

## Cover Sheet for Collection of Assignments and Student Work

*Please answer all questions as specifically as possible.*

1. Title of Assignment: \_\_Distributive Property of Multiplication\_\_
2. Date Assigned to Students: \_\_October 9, 2017\_\_
3. You were asked to select a challenging assignment. Please explain why this assignment is challenging for students.  
\_\_This assignment requires students to apply their prior knowledge of finding the area of rectangles to discover the distributive property of multiplication. It requires students to follow patterns to discover a property that they have never seen before based on the areas of rectangles. This is challenging for students because it requires them to think in different ways than they are used to and investigate a property, rather than being told the property. I have noticed that when students discover the property on their own, they are more likely to remember it long term.\_\_
4. Upload the assignment and any instructions that were given to students in the respective Google Drive Folder. If this is not possible, use the space below to state the task and describe the instructions.  
\_\_Assignment uploaded (with rubric). No additional instructions were given to students, as they were expected to follow the patterns on their own.\_\_
5. Where was this assignment drawn from?
  - ☐ Published
    - Title: \_\_Distributive Property Using Area\_\_
    - Author(s): \_\_Illuminations\_\_
    - Date: \_\_2007\_\_
    - Volume: \_\_\_\_\_
    - Publisher: \_\_National Council of Teachers of Mathematics\_\_
  - ☐ From a Website (link: \_\_http://illuminations.nctm.org/\_\_\_\_)
  - ☐ From a colleague (explain: \_\_\_\_\_)

▫ Other (explain: \_\_\_\_\_)

6. Did you adapt this assignment? If so, describe adaptations & rationale for making them.

\_\_\_Yes, I adapted this assignment. I work at an IB school, so we have specific requirements for our assessments and our rubrics. One of the criteria that we assess is Criterion B: Investigating Patterns. This requires students to apply critical thinking skills to discover properties using patterns. I thought this assignment would fit nicely into a Criterion B assessment, so I took the idea from this assignment and turned it into an assessment.\_\_\_\_\_

7. Describe the unit this assignment was a part of, including the goals of the unit:

\_\_\_This assessment was part of our unit on Expressions and Equations. The goals of the unit were for students to understand how to simplify expressions and solve one and two-step equations. The specific standards that this assessment addressed were: 7.EE.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients, 7.EE.2 Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related, and 7.EE.4a Solve word problems leading to equations of the form  $px + q = r$  and  $p(x + q) = r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.\_\_\_\_\_

8. What role did this assignment play in the unit (e.g., summative assessment, knowledge acquisition, practice, active participation, making a connection to the real world or other contexts):

\_\_\_This was an IB Criterion B assessment to get students to investigate patterns to discover properties.\_\_\_\_\_

9. What kinds of activities did your students engage in while working on this assignment?

\_\_\_Students completed this assessment individually prior to learning anything for this unit.\_\_\_\_\_

10. What expectations were given to students for quality work?

\_\_Students are very familiar with our IB rubrics (they are used in all classes) and have taken Criterion B assessments before. We went over the rubric as a class and discussed expectations for quality and exceptional work (7/8 level).\_\_\_\_\_

11. Describe your grading criteria in the format provided below. If you created a rubric or grading criteria, *upload these to the Google Drive Folder* and indicate this below. If your students used a criteria chart or rubric that was posted in the classroom [that you were unable to upload], please sketch or describe it here.)

High:

Students are able to select and apply mathematical problem-solving techniques to find areas of rectangles in order to discover complex patterns and describe the pattern to write area as product to area as a sum as relationships and/or general rules consistent with correct findings in problem 8.

Medium:

Students are able to apply mathematical problem-solving techniques to find areas of rectangles in order to discover simple patterns and suggest the pattern to write a product as a sum as relationships and/or general rules consistent with findings in problem 8.

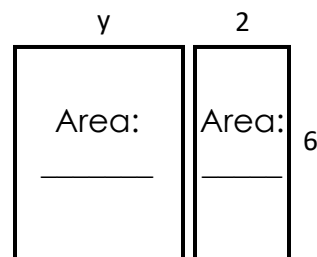
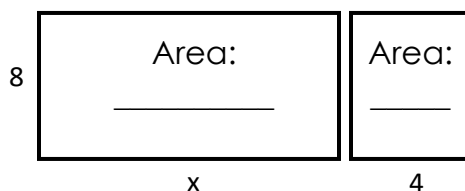
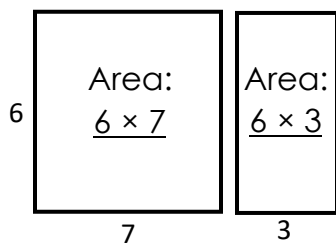
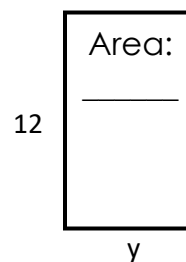
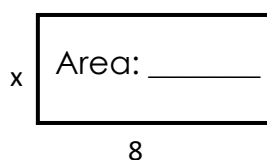
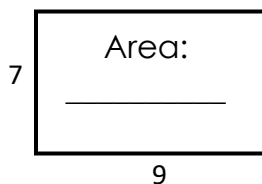
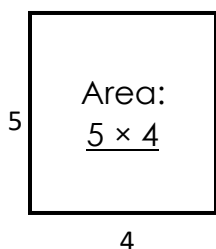
Low: Students are able to apply, with teacher support, mathematical problem-solving techniques to find areas of rectangles in order to discover simple patterns and state predictions to write a product as a sum consistent with findings in problem 8.

12. How did you share your grading criteria for this assignment with students before this assignment was due? (e.g.: develop criteria with students, discuss expectations /scoring guides with students in class)

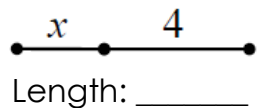
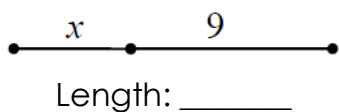
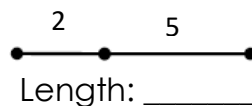
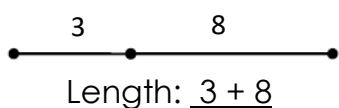
\_\_We went over the rubric as a class before the students began the assessment.

## Distributive Property of Multiplication

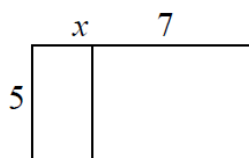
1. Write an expression that represents the area of each rectangle:



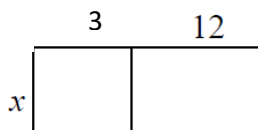
2. Write an expression that represents the length of each segment:



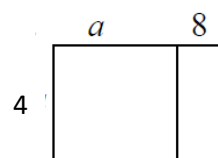
3. Write the area of each rectangle as the product of *length*  $\times$  *width* and also as the sum of the areas of each box.



