Bell Work 1/5  Complete each generic rectangle. Write each as a product = simplified sum.

a. \[
\begin{array}{c|c|c}
  & 4 & \\
3x & 3x^2 & 12x \\
\hline \\
x & +4 & \\
\end{array}
\]
\[(x + 4)(3x + 1) = 3x^2 + 13x + 4\]

b. \[
\begin{array}{c|c|c}
  & -6 & \\
3x & 2x^2 & -4x \\
\hline \\
2x & x - 2 & \\
\end{array}
\]
\[(2x + 3)(x - 2) = 2x^2 - x - 6\]

c. \[
\begin{array}{c|c|c}
  & -3 & \\
-2x & 2x^2 & 3x \\
\hline \\
x & 2x + 3 & \\
\end{array}
\]
\[(2x + 3)(x - 1) = 2x^2 + x - 3\]

8-1. Write each as a product equal to a simplified sum.

a. Use the algebra tile model to the right.
\[(y + x + 2)(x + 4) = xy + x^2 + 4y + 6x + 8\]

b. Use a generic rectangle to multiply \((6x - 1)(3x + 2)\).
\[
\begin{array}{c|c|c}
  & -2 & \\
3x & 12x & \\
\hline \\
6x & 3x^2 & -3x \\
\hline \\
x & +1 & \\
\end{array}
\]
\[(6x - 1)(3x + 2) = 18x^2 + 9x - 2\]

8-2. The process of changing a sum to a product is called factoring. Can every expression be factored? That is, does every sum have a product that can be represented with tiles? No

Investigate this question by building rectangles with algebra tiles for the following expressions (make a sketch if you successfully create a model and write the area as a product). If you cannot build a rectangle for one of the expressions, explain why building a rectangle is impossible (which means it is not factorable).

a. \[2x^2 + 7x + 6 = (2x + 3)(x + 2)\]

b. \[6x^2 + 7x + 2 = (3x + 2)(2x + 1)\]

c. \[x^2 + 4x + 1\]
Not possible. Four x’s and only 1 unit for the corner make a rectangle impossible.

d. \[2xy + 6x + y^2 + 3y = (2x + y)(y + 3)\]
8-3. Work with your team to find the sum and the product for the following generic rectangles. Are there any special strategies you discovered that can help you determine the dimensions of the rectangle? Be sure to share these strategies with your teammates.

a.  
\[ \begin{array}{c|c|c|c} 2x & 5 \\
6x^2 & 15x \end{array} \]

\[ +1 \begin{array}{c|c|c|c} 2x & +5 \\
3x & 6x^2 & 15x \end{array} \]

\[(2x + 5)(3x + 1) = 6x^2 + 17x + 5 \]

b.  
\[ \begin{array}{c|c|c|c} -2y & -6 \\
5xy & 15x \end{array} \]

\[-2 \begin{array}{c|c|c|c} 2y & -6 \\
5x & 5xy & 15x \end{array} \]

\[(5x - 2)(y + 3) = 5xy - 2y + 15x - 6 \]

c.  
\[ \begin{array}{c|c|c|c} -9x & -12 \\
12x^2 & 16x \end{array} \]

\[-3 \begin{array}{c|c|c|c} -9x & -12 \\
4x & 12x^2 & 16x \end{array} \]

\[(3x + 4)(4x - 3) = 12x^2 + 7x - 12 \]

8-4. While working on problem 8-3, Casey noticed a pattern with the diagonals of each generic rectangle. However, just before she shared her pattern with the rest of her team, she was called out of class! The drawing on her paper looked like the diagram below. Can you figure out what the two diagonals have in common?

![Diagram of a 2x2 generic rectangle with the diagonals highlighted.]

8-4. The product of each diagonal is equal: \(6x^2 \cdot 5 = 30x^2\) and \(2x \cdot 15x = 30x^2\).

8-5. Does Casey’s pattern always work? Verify that her pattern works for all of the 2-by-2 generic rectangles in problem 8-3.

8-5. Diagonals: part (a) are both \(30x^2\), part (b) are both \(-30xy\), part (c) are both \(-144x^2\).

“The product of one diagonal always equals the product of the other diagonal.”
8-6. Write the area of the rectangle as a sum and as a product.

\[
\begin{array}{ccc}
-3 & -6y & 12 \\
2x^2 & 4xy & -8x
\end{array}
\]

\[(x + 2y - 4)(2x - 3) = 2x^2 - 11x + 4xy - 6y + 12\]

8-7. Multiply the expressions below using algebra tiles (make a sketch) and with a generic rectangle. Verify that the product of one diagonal equals the product of the other diagonal.

a. \((4x - 1)(3x + 2) = 12x^2 + 5x - 2\)
b. \((2x - 3)^2 = 4x^2 - 12x + 9\)

8-8. Write an expression for the \(n\)th term of each sequence.

a. 500, 2000, 3500, … \(t(n) = 1500n - 1000\)
b. 30, 150, 750, 3750, … \(t(n) = 6(5)^n\)

8-9. Complete the diamonds using the pattern shown.

8-10. Use the greatest common factor to rewrite each sum as a product.

\textbf{Examples:} \(12x + 18 = 6(2x + 3)\) and \(x^2 + xy + x = x(x + y + 1)\).

a. \(4x + 8\)

b. \(10x + 25y + 5\)

c. \(2x^2 - 8x\)

d. \(9x^2y + 12x + 3xy\)

e. \(6x^2 - 7x\)

f. \(-7x^2 - 6x\)
8-11. Graph \( y = x^2 - 2x - 8 \). Use the graphing calculator to assist in answering these questions.

a. Name the \( y \)-intercept. What is the connection between the \( y \)-intercept and the equation?
   
   \( -8 \), it is the last number in the equation

b. Name the \( x \)-intercepts.
   
   \(-2\) and 4

c. Find the lowest point of the graph, called the vertex.
   
   \((1, -9)\)

8-12. Calculate the value of each expression below.

a. \(5 - \sqrt{36} \)  
   a. \(-1\)

b. \(1 + \sqrt{39} \)  
   b. \(\approx 7.24\)

c. \(-2 - \sqrt{5} \)  
   c. \(\approx -4.24\)

EOC Practice:

1. The population of a city in 2005 was 36,000. By 2010, the city's population had grown to 43,800 people.

   The population increased 7800 people in 5 years.

Part A

Assume that the population of the city has grown linearly since 2005 and that it will continue to grow this way. What will be the population in 2015?

Enter your answer in the box.

\[ 51600 \text{ people} \]

2015 is 5 years after 2010. Add 7800 to 43,800.

Part B

Suppose instead that the population of the city is growing exponentially. Write an expression for the population in terms of \( t \), the number of years since 2005.

Enter your answer in the space provided. Enter only your expression.

\[ 36000(1.04)^t \]

Part C

Assume that the population of the city has grown exponentially since 2005 and that it will continue to grow this way. What will be the population in 2015? Give your answer to the nearest whole number.

Enter your answer in the box.

\[ 53289 \text{ people} \]

\[ 36000(1.04)^{10} \approx 53288.794 \]

The multiplier \( = b \)

\[ b^5 = \frac{43800}{36000} \]

\[ b = \sqrt[5]{\frac{43800}{36000}} \approx 1.04 \]