

Quiz #4—**Solutions**
 Mathematics 140—Applied Calculus
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Directions: Carefully answer the questions below. Remember that your goal is to convince me that you know what is going on, so show your work! When relevant, round your final answers to 3 decimal places.

1. **Modeling:** The intensity, I , of light at a given location is inversely proportional to the square of the distance, d , from that location to the light source.

(a) Write the form of the mathematical model for this situation.

Answer: $I = k \cdot \frac{1}{d^2}$.

(b) List the factors which cannot affect the value of the proportionality constant if the model is to remain valid.

Answer: The values of I and d cannot affect the value of k if the model is to remain valid.

(c) List *two factors* which do affect the value of the proportionality constant.

Answer: Anything other than d which affects the intensity of the light will affect k , such as: the intensity of the light at its source, the presence of particulate matter in the air, the humidity in the air, etc.

(d) The intensity of a light for various distances is shown in the table below. Do they indicate the model is valid and, if so, determine the proportionality constant.

Answer: To determine this, then for each data pair, we compute $k = I \cdot d^2$ to obtain about 4.76 each time. Since the value of k is constant, it appears that the model is valid and the value of $k = 4.76$.

d in m	0.1	0.5	0.75	2.0
I in $\frac{W}{m^2}$	476.03	19.11	8.46	1.19

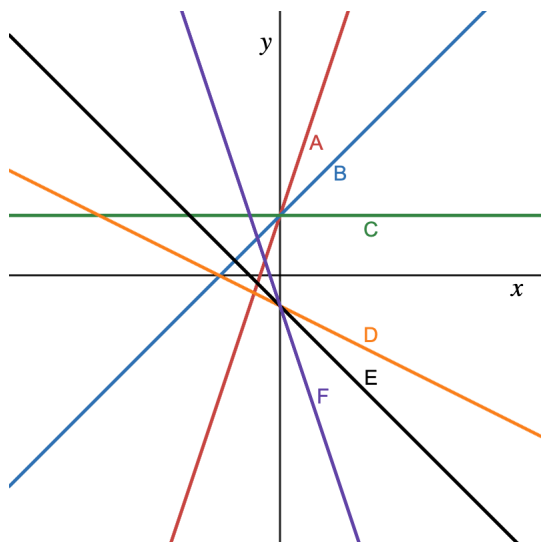
2. **Linear Equations:** If $s(2.3) = 5.7$ and $s(4.8) = 1.2$, then write a linear equation of s as a function of q .

Answer:

- Compute the Slope: $\frac{\Delta s}{\Delta r} = \frac{5.7 - 1.2}{2.3 - 4.8} = -1.8$.
- Form of the Line: $s = -1.8q + b$.
- Find b : Substitute $q = 2.3$ and $s = 5.7$ to obtain $5.7 = -1.8 \cdot 2.3 + b \rightarrow b = 9.84$.
- Final Linear Equation: $s = -1.80q + 9.84$.

3. **Graphs of Linear Functions:** Match the following linear equations with the lines shown in the figure below:

(1) $y = -x - 1$, (2) $y = 3x + 2$, (3) $y = -3x - 1$, (4) $y = 2 + x$, (5) $y = -\frac{1}{2}x - 1$, (6) $y = 2$.



(1): E

(2): A

(3): F

(4): B

(5): D

(6): C

Extra Credit: A car rental company charges a daily fee of \$35 plus \$0.20 per mile driven. Find a formula for the daily charge, C , in dollars, as a function of the number of miles, m , driven that day.

Answer: $C = 0.20m + 35$.