Notice that this answer is consistent with the ray diagram in part (a); *i.e.*, the image is upright and twice the size of the object.