Tennessee Comprehensive Assessment Program / Mathematics

TCAP/CRA 2012-2013

Task 2: Honor Roll Task
Full Scoring Guide

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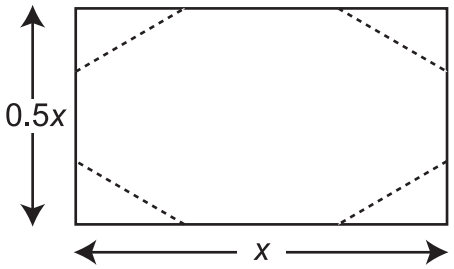
Task 2. Honor Roll Task

Danielle's 8th grade teacher is making honor roll certificates in the shape of a rectangle with the corners cut off.



She wonders how many square inches of paper will be needed for differently sized certificates. She creates the table below to describe the pattern for the certificates.

x length (in inches)	*y* area (in square inches)
6	16
8	30
10	48
12	70

a. Explain whether the data represent a linear function. Use an equation, numerical expressions, a graph, or words in your explanation.

CC BY ND

b. Marianne says the equation that relates area to length is $y = \frac{1}{2}x^2 - 2$ and so the slope is $\frac{1}{2}$. Is her reasoning correct? Why or why not?

GO ON TO THE NEXT PAGE.

2. Honor Roll Task Scoring Guide

The CCSS for Mathematical Content (2 points)

8.F.3(a) The student determines that the situation described does not represent a linear function. The student may do this in one of the following ways: _____

- by graphing the points from the table and showing the points do not have a constant rate of change, or by saying that the slope or rate of change is not always the same, so the function is not linear.
- by noting that in the table, the *x*-values increase at a constant rate (by 2 each time); however, the *y*-values do not increase at a constant rate. The student concludes that the function is not linear.
- by determining the equation for the data and stating it is not linear because it is not of the form $y = mx + b$.
- by stating that a function whose *x*-value units are inches but whose *y*-value units are square inches cannot be linear, because the equation would be a second-degree equation or would contain an *x*-squared term.

8.F.3(b) The student indicates that the slope is not $\frac{1}{2}$. The student may do this in one of the following ways: _____

- by stating the equation is not linear, so the slope is not a constant $\frac{1}{2}$.
- by using data from the table to show the slope is not a constant $\frac{1}{2}$.
- by noting the graph is not a straight line, and only straight lines can have a constant slope of $\frac{1}{2}$.

Total Content Points _____

The CCSS for Mathematical Practice (4 points)

MP1 The student selects an appropriate criterion to check if the data are linear and provides reasonable justification for the argument given in Part B. _____

(MP1: Make sense of problems and persevere in solving them.)

MP3 The student states that the table data set is not linear and provides appropriate justification; the student disagrees with Marianne, providing appropriate justification for why $\frac{1}{2}$ is not the slope. _____

(MP3: Construct viable arguments and critique the reasoning of others.)

MP4 The student makes use of mathematical models when determining if the function is linear. _____

(MP4: Model with mathematics.)

MP7 The student accurately makes use of the structure of linear functions to determine the data in the table does not represent a linear function. _____

(MP7: Look for and make use of structure.)

Total Practice Points _____

Total Awarded Points _____

The CCSS for Mathematical Content Addressed in This Task

Define, evaluate, and compare functions.

8.F.3 Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4), and (3,9), which are not on a straight line.*

The CCSS for Mathematical Practice*

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

*Gray text indicates Mathematical Practices that are not addressed in this task.

Students' responses to a mathematical task provide evidence of what they understand and are able to do in relation to the standards and practices. Across tasks, this cumulative evidence shows students' understanding and abilities within a domain. When students do not respond completely to all parts of a task, they provide insufficient evidence of their mathematical understanding and abilities and therefore do not fully demonstrate the expectations of the standards and practices aligned with that task.

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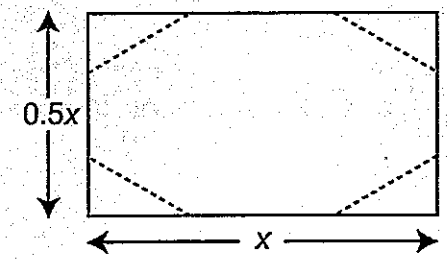

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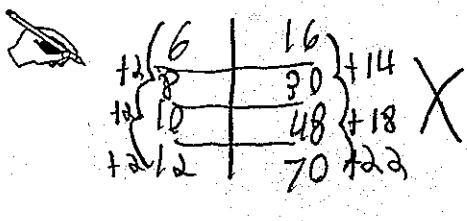
a. Explain whether the data represent a linear function. Use an equation, numerical expressions, a graph, or words in your explanation.