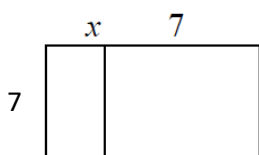
| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $5(x+7)$           | $5x+35$        |



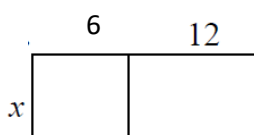
| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
|                    |                |



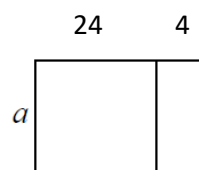
| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
|                    |                |



| AREA AS<br>PRODUCT | AREA AS<br>SUM |
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|                    |                |

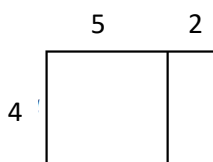


| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
|                    |                |



| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
|                    |                |

4. What do you notice? Is the area as a product the same as the area as a sum? Hint: try the example below and calculate the area both ways. Do you get the same answer?



| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
|                    |                |

5. How can you get from the area as a product to the area as a sum? (What patterns do you see?)

| As a product | As a sum     |
|--------------|--------------|
| $4(x + 7)$   | $4x + 28$    |
| $7(x - 3)$   | $7x - 21$    |
| $3(x + 4)$   | $3x + 12$    |
| $4(a - 4)$   | $4a - 16$    |
| $2(x + 12)$  | $2x + 24$    |
| $12(a + 2)$  | $12a + 24$   |
| $100(x - 5)$ | $100x - 500$ |

6. Using the pattern you came up with, write the following products as sums (if you need help, draw rectangles to help you see the area as a sum):

| As a product | As a sum |
|--------------|----------|
| $4(x + 2)$   |          |
| $6(x + 7)$   |          |
| $2(x - 11)$  |          |
| $7(a - 4)$   |          |

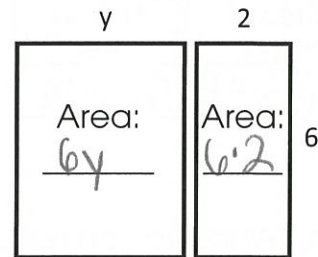
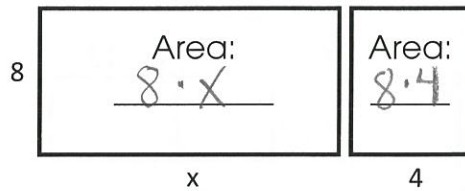
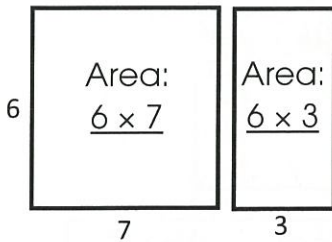
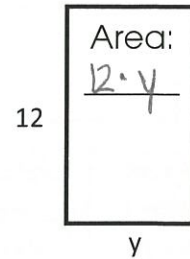
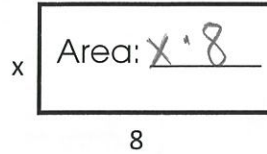
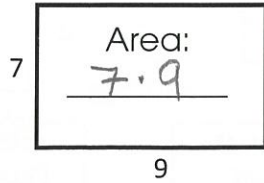
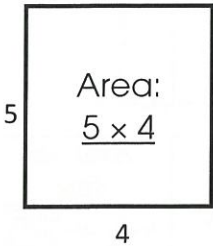
7. Draw your own rectangle. Come up with two ways that you can express the area.

8. Describe the pattern that you see to go from a product to a sum:

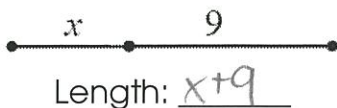
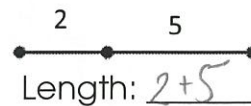
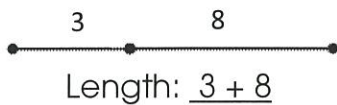
| Criterion B: Investigating Patterns |   | For this task, that means...   |
|-------------------------------------|---|--|
| 0                                   | You did not reach any standard described above.   |  |
| 1-2                                 | You are able to:<br><input type="checkbox"/> apply, <b><u>with teacher support</u></b> , mathematical problem-solving techniques to discover <b><u>simple</u></b> patterns<br><input type="checkbox"/> <b><u>state</u></b> predictions consistent with patterns   | <input type="checkbox"/> apply, <b><u>with teacher support</u></b> , mathematical problem-solving techniques to find areas of rectangles in order to discover <b><u>simple</u></b> patterns<br><input type="checkbox"/> <b><u>state</u></b> predictions to write a product as a sum consistent with findings in problem 8  |
| 3-4                                 | You are able to:<br><input type="checkbox"/> <b><u>apply</u></b> mathematical problem-solving techniques to discover simple patterns<br><input type="checkbox"/> <b><u>suggest</u></b> relationships and/or general rules consistent with findings  | <input type="checkbox"/> <b><u>apply</u></b> mathematical problem-solving techniques to find areas of rectangles in order to discover simple patterns<br><input type="checkbox"/> <b><u>suggest</u></b> the pattern to write a product as a sum as relationships and/or general rules consistent with findings in problem 8  |
| 5-6                                 | You are able to:<br><input type="checkbox"/> <b><u>Select</u></b> and <b><u>apply</u></b> mathematical problem-solving techniques to discover <b><u>complex</u></b> patterns<br><input type="checkbox"/> <b><u>describe</u></b> patterns as relationships and/or general rules consistent with findings | <input type="checkbox"/> <b><u>Select</u></b> and <b><u>apply</u></b> mathematical problem-solving techniques to find areas of rectangles in order to discover <b><u>complex</u></b> patterns<br><input type="checkbox"/> <b><u>describe</u></b> the pattern to write a product as a sum as relationships and/or general rules consistent with findings in problem 8         |
| 7-8                                 | You are able to:<br><input type="checkbox"/> <b><u>select</u></b> and apply mathematical problem-solving techniques to discover complex patterns<br><input type="checkbox"/> <b><u>describe</u></b> patterns as relationships and/or general rules consistent with <b><u>correct</u></b> findings       | <input type="checkbox"/> <b><u>select</u></b> and apply mathematical problem-solving techniques to find areas of rectangles in order to discover complex patterns<br><input type="checkbox"/> <b><u>describe</u></b> the pattern to write area as product to area as a sum as relationships and/or general rules consistent with <b><u>correct</u></b> findings in problem 8 |

## Distributive Property of Multiplication

1. Write an expression that represents the area of each rectangle:



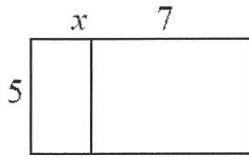
2. Write an expression that represents the length of each segment:



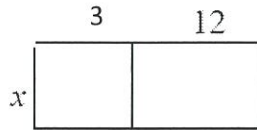
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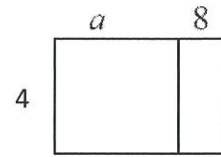
3. Write the area of each rectangle as the product of *length*  $\times$  *width* and also as the sum of the areas of each box.



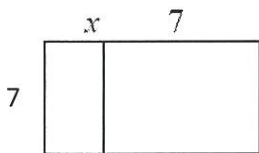
| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $5(x+7)$        | $5x+35$     |



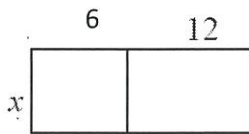
| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $x(3+12)$       | $3x+12x$    |



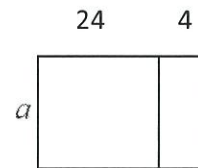
| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $4(a+8)$        | $4a+32$     |



| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $7(x+7)$        | $7x+49$     |



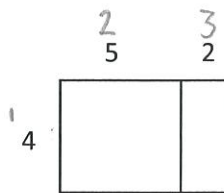
| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $x(6+12)$       | $6x+12x$    |



| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $a(24+4)$       | $24a+4a$    |

~~\*~~

4. What do you notice? Is the area as a product the same as the area as a sum? Hint: try the example below and calculate the area both ways. Do you get the same answer?



| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $4(5+2)$        | $20+8$      |

~~\*~~

The area as a product is the same as the area with a sum because the area as a product is equal to the area as a sum. They are just in two different forms, but you get the same answer. You do the equation inside the parenthesis first and you multiply that by the # on the outside.

