STRETCHING SPRING

Performance Standard (7A/8A/8C/10A).I

Create a line of best fit for a given set of data points and use it to interpolate and extrapolate values for given situations accordingly:

- *Mathematical knowledge*: Create an equation of a line of best fit from a set of ordered pairs or set of data points; know how to interpolate and extrapolate values.
- *Strategic knowledge*: Solve the problem.
- *Explanation*: Explain completely and clearly what was done and why it was done.

Procedures

1. ***In order to measure and compare quantities using appropriate units, instruments, and methods (7A), describe numerical relationships using variables and patterns (8A), solve problems using systems of numbers and their properties (8C), and organize, describe and make predictions from existing data (10A),*** students with sufficient learning opportunities to develop the following:
   - Calculate by an appropriate method the length, width, height, perimeter, area, volume, surface area, angle measures or sums of angle measures of common geometric figures, or combinations of common geometric figures.
   - Create an equation of a line of best fit from a set of ordered pairs or set of data points.
   - Interpolate and extrapolate to solve problems using systems of numbers.
   - Analyze two-variable data for linear or quadratic fit.
   - Make decisions based on data, including the relationships of correlation and causation.
2. Provide each student a copy of the "Stretching Spring" task sheet and the rubric. Have students review and discuss the task to be completed and how the rubric will be used to evaluate it.
3. Ask students are to complete the following task in a classroom setting:

   These data represent the mass suspended from a spring and the distance the spring stretched for each mass.

Mass	50	60	70	80	90	100	110	120	130	140	150	160	170	180
Length	5.0	5.5	6.0	6.3	6.8	7.1	7.5	7.7	8.1	8.5	8.8	9.2	9.5	9.9

   Use a scatter plot graph, determine a line of best fit, write its equation and use it to answer the questions. Use mass as the independent variable (x).
   (1) Write an equation that represents the data, giving the real-world meaning of the slope and the y-intercept of the graph.
   (2) What mass would make the spring stretch 20.0 centimeters?
   (3) If the spring is a coil of wire 1.5 cm in diameter with 49 loops, predict, using mathematics, the maximum the spring could stretch, assuming it is possible, and the mass that would be required to stretch the spring that far.
4. Evaluate each student's work using all three dimensions of the rubric and its guide to determine the performance level. Since success on the first question will determine the results of the following two questions, one score should be given in each of the categories for the entire task. If all three parts are correct, score 4 in mathematical knowledge. If two of the parts are correct, score 3 and if only one is correct, score 2 in mathematical knowledge. Answers: 1) (y=0.036x+3.376 if by calculator, y=0.021x+5.65 if by median-median line or any other reasonable method for finding equation of Line). Slope is rate of change of length of spring per unit of change in mass 2) 457 or 456.5, and 3) length 230.9, mass 6320.3. A 4 in Strategy would require an appropriate method to find the line, including the use of technology, to be determined by the explanation. A 4 in explanation would require a complete description of what was done and why each step was done.

Examples of Student Work follow

Resources

- Copies of the "Stretching Spring" task sheet
- Graphing calculator
- Mathematics Rubric

Time Requirements

- 30 minutes

NAME _____ DATE _____

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Show all work and write a complete explanation of the work done to answer each of the questions.

Adapted from Mathematics in Michigan, Volume XXXIII, Number 2, Ypsilanti, University Publications, Eastern Michigan University, 1993, pp. 14-15.

THE STRETCHING SPRING

Name [redacted]
Date 5/7/01

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(1) Points (60, 5.5) (170, 9.5)
Subtraction $\frac{5.5-9.5}{60-170} = \frac{-4}{-110} \div .0364$
.0364 is the slope
$y - 5.5 = .0364(x - 60)$
$y - 5.5 = .0364x - 2.18$
$y = .0364x + 3.32$
$y = .0364x + 3.32$ is my equation