This data does not represent a linear function because although the length always goes up by two the area is change its rate therefore nonlinear

Litho#: 12347

b. Marianne says the equation that relates area to length is $y = \frac{1}{2}x^2 - 2$ and so the slope is $\frac{1}{2}$. Is her reasoning correct? Why or why not?

Her reasoning is correct because $y = mx + b$ (slope)

I understand why she got 1/2 but that is not the right answer to this question because the x has a exponent of 2 which changes the equation

Guide 1 Litho 12347

Total Content Points: 2 (8.F.3(a), 8.F.3(b))

Total Practice Points: 4 (MP1, MP3, MP4, MP7)

In this response, the student explains that the data set does not represent a linear function, because in the table the length increases at a constant rate ("…always goes up by two…") while the area does not ("…area is change its rate…") (8.F.3(a)). Thus, the student accurately makes use of linear structure to reach this conclusion (MP7). The student disagrees with Marianne in Part B, indicating that $\frac{1}{2}$ is not the slope because the linear equation model ($y = mx + b$) is not the appropriate model to use in this case as "…the x has a exponent of 2 which changes the equation" (8.F.3(b), MP4). The student states the table data is not linear, disagrees with Marianne, and provides appropriate justification for both (MP3). The student selects an appropriate criterion for determining if the data set is linear (comparing rates of increase for length and area) and completes all parts of the task (MP1).

Total Awarded Points: 6 out of 6

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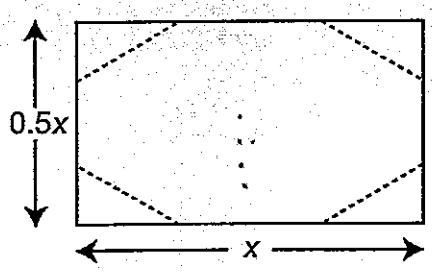

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+2 +2 +2 | +14 +18 +22

$\frac{2}{14} = \frac{1}{7}$

a. Explain whether the data represent a linear function. Use an equation, numerical expressions, a graph, or words in your explanation.

Non linear

+2	6	16	+14
+2	8	30	+18
+2	10	48	+22
+2	12	70	

$\frac{2}{14} = \frac{1}{7}$ $\frac{2}{18} = \frac{1}{9}$ $\frac{2}{22} = \frac{1}{11}$

Litho#: 12355

b. Marianne says the equation that relates area to length is $y = \frac{1}{2}x^2 - 2$ and so the slope is $\frac{1}{2}$. Is her reasoning correct? Why or why not?

$y = \frac{1}{2}x^2 - 2$

No because the ^{2} messes everything up.

If it was

$Y = \frac{1}{2}x - 2$

then the slope would be $\frac{1}{2}$

Marianne is Incorrect

Guide 2 Litho 12355

Total Content Points: 2 (8.F.3.(a), 8.F.3(b))

Total Practice Points: 4 (MP1, MP3, MP4, MP7)

In this response, the student states that the data set does not represent a linear function. The student explains this not only by indicating a constant rate of change for the length (+2, +2, +2) and an inconsistent rate of change for the area (+14, +18, +22), but also by computing varying rates between data points ($\frac{2}{14} = \frac{1}{7}$, etc.) (8.F.3(a)). Thus, the student accurately makes use of linear structure to reach the conclusion (MP7). The student makes use of a mathematical model by comparing the model of the linear function, $y = (\frac{1}{2})x - 2$, to the given equation, $y = (\frac{1}{2})x^2 - 2$, and indicating that the exponent 2 is not appropriate in a linear equation ("…messes everything up") (MP4). Using this comparison, the student indicates $\frac{1}{2}$ is not the slope and disagrees with Marianne in Part B (8.F.3(b)). The student states the table data are not linear, disagrees with Marianne, and provides appropriate justification for both (MP3). The student selects an appropriate criterion to determine if the data set is linear (comparing rates of increase for length and area) and completes all parts of the task (MP1).