5. How can you get from the area as a product to the area as a sum? (What patterns do you see?)

$$4(x+7)$$

$$4x+28$$

| As a product | As a sum   |
|--------------|------------|
| $4(x+7)$     | $4x+28$    |
| $7(x-3)$     | $7x-21$    |
| $3(x+4)$     | $3x+12$    |
| $4(a-4)$     | $4a-16$    |
| $2(x+12)$    | $2x+24$    |
| $12(a+2)$    | $12a+24$   |
| $100(x-5)$   | $100x-500$ |

Multiply what's on the outside by what's on the inside to both numbers and you get your equation of  $4x+28$ .

*✗*

6. Using the pattern you came up with, write the following products as sums (if you need help, draw rectangles to help you see the area as a sum):

| As a product | As a sum |
|--------------|----------|
| $4(x+2)$     | $4x+8$   |
| $6(x+7)$     | $6x+42$  |
| $2(x-11)$    | $2x-22$  |
| $7(a-4)$     | $7a-28$  |

*✗*

7. Draw your own rectangle. Come up with two ways that you can express the area.

$$y \begin{array}{|c|c|} \hline 4 & 8 \\ \hline \end{array}$$

$$4 \cdot y + 8 \cdot y = 4y + 8y$$

$$y(4+8)$$

?

8. Describe the pattern that you see to go from a product to a sum:

Multiply the outside variable/number by both numbers on the inside and keep your sign the same.

*nice!*

$$y(4+8)$$

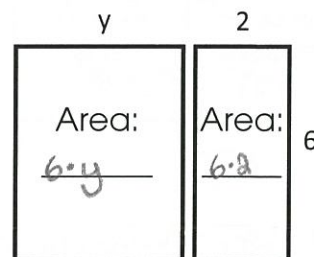
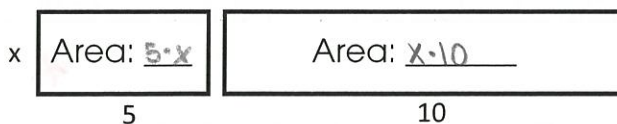
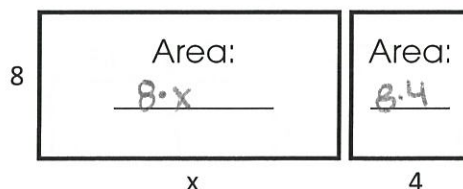
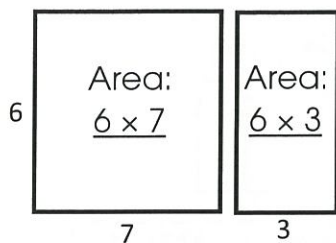
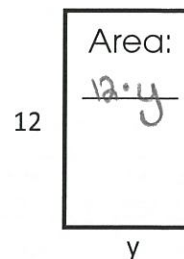
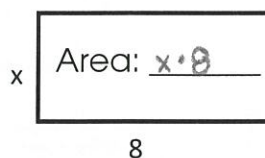
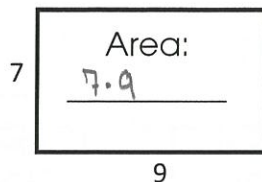
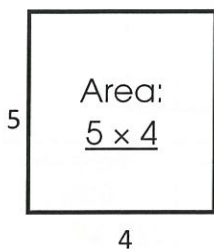
$$4y+8y$$

| Criterion B: Investigating Patterns | For this task, that means...   |
|-------------------------------------|--|
| 0                                   | You did not reach any standard described above.  |
| 1-2                                 | <p>You are able to:</p> <p><input type="checkbox"/> apply, <b>with teacher support</b>, mathematical problem-solving techniques to discover <b>simple</b> patterns</p> <p><input type="checkbox"/> <b>state</b> predictions consistent with patterns</p> <p><input type="checkbox"/> apply, <b>with teacher support</b>, mathematical problem-solving techniques to find areas of rectangles in order to discover <b>simple</b> patterns</p> <p><input type="checkbox"/> <b>state</b> predictions to write a product as a sum consistent with findings in problem 8</p>  |
| 3-4                                 | <p>You are able to:</p> <p><input type="checkbox"/> <b>apply</b> mathematical problem-solving techniques to discover simple patterns</p> <p><input type="checkbox"/> <b>suggest</b> relationships and/or general rules consistent with findings</p> <p><input type="checkbox"/> <b>apply</b> mathematical problem-solving techniques to find areas of rectangles in order to discover simple patterns</p> <p><input type="checkbox"/> <b>suggest</b> the pattern to write a product as a sum as relationships and/or general rules consistent with findings in problem 8</p>   |
| 5-6                                 | <p>You are able to:</p> <p><input type="checkbox"/> <b>Select</b> and <b>apply</b> mathematical problem-solving techniques to discover <b>complex</b> patterns</p> <p><input type="checkbox"/> <b>describe</b> patterns as relationships and/or general rules consistent with findings</p> <p><input type="checkbox"/> <b>Select</b> and <b>apply</b> mathematical problem-solving techniques to find areas of rectangles in order to discover <b>complex</b> patterns</p> <p><input type="checkbox"/> <b>describe</b> the pattern to write a product as a sum as relationships and/or general rules consistent with findings in problem 8</p>                 |
| 7-8                                 | <p>You are able to:</p> <p><input type="checkbox"/> <b>select</b> and apply mathematical problem-solving techniques to discover complex patterns</p> <p><input type="checkbox"/> <b>describe</b> patterns as relationships and/or general rules consistent with <b>correct</b> findings</p> <p><input type="checkbox"/> <b>select</b> and apply mathematical problem-solving techniques to find areas of rectangles in order to discover complex patterns</p> <p><input type="checkbox"/> <b>describe</b> the pattern to write area as product to area as a sum as relationships and/or general rules consistent with <b>correct</b> findings in problem 8</p> |

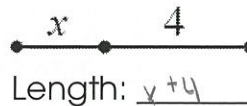
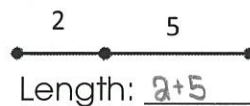
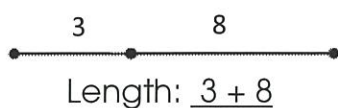


## Distributive Property of Multiplication

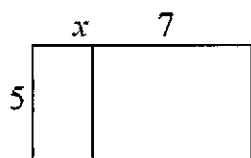
1. Write an expression that represents the area of each rectangle:



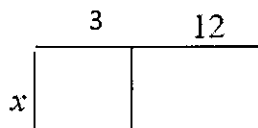
2. Write an expression that represents the length of each segment:



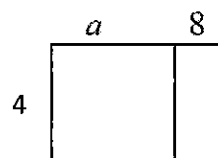
3. Write the area of each rectangle as the product of *length*  $\times$  *width* and also as the sum of the areas of each box.