(2.) how you work 20.0 into the equation to find mass

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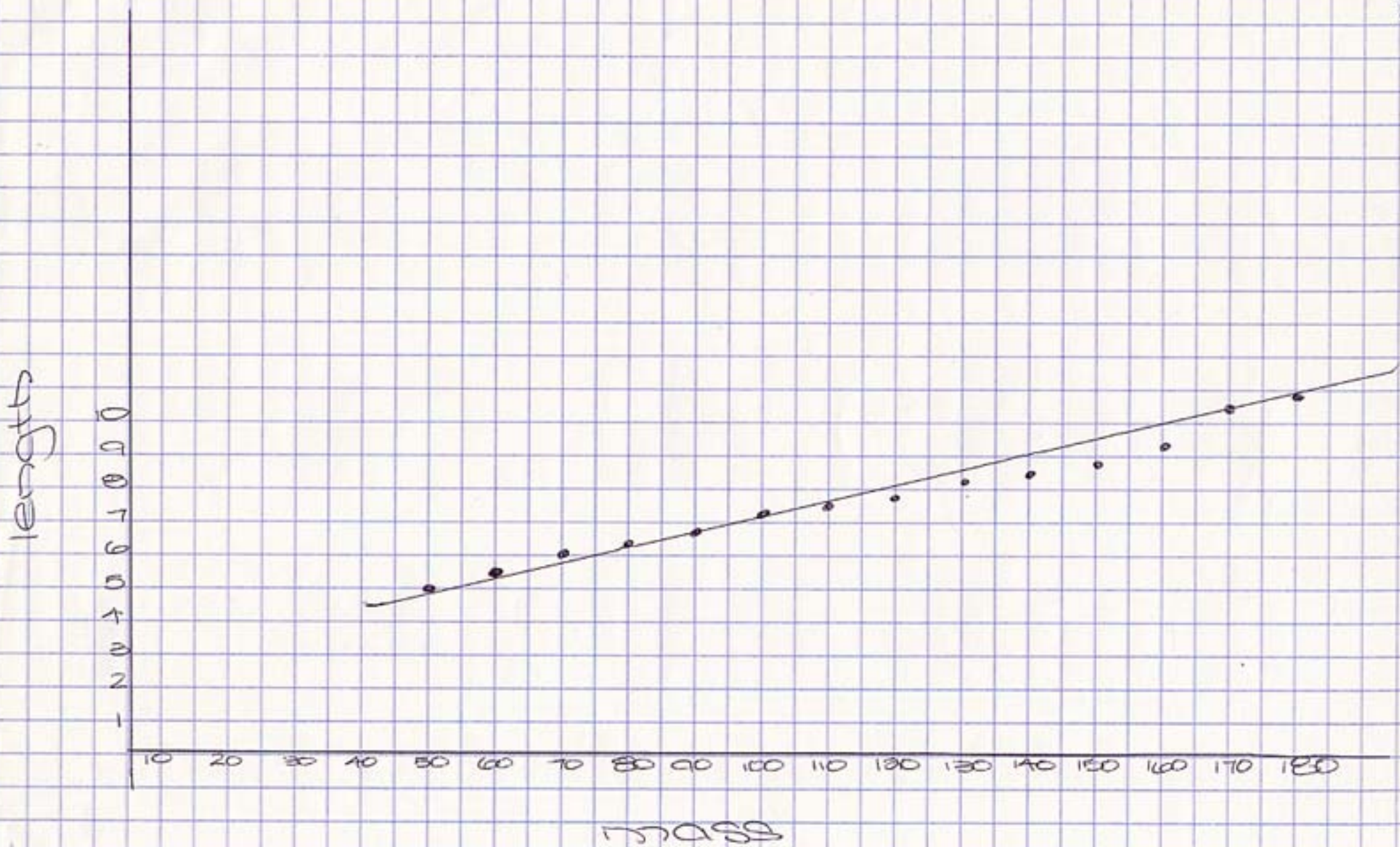
$20 = .0364x + 3.32$
$.0364x = 16.68$
$x = 458$ 458 is my mass

"Meets" (page 2)

TA8A8C10A-IM2



(3.) it goes around 49 times the diameter is 1.5cm

to find how far it will stretch

$C = \pi D$ $\pi = 3.14$

do length = $\pi (1.5)(49)$

so 230.9 will be my spring length.