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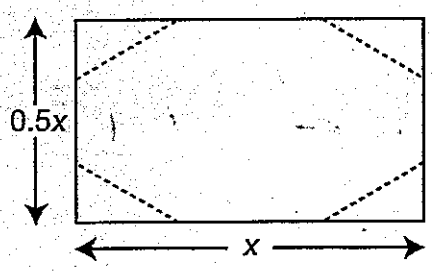

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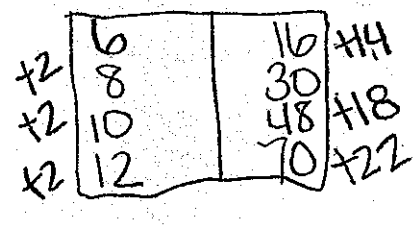
a. Explain whether the data represent a linear function. Use an equation, numerical expressions, a graph, or words in your explanation.



No, It's not a linear equation, because the y-intercept has different numbers.

Litho#: 12278

b. Marianne says the equation that relates area to length is $y = \frac{1}{2}x^2 - 2$ and so the slope is $\frac{1}{2}$. Is her reasoning correct? Why or why not?

$y = 1/2x^2 - 2$

$Y = 1/4 - 2 = -7/4$

No her reasoning is in-correct because the 1/2 can have a valrable in it but the exponet of (2) messes it up.

Guide 3 Litho 12278

Total Content Points: 2 (8.F.3(a), 8.F.3(b))

Total Practice Points: 3 (MP1, MP4, MP7)

In this response, the student states that the data set does not represent a linear function and explains this by indicating a constant rate of change for the length (+2, +2, +2) and an inconsistent rate of change for the area (+14, +18, +22) (8.F.3(a)). By utilizing these rates of change to explain why the data are not linear, the student mathematically models linearity (MP4). While the student's work is accurate and sufficient to indicate that the function is not linear (MP7), the student's reference to "the *y*-intercept has different numbers" is incorrect and not an appropriate explanation (no credit for MP3). The student disagrees with Marianne by explaining that $\frac{1}{2}$ is not the slope because "…the exponet of (2) messes it up," indicating that the function is not linear (8.F.3(b)). The student selects an appropriate criterion to determine if the data set is linear (comparing rates of increase for length and area) and completes all parts of the task (MP1).

Total Awarded Points: 5 out of 6

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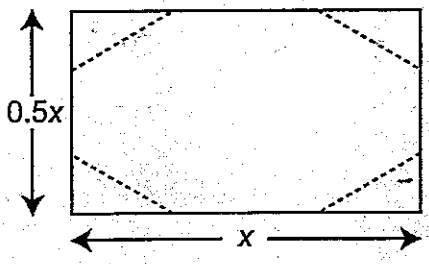

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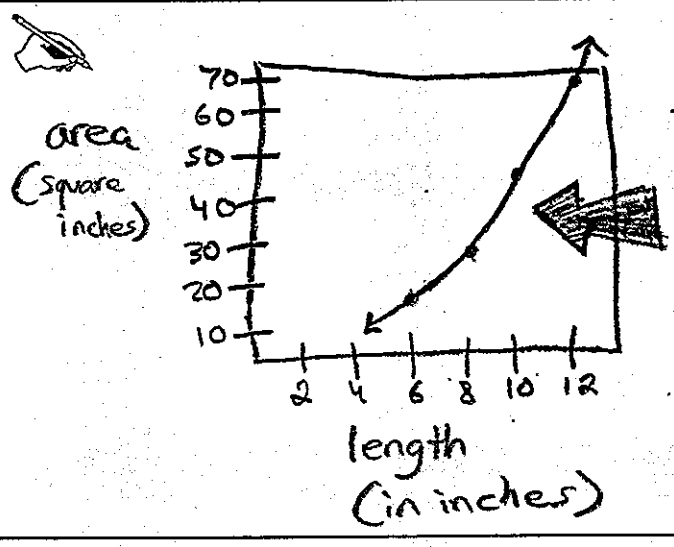

Litho#: 12354

b. Marianne says the equation that relates area to length is $y = \frac{1}{2}x^2 - 2$ and so the slope is $\frac{1}{2}$. Is her reasoning correct? Why or why not?

No. The y-intercept in the equation is -2. It is impossible to have negative area, so Marianne would be wrong.