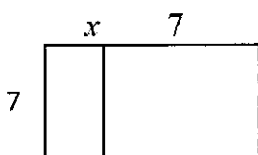
| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $5(x+7)$           | $5x+35$        |



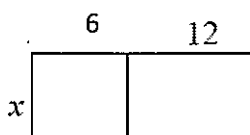
| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $x(3+12)$          | $x3+12x$       |



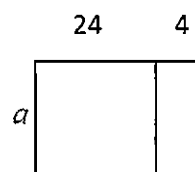
| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $4(a+8)$           | $4a+24$        |



| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $7(x+7)$           | $7x+49$        |



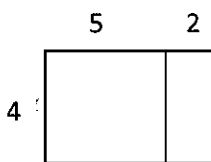
| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $x(6+12)$          | $6x+12x$       |



| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $a(24+4)$          | $24a+4a$       |

✗

4. What do you notice? Is the area as a product the same as the area as a sum? Hint: try the example below and calculate the area both ways. Do you get the same answer?



| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $4(5+2)$           | $20+8$         |

$$4(5+2) = 28$$

$$20+8 = 28$$

yes you do get the same answer and a pattern is where you multiply both numbers and then you add also known as distributed property.

✗

5. How can you get from the area as a product to the area as a sum? (What patterns do you see?)

| As a product | As a sum     |
|--------------|--------------|
| $4(x + 7)$   | $4x + 28$    |
| $7(x - 3)$   | $7x - 21$    |
| $3(x + 4)$   | $3x + 12$    |
| $4(a - 4)$   | $4a - 16$    |
| $2(x + 12)$  | $2x + 24$    |
| $12(a + 2)$  | $12a + 24$   |
| $100(x - 5)$ | $100x - 500$ |

You multiply the first number with the rest of the numbers then add/subtract the numbers you multiplied.

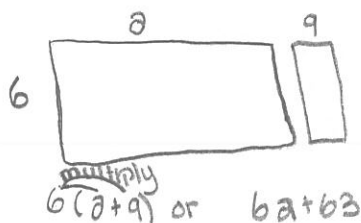
nice!

6. Using the pattern you came up with, write the following products as sums (if you need help, draw rectangles to help you see the area as a sum):

| As a product | As a sum  |
|--------------|-----------|
| $4(x + 2)$   | $4x + 8$  |
| $6(x + 7)$   | $6x + 42$ |
| $2(x - 11)$  | $2x - 22$ |
| $7(a - 4)$   | $7a - 28$ |

✗

7. Draw your own rectangle. Come up with two ways that you can express the area.



8. Describe the pattern that you see to go from a product to a sum:

The pattern is that you multiply the first number to the numbers in parenthesis() and then add.

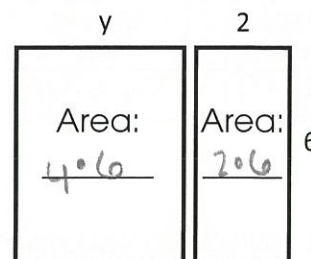
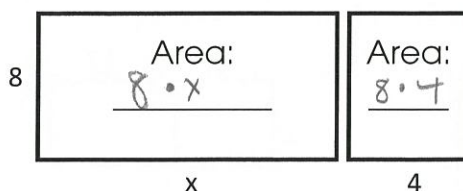
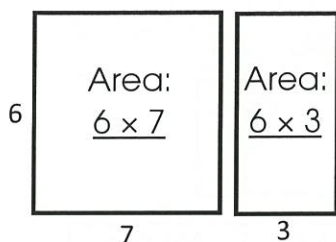
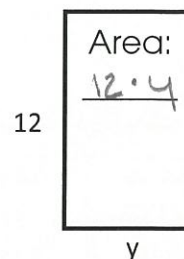
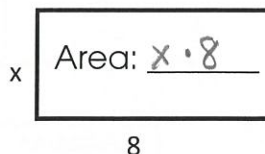
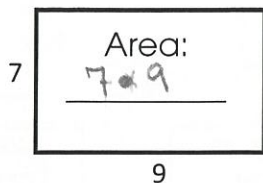
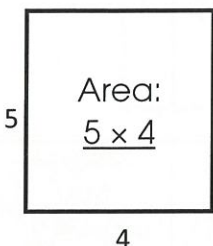
yes!

| Criterion B: Investigating Patterns | For this task, that means...   |
|-------------------------------------|--|
| 0                                   | You did not reach any standard described above.  |
| 1-2                                 | <p>You are able to:</p> <p><input type="checkbox"/> apply, <b><u>with teacher support</u></b>, mathematical problem-solving techniques to discover <b><u>simple</u></b> patterns</p> <p><input type="checkbox"/> <b><u>state</u></b> predictions consistent with patterns</p> <p><input type="checkbox"/> apply, <b><u>with teacher support</u></b>, mathematical problem-solving techniques to find areas of rectangles in order to discover <b><u>simple</u></b> patterns</p> <p><input type="checkbox"/> <b><u>state</u></b> predictions to write a product as a sum consistent with findings in problem 8</p>  |
| 3-4                                 | <p>You are able to:</p> <p><input type="checkbox"/> <b><u>apply</u></b> mathematical problem-solving techniques to discover simple patterns</p> <p><input type="checkbox"/> <b><u>suggest</u></b> relationships and/or general rules consistent with findings</p> <p><input type="checkbox"/> <b><u>apply</u></b> mathematical problem-solving techniques to find areas of rectangles in order to discover simple patterns</p> <p><input type="checkbox"/> <b><u>suggest</u></b> the pattern to write a product as a sum as relationships and/or general rules consistent with findings in problem 8</p>   |
| 5-6                                 | <p>You are able to:</p> <p><input type="checkbox"/> <b><u>Select</u></b> and <b><u>apply</u></b> mathematical problem-solving techniques to discover <b><u>complex</u></b> patterns</p> <p><input type="checkbox"/> <b><u>describe</u></b> patterns as relationships and/or general rules consistent with findings</p> <p><input type="checkbox"/> <b><u>Select</u></b> and <b><u>apply</u></b> mathematical problem-solving techniques to find areas of rectangles in order to discover <b><u>complex</u></b> patterns</p> <p><input type="checkbox"/> <b><u>describe</u></b> the pattern to write a product as a sum as relationships and/or general rules consistent with findings in problem 8</p>   |
| 7-8                                 | <p>You are able to:</p> <p><input type="checkbox"/> <b><u>select</u></b> and apply mathematical problem-solving techniques to discover complex patterns</p> <p><input type="checkbox"/> <b><u>describe</u></b> patterns as relationships and/or general rules consistent with <b><u>correct</u></b> findings</p> <p><input type="checkbox"/> <b><u>select</u></b> and apply mathematical problem-solving techniques to find areas of rectangles in order to discover complex patterns</p> <p><input type="checkbox"/> <b><u>describe</u></b> the pattern to write area as product to area as a sum as relationships and/or general rules consistent with <b><u>correct</u></b> findings in problem 8</p> |

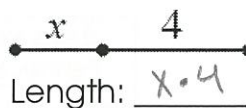
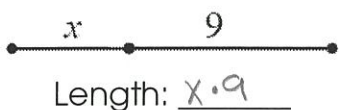
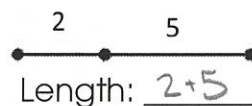


