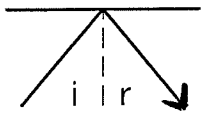
REFLECTION OF LIGHT LAB

NOTES: Groups of 2-3, full lab report required (25 points).
Handle lasers with care, no pointing of lasers around room.
Do not stare directly into beam or view directly with optical instruments.
Handle mirrors with care, they are easily scratched; return to front when done.

➔**MATERIALS NEEDED:** Laser, mirrors and wood supports, sheet of paper, metric ruler, protractor

➔**INVESTIGATION:** In your last lab (Images/Draw Your Face) you found that light reflected from a mirror such that the angle of incidence equals the angle of reflection. This is known as the Law of Reflection. These two angles are measured relative to the normal to the surface:

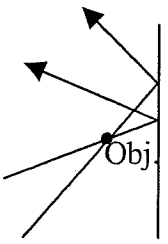


During this lab, you will investigate and hopefully confirm the Law of Reflection for plane and curved mirrors and observe the orientation of the image.

➔ PART 1 -- LOCATING IMAGE POSITION BY PARALLAX

1. Place plane mirror along short dimension and midway on paper, vertically supported by wood blocks. Trace a line on the paper along silvered side of mirror.

2. Aim laser at silvered side of mirror at an incident angle of 20-40°.
On the paper:
   a. Trace the path of the incident beam to the mirror.
   b. Mark the point at the mirror where the beam hits.
   c. Trace the path of the reflected beam from the mirror.



3. Place a dot anywhere along the incident ray and label it "Object".

4. Move the laser over at least 10-15° from the original incident path and aim it toward the mirror while passing through the "Object". Repeat steps 2a-c above.

5. Remove all materials from the paper. Use a straightedge to accurately draw in the two incident and reflected rays (solid lines). Use a protractor to properly measure angles of incidence and reflection.

6. On the paper draw extensions (with dashed lines) of the two reflected beams to an intersecting point behind the mirror surface. This is the image location. Measure image and object distances from mirror surface and label sketch (image, object, angles, distances).

7. Use two-way mirror to check accuracy of sketch (silvered side on line). Label location of "Mirror check" and measure the difference (cm), if any. You should be within one cm of plotted image.

➔ PART 2 -- IMAGE ORIENTATION

1. Turn the paper over and draw a line across the middle of the paper. At a short distance from the line draw a scalene triangle and label the corners A, B, and C.

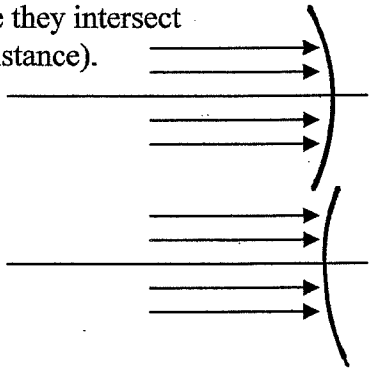
2. Place the two-way mirror with wood support on the paper with its silvered side along the line and facing the object triangle.

3. Look through the mirror and locate the image triangle. Reach behind the mirror and use a pencil to mark the three corners of the triangle, labeling them accordingly.

4. Remove all materials from the paper and use a straightedge to complete the image triangle. Measure and label the distance of both triangles from the mirror surface, as well as the length of all sides.

➔ PART 3 -- CURVED MIRRORS

1. On a new sheet of paper, set up a converging (concave) mirror and trace four parallel rays, two on each side of center axis. Trace the reflected rays and show where they intersect (focal point). Measure/label distance (cm) from mirror to focal point (focal distance).



2. On the other side of the paper, repeat steps 1 and 2 for the diverging (convex) mirror. Measure/label focal distance (cm).

➔ LAB REPORT (25 points)

- Full lab report per group due _____. Each person write a conclusion and summary.
- Discuss observations directly on each sketch. Be sure to include:

Part 1: What you found concerning the position of the image relative to the object and whether the law of reflection held true.

Part 2: What you found concerning the position, size, and orientation of the image triangle relative to the object triangle.

Part 3: What you found about how parallel light rays reflect from concave and convex mirrors. Compare focal distances of the two mirrors. How should they compare? How did yours compare?

- Answer the following questions:

a. If a woman stands 2.5 meters in front of a plane mirror, where is her image? How does the image size and orientation compare to her?
b. What is parallax and how can it be useful in the real world?
c. A ray of light strikes a plane mirror at an angle of incidence of 30°. Draw a diagram showing the angles of incidence and reflection and their values.
d. Why is the lettering on the front of some vehicles (ambulances) printed in reverse?
e. What is the shortest vertical plane mirror that a 2 meter tall man can use and still see a full length image of himself? Explain with words and ray diagram.
f. Brain teaser: Would a perfect reflector (100% reflecting) be visible or invisible? Explain.