Guide 4 Litho 12354

Total Content Points: 1 (8.F.3(a))

Total Practice Points: 3 (MP1, MP4, MP7)

In this response, the student presents a graphical representation of the data by plotting all 4 coordinate pairs and observes: “It is curved. Therefore, the data is *not* linear” (8.F.3(a)). By graphing these points and using the results to determine the data set is not linear, the student creates a mathematical model and accurately makes use of linear structure (MP4, MP7). The reason the student gives for disagreeing with Marianne in Part B does not include a reference to the slope of the function (no credit for 8.F.3(b)). Although it is true that a shape cannot have a negative area, the student attempts to show that Marianne’s equation fails to describe the data in the table, which is not true (no credit for MP3). The student selects an appropriate criterion to determine if the data set is linear (plotting the points) and, although Part B is incorrect, all parts of the task are completed with some reasoned justification (MP1).

Total Awarded Points: 4 out of 6

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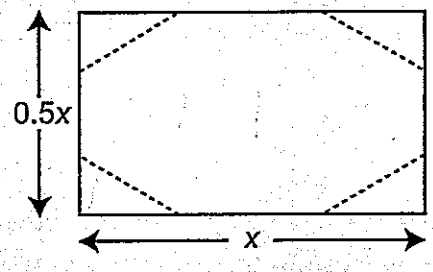

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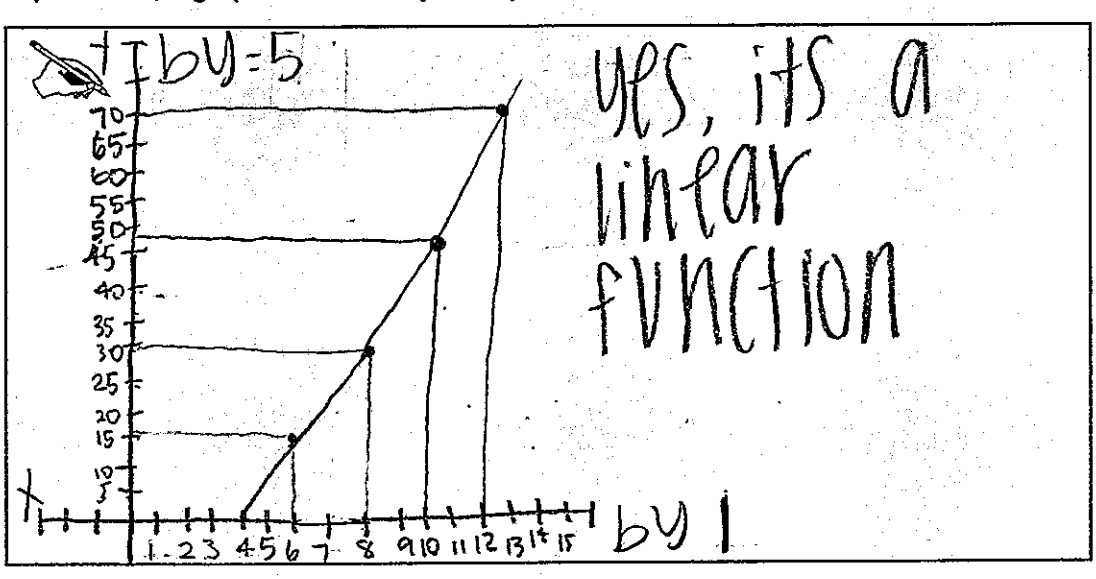

b. Marianne says the equation that relates area to length is $y = \frac{1}{2}x^2 - 2$ and so the slope is $\frac{1}{2}$. Is her reasoning correct? Why or why not?

since the line is linear, the equation can't have an exponent, because that would make it a V or a U shape graph.

Guide 5 Litho 12344

Total Content Points: 1 (8.F.3(b))

Total Practice Points: 3 (MP1, MP4, MP7)

In this response, the student presents a graphical representation of the data by plotting all 4 coordinate pairs but incorrectly concludes that the data set is a linear function (no credit for 8.F.3(a), no credit for MP3). In Part B the student makes it clear that a linear equation cannot have an exponent and illustrates with the figure on the right side that an equation with an exponent would graph to a non-linear shape (8.F.3(b)). By graphing the coordinate pairs and using the results, the student creates a mathematical model (MP4). Although the graph is inaccurate and leads to an incorrect conclusion, the data is reasonably well plotted, and a correct conclusion based on the linear structure of the incorrect graph is reached (MP7). The student selects an appropriate criterion for linearity (plotting the points) and, although Part A is incorrect, all parts of the task are completed with some reasoned justification (MP1).

