Guided Practice 5.1

Example 1

Find the sum of $(4 + 3x) + (2 + x)$.

1. Rewrite the sum so that like terms are together.

   There are two numeric quantities, 4 and 2, and two terms that contain a variable, $3x$ and x. All the terms are positive.

   $(4 + 3x) + (2 + x)$

   $= 4 + 2 + 3x + x$

2. Find the sum of any numeric quantities.

   The numeric quantities in this example are 4 and 2.

   $4 + 2 + 3x + x$

   $= 6 + 3x + x$

3. Find the sum of any terms with the same variable raised to the same power.

   The two terms $3x$ and x both contain only the variable x raised to the first power.

   $6 + 3x + x$

   $= 6 + 4x$

   The result of $(4 + 3x) + (2 + x)$ is $6 + 4x$.

Example 2

Find the sum of $(7x^2 - x + 15) + (6x + 12)$.

1. Rewrite the sum so that like terms are together.

   Be sure to keep any negatives with the expression that follows, such as $-x$.

   $(7x^2 - x + 15) + (6x + 12)$

   $= 7x^2 - x + 6x + 15 + 12$

2. Find the sum of any numeric quantities.

   $7x^2 - x + 6x + 15 + 12$

   $= 7x^2 - x + 6x + 27$

3. Find the sum of any terms with the same variable raised to the same power.

   There is only one term with the variable x raised to the second power.

   There are two terms with the variable x raised to the first power, $-x$ and $6x$, so these can be combined.

   Add the coefficients of the variable.

   $7x^2 - x + 6x + 27$

   $= 7x^2 + 5x + 27$

   The result of $(7x^2 - x + 15) + (6x + 12)$ is $7x^2 + 5x + 27$.

Example 3

Find the difference of $(x^5 + 8) - (3x^5 + 5x)$.

1. Rewrite the difference as a sum.

   A difference can be written as a sum by adding the opposite of the second expression.

   Simplify "$-(3x^5 + 5x)$" by distributing –1 and writing the polynomial as $(-3x^5 - 5x)$.

   $(x^5 + 8) - (3x^5 + 5x)$

   $= (x^5 + 8) + [-1(3x^5 + 5x)]$

   $= (x^5 + 8) + (-3x^5 - 5x)$

2. Rewrite the sum so that any like terms are together.

   Be sure to keep any negatives with the expression that follows, such as $-3x^5$.

   $(x^5 + 8) + (-3x^5 - 5x)$

   $= x^5 + (-3x^5) + (-5x) + 8$

3. Find the sum of any terms with the same variable raised to the same power.

   There are two terms with the variable x raised to the fifth power.

   There is only one term with x raised to the first power, and only one numeric quantity.

   The sum of the two terms with x^5 can be combined by adding their coefficients.

   $x^5 + (-3x^5) + (-5x) + 8$

   $= -2x^5 - 5x + 8$

   The result of $(x^5 + 8) - (3x^5 + 5x)$ is $-2x^5 - 5x + 8$.

Example 4

Caleb has fourteen 3-foot fence sections and would like to use them all to create a rectangular garden. If he uses only whole fence sections, how should Caleb use the fence sections to create a garden with the most area? Use the formula for the area of a rectangle, $A = lw$.

1. Assign a variable to the number of fence sections needed to create the maximum area.

   Let x represent the number of sections for the length of the rectangle. There are a total of 14 sections in all, so the length plus the width must be made up of 7 sections. The width can be represented by $7 - x$.

2. Write a function model for the area of the garden.

   Substitute the values for the length and width into the formula $A = lw$ to calculate the area.

$A = lw$	Area formula for a rectangle
$A = (x)(7 - x)$	Substitute x for l and $7 - x$ for w.
$A = 7x - x^2$	Distribute.

   The area of the garden can be modeled by the function $A = 7x - x^2$.

3. Use a graphing calculator to generate a table of data for different values of x.

   Follow the steps appropriate to your calculator model.

   On a TI-83/84:

   Step 1: Press [Y=]. At Y_1, use your keypad to enter the function. Use [X, T, θ, n] for x and [x^2] for any exponents.

   Step 2: Press [GRAPH]. Press [WINDOW] to adjust the graph's axes.

   Step 3: Press [2ND][GRAPH] to display a table of values.

(*continued*)

On a TI-Nspire:

Step 1: Press [home]. Arrow down to the graphing icon, the second icon from the left, and press [enter].

Step 2: Enter the function to the right of "*f1*(*x*) =" and press [enter].

Step 3: To adjust the *x*- and *y*-axis scales on the window, press [menu] and select 4: Window and then 1: Window Settings. Enter each setting as needed. Tab to "OK" and press [enter].

Step 4: To see a table of values, press [menu] and scroll down to 2: View and 9: Show Table. (For some models, press [menu] and select 7: Table, then 1: Split-screen Table.)

4. Use the table of values to determine the maximum value(s) of x.

   The maximum value of the function occurs when x = 3.5, but since we must use complete fence sections, use the integers on either side of 3.5: $x = 3$ and $x = 4$.

5. Use the results of step 4 to determine the maximum area of the garden.

   $A = 12$ at both $x = 3$ and $x = 4$. Multiply 12 by the squared length of the individual 3-foot fence sections ($3^2 = 9$) to find the maximum area.

   The maximum area at $x = 3$ or $x = 4$ is 12 fence sections squared, or 108 square feet of garden area ($108 = 12 \bullet 9$).

6. Explain how Caleb should use the fence sections to create a garden with the most area. Refer to the domain of x in your explanation.

   The domain of x is whole fence sections, so it can be represented by the interval [0, 7]. Parts of a fence section cannot be used, so either $x = 3$ or $x = 4$ will give the largest area possible given the constraint of the domain. Both values of x give the same dimensions for the garden. That is, either 3 fence sections by 4 fence sections or 4 fence sections by 3 fence sections gives 108 square feet.

   $$108 = 9 \bullet 12 = 3^2 \bullet 12 = 3^2 \bullet 4 \bullet 3 = 3^2 \bullet 3 \bullet 4$$