I. Relationship of Variables.

1. **Directly Proportional**: If one variable changes by a certain factor, the other changes by that same factor.

   Ex: y = 5x

   Using our example formula, if x = 10, y = _____. If x = 20, y = _____. The both increased by _____ times.

   If x goes from 3 to 1, then y goes from _____ to _____.

   $\frac{y}{x}$ Always = _____.

2. **Inversely Proportional**: If one variable is increased by a certain factor, the other is decreased by that factor.

   Ex: PV = 20

   Using our example formula, if P = 2. V = _____. If P is doubled, what happens to V? _____.

   If P = 4, V = _____. If P = 1, V = _____. P times V always equals_____.

3. **Directly Proportional to Square**:

   Ex: $y = k x^2$ (k is a constant)

   If x doubles, then y = _____. If x is tripled, then y increases by a factor of _____.

4. **Directly Proportional to Square Root**: Ex: $y = k\sqrt{(x)}$

II. Application.

1. On graph paper, graph each of the following four sets of data according to the rules.

A. Distance (y-axis) vs. Time (x-axis)

D (meters):	5	10	15	20	25	30
T (seconds):	0	1	2	3	4	5

B. Distance Fallen vs. Time $s = \frac{1}{2}gt^2$

s (meters):	5	20	44	78	123
t (sec):	1	2	3	4	5

C. Resistance vs. Area $R = \frac{\rho l}{A}$

R (◁):	8	5	4	3	2	1
A (m^2):	.125	.2	.25	.33	.5	1

D. Period (T) vs. Length $T = 2\pi\sqrt{\frac{l}{g}}$

T(s):	2	2.8	3.5	4	4.5	4.9
L(m):	1	2	3	4	5	6

2. Using the relationships 1-4 from above, identify the relationship between the variables in each group A-D. Give a brief description of the graph's shape.

A._____

B._____

C._____

D._____

3. **Meaning of Slope.** Write the formula for the slope of a line: _____.

Rewrite the formula substituting the variables from graph A _____.

What does the slope of the graph tell you? _____.

Figure out how fast the object in graph A was moving. _____.

4. **Interpolation/Extrapolation.** You can get more information out of a graph than you put in by drawing the "best fit" curve and interpolating or extrapolating.

On graph B, interpolate the distance fallen at t = 1.5 s. _____

The actual distance is 11 meters. Calculate the percent error using the formula:

$$\% \text{ error } = \left(\frac{\text{experimental value - actual value}}{\text{actual value}} \right) * 100$$

Extrapolate the distance fallen in 6 seconds. _____

The actual distance is 176 meters. Calculate your % error.

Fill in the blanks with "interpolate" or "extrapolate."

When you _____, you estimate a value between data points.

When you _____, you estimate a value outside data points.