Total Awarded Points: 4 out of 6

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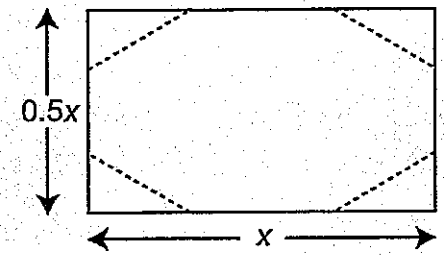

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8	30
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a. Explain whether the data represent a linear function. Use an equation, numerical expressions, a graph, or words in your explanation.

No, is a nonlinear function, because the y's does not add by the same number the whole time.

Litho#: 12283

b. Marianne says the equation that relates area to length is $y = \frac{1}{2}x^2 - 2$ and so the slope is $\frac{1}{2}$. Is her reasoning correct? Why or why not?

yes its correct because the square is for the variable x not the slope.

Guide 6 Litho 12283

Total Content Points: 1 (8.F.3(a))

Total Practice Points: 2 (MP4, MP7)

In this response, the student shows at the sides of the table the incremental changes between data points and correctly states that the data set represents a non-linear function "…because the *y*'s does not add by the same number the whole time" (8.F.3(a)). By utilizing these rates of change to determine an answer, the student creates a mathematical model of linearity and accurately makes use of linear structure (MP4, MP7). The student incorrectly agrees with Marianne in Part B and consequently does not provide appropriate justification for why $\frac{1}{2}$ is not the slope (no credit for 8.F.3(b), no credit for MP3). Although the student selects an appropriate criterion to determine if the data set is linear in Part A, the incorrect response and insufficient explanation in Part B indicate the student is unable to make sense of this part of the task (no credit for MP1).

Total Awarded Points: 3 out of 6

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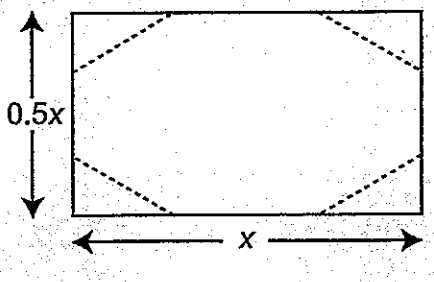

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12	70

a. Explain whether the data represent a linear function. Use an equation, numerical expressions, a graph, or words in your explanation.

the data does not represent a linear function. the area is uneven and the graphed line wouldn't be straight.

Litho#: 12348

b. Marianne says the equation that relates area to length is $y = \frac{1}{2}x^2 - 2$ and so the slope is $\frac{1}{2}$. Is her reasoning correct? Why or why not?

Yes, because, the slope is $\frac{1}{2}$

Guide 7 Litho 12348

Total Content Points: 1 (8.F.3(a))

Total Practice Points: 1 (MP7)

The student provides a weak but sufficient reason for why the data set does not represent a linear function (“the area is uneven and the graphed line wouldn’t be straight”) (8.F.3(a)). By recognizing that the graph of the data would not be a straight line, the student accurately makes use of linear structure (MP7). However, no work is provided that indicates the use of a mathematical model (no credit for MP4). The student incorrectly agrees with Marianne in Part B and consequently does not provide appropriate justification for why $\frac{1}{2}$ is not the slope (no credit for 8.F.3(b), no credit for MP3). The incorrect response and insufficient explanation in Part B indicate the student is unable to make sense of this part of the task (no credit for MP1).

Total Awarded Points: 2 out of 6

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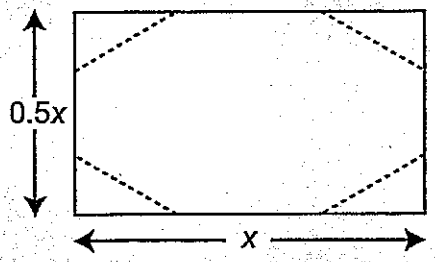