## Distributive Property of Multiplication

1. Write an expression that represents the area of each rectangle:

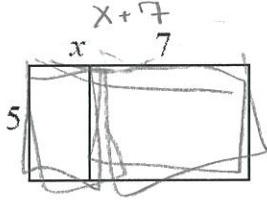


2. Write an expression that represents the length of each segment:

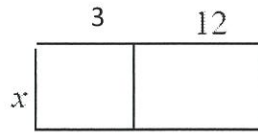




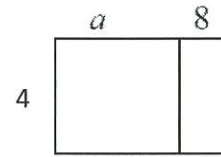
3. Write the area of each rectangle as the product of *length*  $\times$  *width* and also as the sum of the areas of each box.



| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $5(x+7)$        | $5x+35$     |

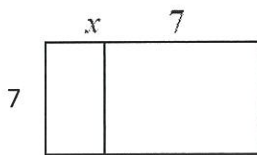


| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $x(3+12)$       | $3x+12x$    |

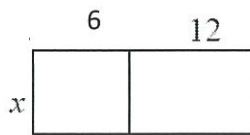


| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $4(a+8)$        | $4a+32$     |

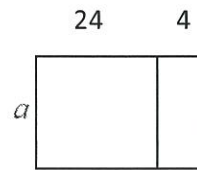
$$\begin{array}{r} 4a \\ + 32 \\ \hline 4a+32 \end{array}$$



| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $7(x+7)$        | $7x+49$     |



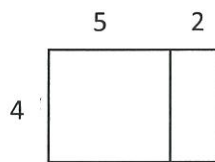
| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $x(6+12)$       | $6x+12x$    |



| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $a(24+4)$       | $24a+4a$    |

*✗*

4. What do you notice? Is the area as a product the same as the area as a sum? Hint: try the example below and calculate the area both ways. Do you get the same answer?



| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $4(5+2)$        | $4+5+2=11$  |

$$\rightarrow 28$$

$$4 \cdot 5 + 4 \cdot 2$$

no I did  
not get the  
same answer

*you should*

5. How can you get from the area as a product to the area as a sum? (What patterns do you see?)

| As a product | As a sum     |
|--------------|--------------|
| $4(x + 7)$   | $4x + 28$    |
| $7(x - 3)$   | $7x - 21$    |
| $3(x + 4)$   | $3x + 12$    |
| $4(a - 4)$   | $4a - 16$    |
| $2(x + 12)$  | $2x + 24$    |
| $12(a + 2)$  | $12a + 24$   |
| $100(x - 5)$ | $100x - 500$ |

You take out the  $()$ 's  
and put the letter next  
to the first number which  
shows that you  $\times$  them

6. Using the pattern you came up with, write the following products as sums (if you need help, draw rectangles to help you see the area as a sum):

| As a product | As a sum          |
|--------------|-------------------|
| $4(x + 2)$   | $4x + 2 \cdot 4$  |
| $6(x + 7)$   | $6x + 7 \cdot 6$  |
| $2(x - 11)$  | $2x - 11 \cdot 2$ |
| $7(a - 4)$   | $7a - 4 \cdot 7$  |

7. Draw your own rectangle. Come up with two ways that you can express the area.



|                               |                         |
|-------------------------------|-------------------------|
| as a product:<br>$10(x + 15)$ | as a sum:<br>$10x + 15$ |
|-------------------------------|-------------------------|

8. Describe the pattern that you see to go from a product to a sum:

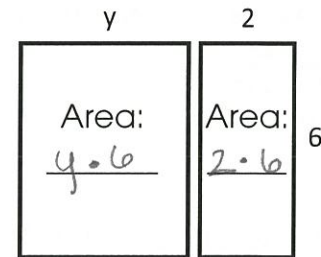
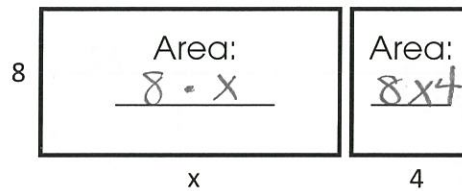
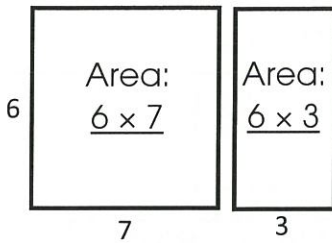
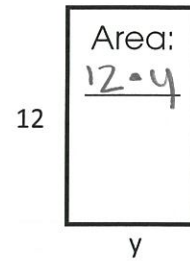
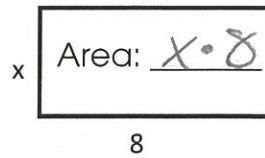
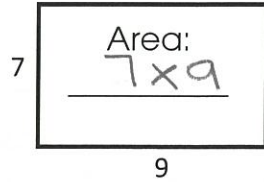
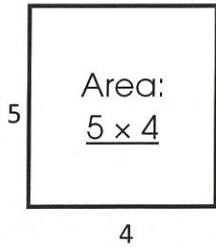
How I formed  $10(x + 15)$  from a product to  
a sum is I took out the  $()$ 's and  
put the  $\times$  next to the 10 moved  
the addition sign ~~behind~~ behind the  
10 then left the 15 as it was  
multiply last #

| Criterion B: Investigating Patterns | For this task, that means...   |
|-------------------------------------|--|
| 0                                   | You did not reach any standard described above.  |
| 1-2                                 | <p>You are able to:</p> <p><input type="checkbox"/> apply, <b>with teacher support</b>, mathematical problem-solving techniques to discover <b>simple</b> patterns</p> <p><input type="checkbox"/> <b>state</b> predictions consistent with patterns</p> <p><input type="checkbox"/> apply, <b>with teacher support</b>, mathematical problem-solving techniques to find areas of rectangles in order to discover <b>simple</b> patterns</p> <p><input type="checkbox"/> <b>state</b> predictions to write a product as a sum consistent with findings in problem 8</p>  |
| 3-4                                 | <p>You are able to:</p> <p><input type="checkbox"/> <b>apply</b> mathematical problem-solving techniques to discover simple patterns</p> <p><input type="checkbox"/> <b>suggest</b> relationships and/or general rules consistent with findings</p> <p><input type="checkbox"/> <b>apply</b> mathematical problem-solving techniques to find areas of rectangles in order to discover simple patterns</p> <p><input type="checkbox"/> <b>suggest</b> the pattern to write a product as a sum as relationships and/or general rules consistent with findings in problem 8</p>   |
| 5-6                                 | <p>You are able to:</p> <p><input type="checkbox"/> <b>Select</b> and <b>apply</b> mathematical problem-solving techniques to discover <b>complex</b> patterns</p> <p><input type="checkbox"/> <b>describe</b> patterns as relationships and/or general rules consistent with findings</p> <p><input type="checkbox"/> <b>Select</b> and <b>apply</b> mathematical problem-solving techniques to find areas of rectangles in order to discover <b>complex</b> patterns</p> <p><input type="checkbox"/> <b>describe</b> the pattern to write a product as a sum as relationships and/or general rules consistent with findings in problem 8</p>                 |
| 7-8                                 | <p>You are able to:</p> <p><input type="checkbox"/> <b>select</b> and apply mathematical problem-solving techniques to discover complex patterns</p> <p><input type="checkbox"/> <b>describe</b> patterns as relationships and/or general rules consistent with <b>correct</b> findings</p> <p><input type="checkbox"/> <b>select</b> and apply mathematical problem-solving techniques to find areas of rectangles in order to discover complex patterns</p> <p><input type="checkbox"/> <b>describe</b> the pattern to write area as product to area as a sum as relationships and/or general rules consistent with <b>correct</b> findings in problem 8</p> |

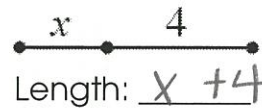
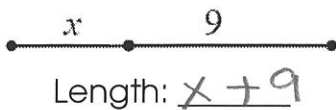
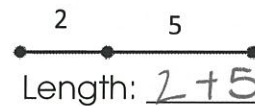
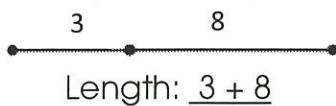


## Distributive Property of Multiplication

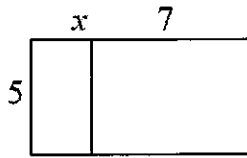
1. Write an expression that represents the area of each rectangle:



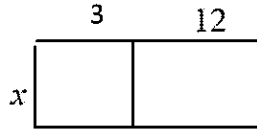
2. Write an expression that represents the length of each segment:



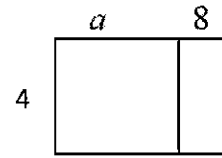
3. Write the area of each rectangle as the product of *length*  $\times$  *width* and also as the sum of the areas of each box.



