Homework No. 10 (Spring 2023)

PHYS 205B: UNIVERSITY PHYSICS

School of Physics and Applied Physics, Southern Illinois University–Carbondale

Due date: Tuesday, 2023 May 2, 9:30 AM, on D2L

Instructions

- You are encouraged to use any of the resources to complete this homework. However, the extent to which you depend on resources while doing homework is usually a measure of how much extra work you need to put in to master the associated concepts. Solutions should be the last resource.
- Describe your thought process in detail and organize it clearly. Make sure your answer has units and the right number of significant digits.
- After completion, scan the pages as a single PDF file, and submit the file on D2L (under Assessments → Assignments).

Problems

1. (**10 points.**) Light takes 8.0 minutes to travel from A to B. Determine the distance between A and B in light-years. Compare this to the distance between Sun and Earth.

   Solution

2. (**10 points.**) The distance to the North Star, Polaris, is approximately 6.44×10^{18} m. If Polaris were to burn out today, how many years from now would we on Earth see it disappear?

   Solution (Problems 1 and 2 are collected in a single video.)

3. (**10 points.**) Given $\alpha = 60.0°$, in Figure 1. Find θ.

   Solution

4. (**10 points.**) A 1.0 cm object is placed upright at a distance 10.0 cm away from a convex mirror. The mirror's focal length is 10.0 cm.

   (a) What is the radius of curvature of the mirror?

   (b) Calculate the image distance.

   (c) What is the magnification?

   (d) Is the image real or virtual?

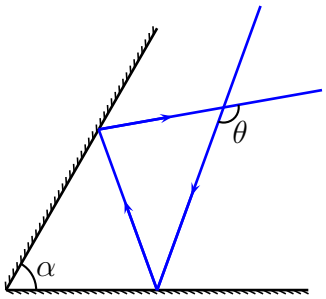

Figure 1: Problem 3

(e) Is the image inverted or upright?

(f) Determine the height of the image.

(g) Confirm your results by drawing a ray diagram for the above case. Choose the scale for the two relevant directions appropriately so that the relevant features are illustrated well. Points will be awarded for clarity and accuracy.

Solution

5. (**10 points.**) A 1.0 cm object is placed upright at a distance 5.0 cm away from a concave mirror. The mirror's focal length is 10.0 cm.

(a) What is the mirror's radius of curvature?

(b) Calculate the image distance.

(c) What is the magnification?

(d) Is the image real or virtual?

(e) Is the image inverted or upright?

(f) Determine the height of the image.

(g) Confirm your results by drawing a ray diagram for the above case. Choose the scale for the two relevant directions appropriately so that the relevant features are illustrated well. Points will be awarded for clarity and accuracy.

Solution