# Materials

* Book or hard object (the wall)
* Ping pong ball, rubber ball, marble, or recess ball
* Paper, white 8 ½ x 11 or chart paper, (soft carbon paper could also be used)
* Tape

Directions:

1. Tape the paper against the book or wall
2. Roll the ball at the book (or wall).
3. Mark on the paper where the ball enters the paper. (Approaching ray)
4. Mark on the paper where the ball bounces off the book (wall).
5. Mark on the paper where the ball exits the paper. (Reflected ray)
6. Connect the marks for the approaching ray.
7. Connect the marks for the reflected ray.
8. Draw a line segment that is perpendicular to the book (wall) at the point where the ball hit.
9. Measure the approaching angle from both the wall and from the perpendicular line segment with your protractor.
10. Measure and compare the reflected angle.
11. Repeat this process for three trials and note any observations.



Name:

Name:

Name:

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| --- | --- | --- | --- | --- |
|  | Approaching Anglefrom the baseline | Reflected Angle from the baseline | Approaching angle from the perpendicular | Reflected angle from the perpendicular |
| Trial 1: |  |  |  |  |
| Trial 2: |  |  |  |  |
| Trial 3: |  |  |  |  |
| Trial 4: |  |  |  |  |
| Trial 5: |  |  |  |  |
| Trial 6: |  |  |  |  |

Compare the angle measures. What patterns do you notice?

Variation on this investigation:

* (Version 2)
	1. Do the same task as outlined in the lesson but use chart paper on the floor against the wall and use a playground ball. Or,
	2. Do the same task as outlined in the lesson above but use a ruler ramp to start the ball. This will provide a more accurate starting point for the approaching ray.



* (Version 3) Use rays of light:
	+ 1. Make a slit in a box (shoe box)
		2. Place a flashlight in the box and direct it at a mirror
		3. Use modeling clay to support a mirror on the desk (or symmetry mirror)
		4. Place paper in front of the mirror
		5. Direct the box (light) at an angle across the paper toward the center of the mirror.
		6. Trace and label the approaching ray and the reflected ray
		7. Use a protractor to measure and compare the angles.