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(6, 16)
(8, 30)
(10, 48)
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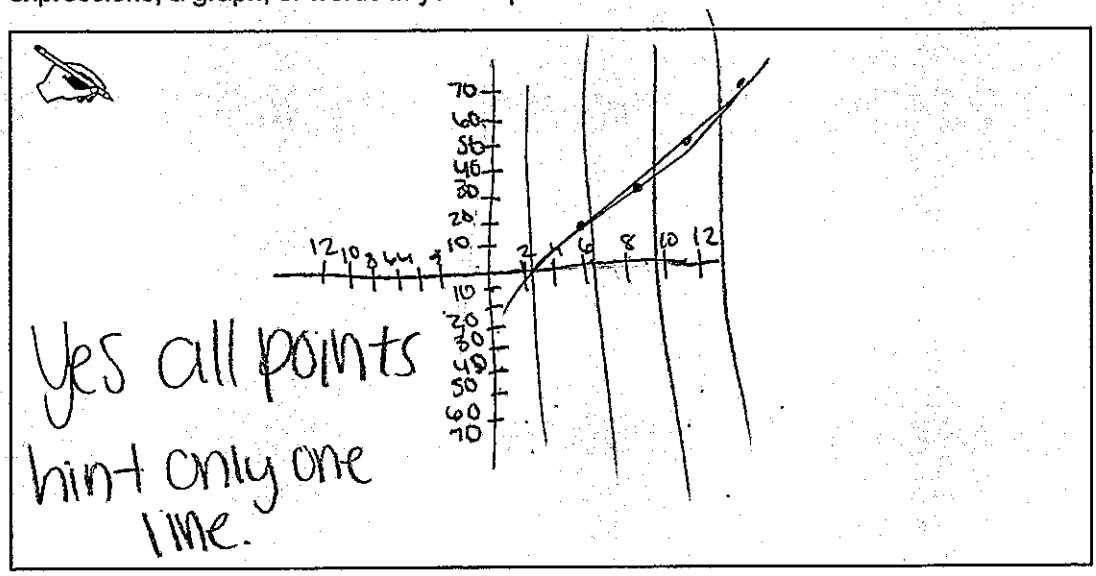
a. Explain whether the data represent a linear function. Use an equation, numerical expressions, a graph, or words in your explanation.



Litho#: 12305

b. Marianne says the equation that relates area to length is $y = \frac{1}{2}x^2 - 2$ and so the slope is $\frac{1}{2}$. Is her reasoning correct? Why or why not?

$y = \frac{1}{2}x^2 - 2 \quad (6, 16)$ (x, y)

$16 = \frac{1}{2}(6^2) - 2$

$16 = \frac{1}{2}(36) - 2$

$16 = 18 - 2$

$16 = 16$

Yes, when you plug in (6,16) into the equation it ends up to be 16.

Guide 8 Litho 12305

Total Content Points: 0

Total Practice Points: 2 (MP4, MP7)

In this response, the student presents a graphical representation of the data by plotting all 4 coordinate pairs, but incorrectly concludes that the data set is a linear function (no credit for 8.F.3(a)). The student also incorrectly agrees with Marianne in Part B (no credit for 8.F.3(b)). Thus, there are incorrect answers in Part A and Part B (no credit for MP3). The student makes use of mathematical models by graphing the points and using the results, and by plugging an x-value into the equation in Part B to verify the y-value (MP4). Although the graph is inaccurate and leads to an incorrect conclusion, the data are reasonably well plotted and a correct conclusion based on linear structure for the incorrect graph is reached (MP7). Overall, the incorrect answers in both parts based on inaccurate or insufficient work indicate that the student is unable to make sense of the task (no credit for MP1).

Total Awarded Points: 2 out of 6

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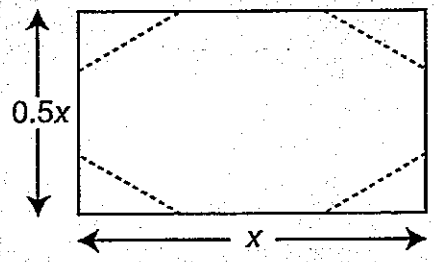

