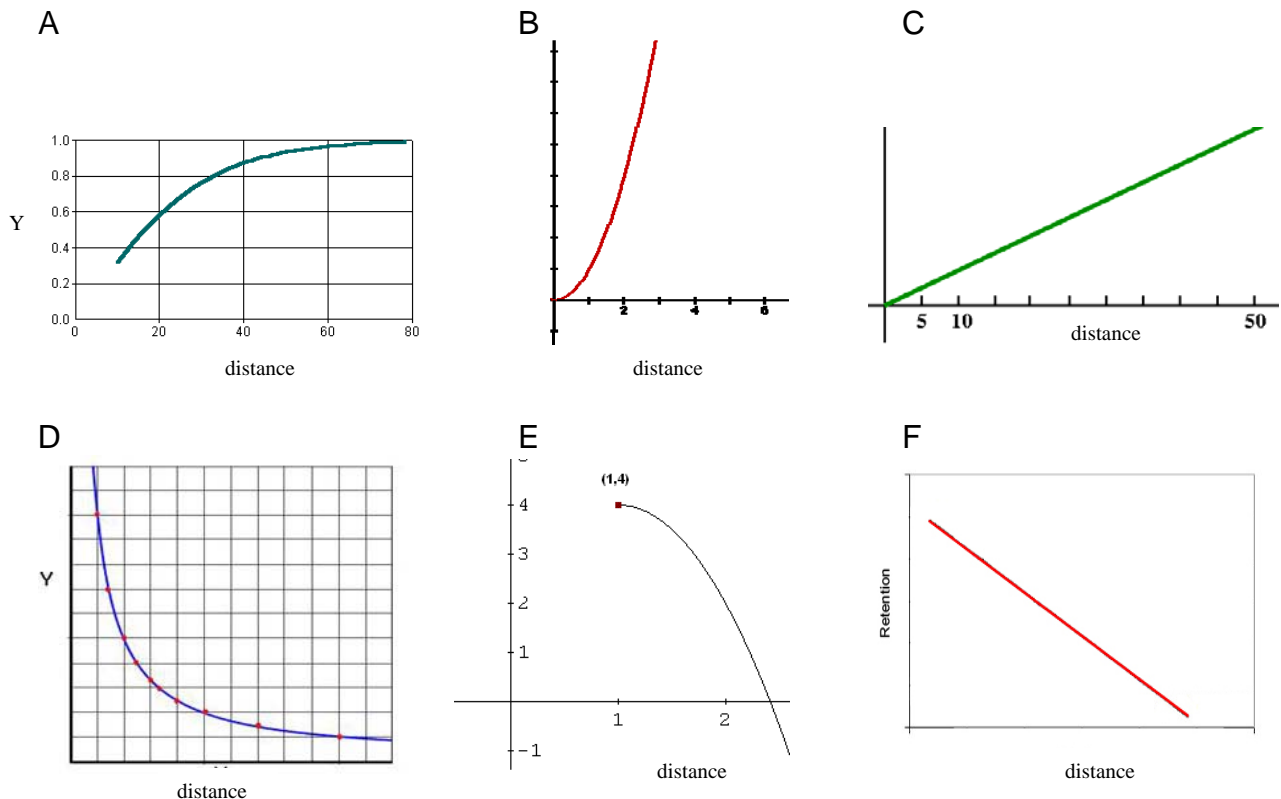


Comparing Light Intensity and Distance

Both hearing and sight, whether in humans, animals or robots, depend on the ability to detect the sound or light energy. When a light or sound source is too faint, we can't see or hear it. If the light is too bright or the sound too loud, it could damage a person's eyes or ears. The intensity of sound from a radio or light from a lamp is related to the distance from the source; the more distant the source, the lower the sound or light intensity. The graphs below show possible patterns for the relations between distance and light intensity.



1. What relationship between distance and intensity is shown in each graph? For each type of graph, what is the relationship between distance and Y (light intensity)?

- A-
- B-
- C-
- D-
- E-
- F-

2. Which do you believe is the graph that best models the relationship between distance and sound or light intensity? Explain your thinking.

Comparing Light Intensity vs. Distance to Source
LAB

Name _____
Date _____

You can get a more precise idea of the way that light and sound intensities decrease by doing a simple experiment. Point a small flashlight directly at a flat dark surface. It will make a circle of light.

- a. As the flash light is moved away from the surface, what happens to the diameter of the light circle?

- b. As the flash light is moved away from the surface, what happens to the intensity of the light?

Now, fill in the table below by measuring the distance from the desk to the flashlight. Use the measurements given below. Then, measure the diameter of the light circle. Finally, use the equations below to complete the table.

FORMULAS TO USE: **Radius = .5(diameter)** **$A = \pi r^2$** **$I = 160 / A$**

Distance from Light in cm (D)	1	2	3	4	5
Diameter of light circle in cm (d)					
Radius of light circle in cm (r)					
Area of light circle in cm ² (A)					
Light Intensity in lumens (I)					

Make a graph with distance (D) on the x-axis and intensity of the light (I) on the y-axis. Use the data you collected in the activity.

Application and Analysis Questions

FOR ALL CALCULATIONS—SHOW YOUR WORK!!!

1. Write an equation relating light intensity (I) to radius of the circle (r).
2. Using that equation, if $r = 10$, what is the light intensity?
3. Re-write the equation to solve for r .
4. Using that equation, if the light intensity is 30 lumens, what is the radius of the light circle?
5. In the question above, what is the diameter of the light circle?
6. Now, look at your graph. If $I = 15$ lumens, what is D ?
7. For that D (distance to the light source), what is r ? What is d ?
8. Look at your data table. Is there a relationship between D , d , and r ? Explain your answer.
9. Re-write the equation above (from #1, $I = \underline{\hspace{2cm}}$) with D instead of r .
10. Using your equation, calculate D for $I = 15$.
11. How close is your calculated answer to the answer you found in #8 on your graph?