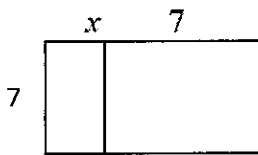
| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $5(x+7)$           | $5x+35$        |



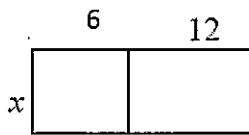
| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $3(x+12)$          | $3x+36$        |



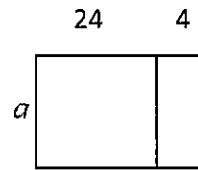
| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $4(a+8)$           | $4a+32$        |



| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $7(x+7)$           | $7x+49$        |



| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $6(x+12)$          | $6x+72$        |

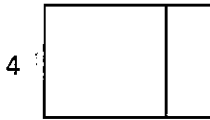


| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $4(a+24)$          | $4a+96$        |

✖

4. What do you notice? Is the area as a product the same as the area as a sum? Hint: try the example below and calculate the area both ways. Do you get the same answer?

yes, we get the same answer because there are all the same set of numbers.



$$4 \cdot 5 = 20$$

| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $4(5+2)$           | 28             |

$$4 \times 2 = 8$$

$$28$$

$$4 \cdot 7 = 28$$

✖

5. How can you get from the area as a product to the area as a sum? (What patterns do you see?)

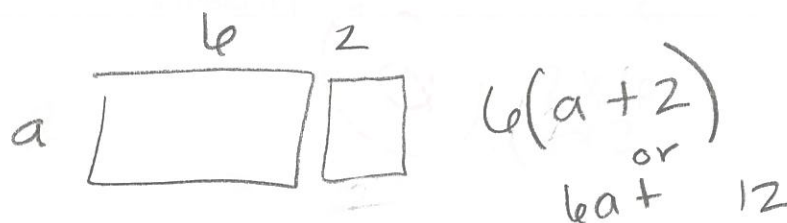
| As a product | As a sum     |
|--------------|--------------|
| $4(x + 7)$   | $4x + 28$    |
| $7(x - 3)$   | $7x - 21$    |
| $3(x + 4)$   | $3x + 12$    |
| $4(a - 4)$   | $4a - 16$    |
| $2(x + 12)$  | $2x + 24$    |
| $12(a + 2)$  | $12a + 24$   |
| $100(x - 5)$ | $100x - 500$ |

I see that you simplify the Product expression and you get the sum expression. *how?*

6. Using the pattern you came up with, write the following products as sums (if you need help, draw rectangles to help you see the area as a sum):

| As a product | As a sum  |
|--------------|-----------|
| $4(x + 2)$   | $4x + 8$  |
| $6(x + 7)$   | $6x + 42$ |
| $2(x - 11)$  | $2x - 22$ |
| $7(a - 4)$   | $7a - 28$ |

7. Draw your own rectangle. Come up with two ways that you can express the area.



8. Describe the pattern that you see to go from a product to a sum:

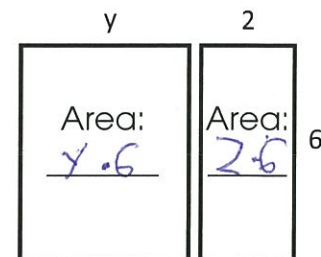
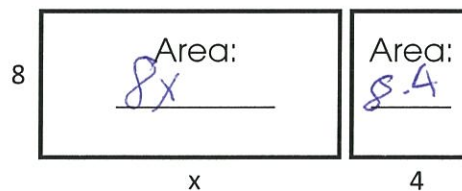
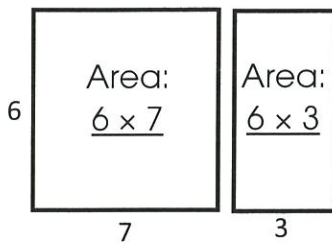
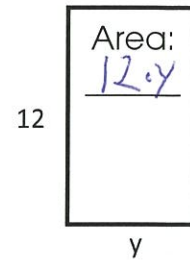
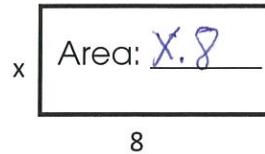
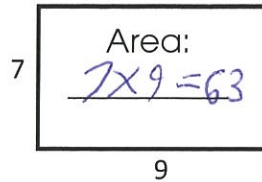
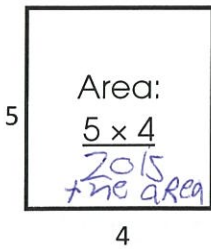
I see that you first find the area expression of both rectangles and then combine the problems/ areas. *how??*

| Criterion B: Investigating Patterns | For this task, that means...   |
|-------------------------------------|--|
| 0                                   | You did not reach any standard described above.  |
| 1-2                                 | <p>You are able to:</p> <p><input type="checkbox"/> apply, <b>with teacher support</b>, mathematical problem-solving techniques to discover <b>simple</b> patterns</p> <p><input type="checkbox"/> <b>state</b> predictions consistent with patterns</p> <p><input type="checkbox"/> apply, <b>with teacher support</b>, mathematical problem-solving techniques to find areas of rectangles in order to discover <b>simple</b> patterns</p> <p><input type="checkbox"/> <b>state</b> predictions to write a product as a sum consistent with findings in problem 8</p>  |
| 3-4                                 | <p>You are able to:</p> <p><input type="checkbox"/> <b>apply</b> mathematical problem-solving techniques to discover simple patterns</p> <p><input type="checkbox"/> <b>suggest</b> relationships and/or general rules consistent with findings</p> <p><input type="checkbox"/> <b>apply</b> mathematical problem-solving techniques to find areas of rectangles in order to discover simple patterns</p> <p><input type="checkbox"/> <b>suggest</b> the pattern to write a product as a sum as relationships and/or general rules consistent with findings in problem 8</p>   |
| 5-6                                 | <p>You are able to:</p> <p><input type="checkbox"/> <b>Select</b> and <b>apply</b> mathematical problem-solving techniques to discover <b>complex</b> patterns</p> <p><input type="checkbox"/> <b>describe</b> patterns as relationships and/or general rules consistent with findings</p> <p><input type="checkbox"/> <b>Select</b> and <b>apply</b> mathematical problem-solving techniques to find areas of rectangles in order to discover <b>complex</b> patterns</p> <p><input type="checkbox"/> <b>describe</b> the pattern to write a product as a sum as relationships and/or general rules consistent with findings in problem 8</p>                 |
| 7-8                                 | <p>You are able to:</p> <p><input type="checkbox"/> <b>select</b> and apply mathematical problem-solving techniques to discover complex patterns</p> <p><input type="checkbox"/> <b>describe</b> patterns as relationships and/or general rules consistent with <b>correct</b> findings</p> <p><input type="checkbox"/> <b>select</b> and apply mathematical problem-solving techniques to find areas of rectangles in order to discover complex patterns</p> <p><input type="checkbox"/> <b>describe</b> the pattern to write area as product to area as a sum as relationships and/or general rules consistent with <b>correct</b> findings in problem 8</p> |