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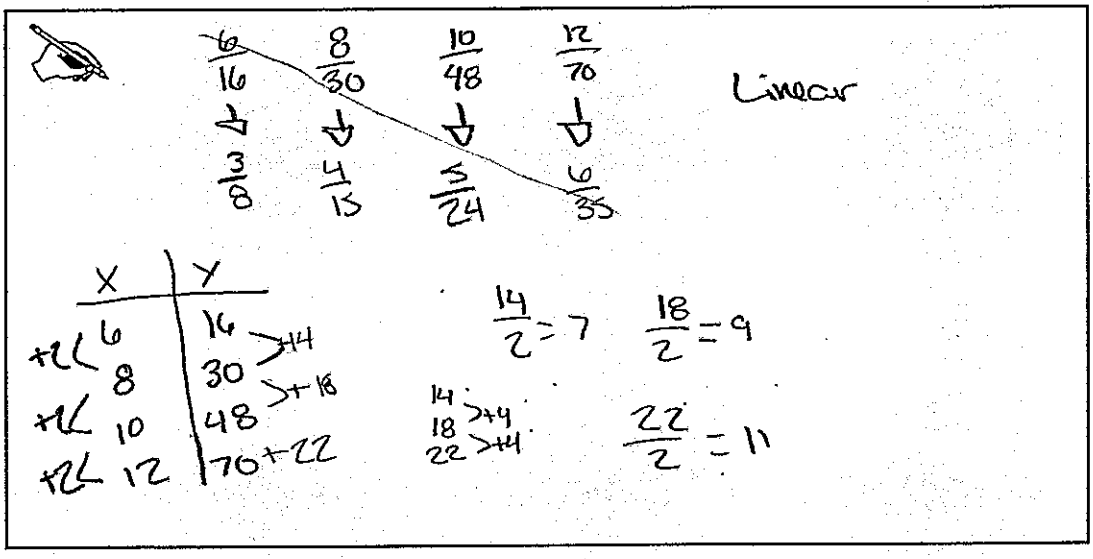

Litho#: 12288

b. Marianne says the equation that relates area to length is $y = \frac{1}{2}x^2 - 2$ and so the slope is $\frac{1}{2}$. Is her reasoning correct? Why or why not?

No, because you have to do something with the exponet. Her equation after dealing with the exponet would become $y = \frac{1}{4}x - 2$. Her slope is actually $\frac{1}{4}$, because you have to distribute the exponet.

Guide 9 Litho 12288

Total Content Points: 0

Total Practice Points: 1 (MP4)

The student models linearity mathematically in Part A by determining the ratios of rate changes between data points (MP4), but uses this information to draw the incorrect conclusion that the function is linear (no credit for 8.F.3(a), no credit for MP7). The student does disagree with Marianne in Part B, but the reasoning provided is incorrect (no credit for 8.F.3(b)). In Part A, the student answers incorrectly, and in Part B, the reasoning is not appropriate justification for why $\frac{1}{2}$ is not the slope (no credit for MP3). The incorrect answers in both parts, based on inaccurate work, indicate that the student is unable to make sense of the task (no credit for MP1).

Total Awarded Points: 1 out of 6

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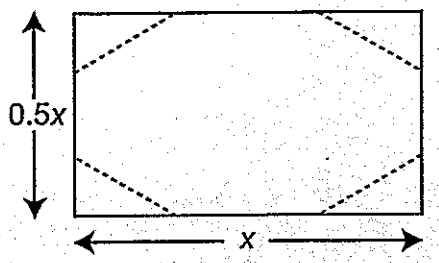
Danielle's 8th grade teacher is making honor roll certificates in the shape of a rectangle with the corners cut off.



She wonders how many square inches of paper will be needed for differently sized certificates. She creates the table below to describe the pattern for the certificates.

x length (in inches)	y area (in square inches)
6	16
8	30
10	48
12	70

a. Explain whether the data represent a linear function. Use an equation, numerical expressions, a graph, or words in your explanation.

The table is a nonlinear because the numbers randomely go up by random numbers.

Litho#: 12312

b. Marianne says the equation that relates area to length is $y = \frac{1}{2}x^2 - 2$ and so the slope is $\frac{1}{2}$. Is her reasoning correct? Why or why not?

No, because the slope is squared.

Guide 10 Litho 12312

Total Content Points: 0

Total Practice Points: 0

The student provides correct answers (“nonlinear” and “no”) in both parts, but in Part A the reasoning given is unclear and insufficient, and in Part B the reasoning is incorrect (no credit for 8.F.3(a), no credit for 8.F.3(b)). The student does not provide appropriate justification for either part (no credit for MP3). The student does not make use of a mathematical model and does not accurately make use of linear structure (no credit for MP4, no credit for MP7). Overall, the student does not make sense of the task (no credit for MP1).

Total Awarded Points: 0 out of 6