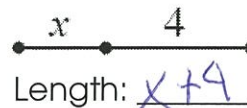
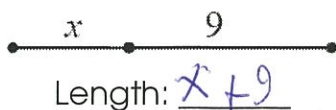
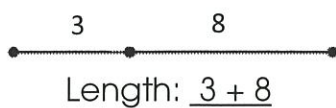
6

## Distributive Property of Multiplication

1. Write an expression that represents the area of each rectangle:

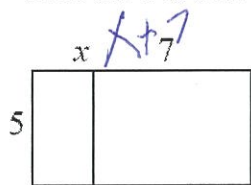


2. Write an expression that represents the length of each segment:

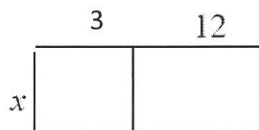




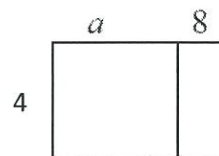
3. Write the area of each rectangle as the product of *length*  $\times$  *width* and also as the sum of the areas of each box.



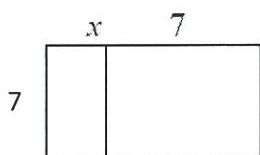
| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $5(x+7)$           | $5x+35$        |



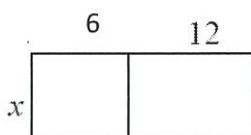
| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $x(3+12)$          | $x3+12x$       |



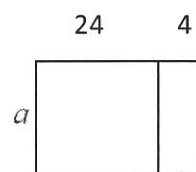
| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $4(a+8)$           | $4a+32$        |



| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $7(x+2)$           | $7x+14$        |



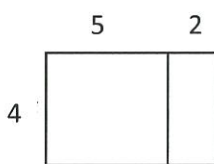
| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $x(6+12)$          | $6x+12x$       |



| AREA AS<br>PRODUCT | AREA AS<br>SUM |
|--------------------|----------------|
| $a(24+4)$          | $24a+4a$       |

✗

4. What do you notice? Is the area as a product the same as the area as a sum? Hint: try the example below and calculate the area both ways. Do you get the same answer?



| AREA AS<br>PRODUCT | AREA AS<br>SUM            |
|--------------------|---------------------------|
| $4(5+2)$           | $4 \times 5 + 4 \times 2$ |
| $28$               | $20 + 8 = 28$             |

~~no~~ <sup>yes</sup> you get 28 for the product and 40 for the sum

5. How can you get from the area as a product to the area as a sum? (What patterns do you see?)

| As a product | As a sum     |
|--------------|--------------|
| $4(x + 7)$   | $4x + 28$    |
| $7(x - 3)$   | $7x - 21$    |
| $3(x + 4)$   | $3x + 12$    |
| $4(a - 4)$   | $4a - 16$    |
| $2(x + 12)$  | $2x + 24$    |
| $12(a + 2)$  | $12a + 24$   |
| $100(x - 5)$ | $100x - 500$ |

there's a letter  
in each equation

6. Using the pattern you came up with, write the following products as sums (if you need help, draw rectangles to help you see the area as a sum):

| As a product | As a sum  |
|--------------|-----------|
| $4(x + 2)$   | $4x + 8$  |
| $6(x + 7)$   | $6x + 42$ |
| $2(x - 11)$  | $2x - 22$ |
| $7(a - 4)$   | $7a - 28$ |

7. Draw your own rectangle. Come up with two ways that you can express the area.

| as a product | as a sum  |
|--------------|-----------|
| $2(B + 3)$   | $2B + 6$  |
| $5(a + 4)$   | $5a + 20$ |
| $6(x + 5)$   | $6x + 30$ |

8. Describe the pattern that you see to go from a product to a sum:

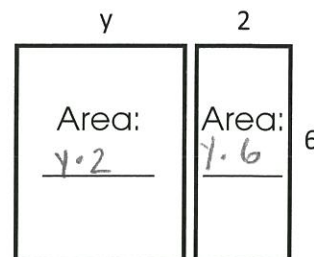
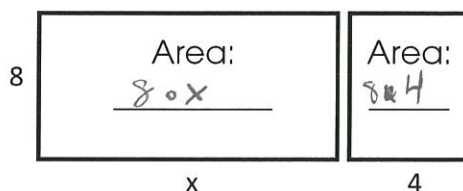
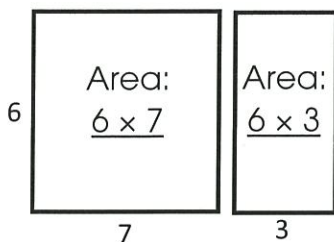
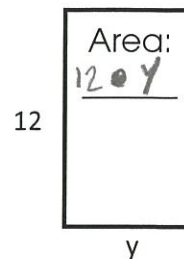
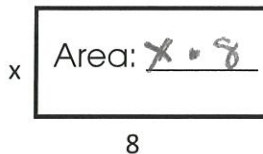
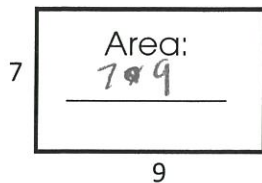
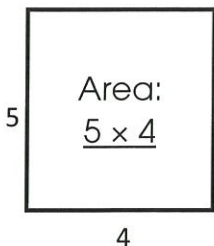
?

| Criterion B: Investigating Patterns | For this task, that means...   |
|-------------------------------------|--|
| 0                                   | You did not reach any standard described above.  |
| 1-2                                 | <p>You are able to:</p> <p><input type="checkbox"/> apply, <b>with teacher support</b>, mathematical problem-solving techniques to discover <b>simple</b> patterns</p> <p><input type="checkbox"/> <b>state</b> predictions consistent with patterns</p> <p><input type="checkbox"/> apply, <b>with teacher support</b>, mathematical problem-solving techniques to find areas of rectangles in order to discover <b>simple</b> patterns</p> <p><input type="checkbox"/> <b>state</b> predictions to write a product as a sum consistent with findings in problem 8</p>  |
| 3-4                                 | <p>You are able to:</p> <p><input type="checkbox"/> <b>apply</b> mathematical problem-solving techniques to discover simple patterns</p> <p><input type="checkbox"/> <b>suggest</b> relationships and/or general rules consistent with findings</p> <p><input checked="" type="checkbox"/> <b>apply</b> mathematical problem-solving techniques to find areas of rectangles in order to discover simple patterns</p> <p><input type="checkbox"/> <b>suggest</b> the pattern to write a product as a sum as relationships and/or general rules consistent with findings in problem 8</p>  |
| 5-6                                 | <p>You are able to:</p> <p><input type="checkbox"/> <b>Select</b> and <b>apply</b> mathematical problem-solving techniques to discover <b>complex</b> patterns</p> <p><input type="checkbox"/> <b>describe</b> patterns as relationships and/or general rules consistent with findings</p> <p><input type="checkbox"/> <b>Select</b> and <b>apply</b> mathematical problem-solving techniques to find areas of rectangles in order to discover <b>complex</b> patterns</p> <p><input type="checkbox"/> <b>describe</b> the pattern to write a product as a sum as relationships and/or general rules consistent with findings in problem 8</p>                 |
| 7-8                                 | <p>You are able to:</p> <p><input type="checkbox"/> <b>select</b> and apply mathematical problem-solving techniques to discover complex patterns</p> <p><input type="checkbox"/> <b>describe</b> patterns as relationships and/or general rules consistent with <b>correct</b> findings</p> <p><input type="checkbox"/> <b>select</b> and apply mathematical problem-solving techniques to find areas of rectangles in order to discover complex patterns</p> <p><input type="checkbox"/> <b>describe</b> the pattern to write area as product to area as a sum as relationships and/or general rules consistent with <b>correct</b> findings in problem 8</p> |

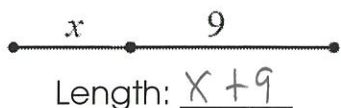
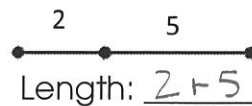
3

## Distributive Property of Multiplication

1. Write an expression that represents the area of each rectangle:

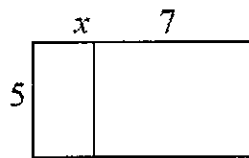


2. Write an expression that represents the length of each segment:

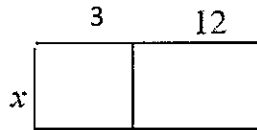




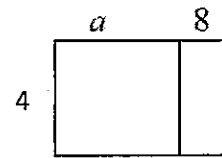
3. Write the area of each rectangle as the product of *length*  $\times$  *width* and also as the sum of the areas of each box.



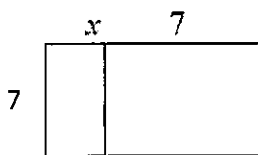
| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $5(x+7)$        | $5x+35$     |



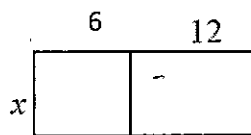
| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $x(3+12)$       | $x3+12$     |



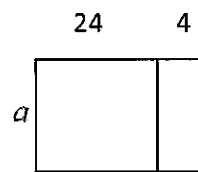
| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $4(a+8)$        | $4a+8$      |



| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $7(x+7)$        | $7x+7$      |



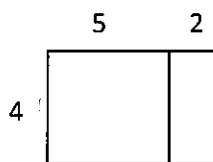
| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $x(6+12)$       | $x6+12$     |



| AREA AS PRODUCT                 | AREA AS SUM |
|---------------------------------|-------------|
| <del><math>a(24+4)</math></del> | $a24+4$     |

$a(24+4)$

4. What do you notice? Is the area as a product the same as the area as a sum? Hint: try the example below and calculate the area both ways. Do you get the same answer? Yes. how?



| AREA AS PRODUCT | AREA AS SUM |
|-----------------|-------------|
| $4(5+2)$        | $45+2$      |

5. How can you get from the area as a product to the area as a sum? (What patterns do you see?)

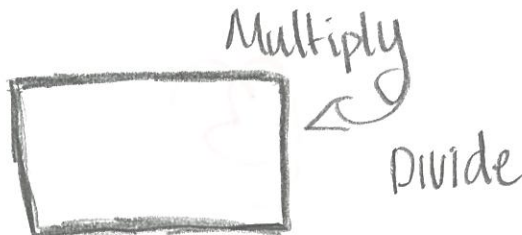
| As a product | As a sum     |
|--------------|--------------|
| $4(x + 7)$   | $4x + 28$    |
| $7(x - 3)$   | $7x - 21$    |
| $3(x + 4)$   | $3x + 12$    |
| $4(a - 4)$   | $4a - 16$    |
| $2(x + 12)$  | $2x + 24$    |
| $12(a + 2)$  | $12a + 24$   |
| $100(x - 5)$ | $100x - 500$ |

?

6. Using the pattern you came up with, write the following products as sums (if you need help, draw rectangles to help you see the area as a sum):

| As a product | As a sum          |
|--------------|-------------------|
| $4(x + 2)$   | $4x + 2 \cdot 4$  |
| $6(x + 7)$   | $6x + 7 \cdot 6$  |
| $2(x - 11)$  | $2x - 11 \cdot 2$ |
| $7(a - 4)$   | $7a - 4 \cdot 7$  |

7. Draw your own rectangle. Come up with two ways that you can express the area.



8. Describe the pattern that you see to go from a product to a sum:

You take away the parentheses. And ~~add~~ <sup>multiply</sup> the first two numbers together.

| Criterion B: Investigating Patterns | For this task, that means...   |
|-------------------------------------|--|
| 0                                   | You did not reach any standard described above.  |
| 1-2                                 | <p>You are able to:</p> <div> <input type="checkbox"/> apply, <b>with teacher support</b>, mathematical problem-solving techniques to discover <b>simple</b> patterns         </div> <div> <input type="checkbox"/> <b>state</b> predictions consistent with patterns         </div> <div> <input type="checkbox"/> apply, <b>with teacher support</b>, mathematical problem-solving techniques to find areas of rectangles in order to discover <b>simple</b> patterns         </div> <div> <input type="checkbox"/> <b>state</b> predictions to write a product as a sum consistent with findings in problem 8         </div>  |
| 3-4                                 | <p>You are able to:</p> <div> <input type="checkbox"/> <b>apply</b> mathematical problem-solving techniques to discover simple patterns         </div> <div> <input type="checkbox"/> <b>suggest</b> relationships and/or general rules consistent with findings         </div> <div> <input type="checkbox"/> <b>apply</b> mathematical problem-solving techniques to find areas of rectangles in order to discover simple patterns         </div> <div> <input type="checkbox"/> <b>suggest</b> the pattern to write a product as a sum as relationships and/or general rules consistent with findings in problem 8         </div>   |
| 5-6                                 | <p>You are able to:</p> <div> <input type="checkbox"/> <b>Select</b> and <b>apply</b> mathematical problem-solving techniques to discover <b>complex</b> patterns         </div> <div> <input type="checkbox"/> <b>describe</b> patterns as relationships and/or general rules consistent with findings         </div> <div> <input type="checkbox"/> <b>Select</b> and <b>apply</b> mathematical problem-solving techniques to find areas of rectangles in order to discover <b>complex</b> patterns         </div> <div> <input type="checkbox"/> <b>describe</b> the pattern to write a product as a sum as relationships and/or general rules consistent with findings in problem 8         </div>                 |
| 7-8                                 | <p>You are able to:</p> <div> <input type="checkbox"/> <b>select</b> and apply mathematical problem-solving techniques to discover complex patterns         </div> <div> <input type="checkbox"/> <b>describe</b> patterns as relationships and/or general rules consistent with <b>correct</b> findings         </div> <div> <input type="checkbox"/> <b>select</b> and apply mathematical problem-solving techniques to find areas of rectangles in order to discover complex patterns         </div> <div> <input type="checkbox"/> <b>describe</b> the pattern to write area as product to area as a sum as relationships and/or general rules consistent with <b>correct</b> findings in problem 8         </div> |

3