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Study Guide and Intervention

Writing Quadratic Functions

Example 1 **Write a function rule.**

Write an equation for the function.

x	y
1	1
2	9
3	23
4	43
5	69

Solution

Step 1 **Determine the finite differences.**

x	y	
1	1	
2	9	$\Delta y = 9 - 1 = 8$
3	23	$\Delta y = 23 - 9 = 14$
4	43	$\Delta y = 43 - 23 = 20$
5	69	$\Delta y = 69 - 43 = 26$

$\Delta x = 1 - 0 = 1$
$\Delta x = 2 - 1 = 1$
$\Delta x = 3 - 2 = 1$
$\Delta x = 4 - 3 = 1$

Step 2 **Determine whether or not the differences are constant.**

$\Delta x = 1$, so they are constant
Δy is not constant

Step 3 **Determine whether or not the second finite differences in successive y-values are constant.**

$\Delta y = 9 - 1 = 8$
$\Delta y = 23 - 9 = 14$
$\Delta y = 43 - 23 = 20$
$\Delta y = 69 - 43 = 26$

$\Delta^2 y = 14 - 8 = 6$
$\Delta^2 y = 20 - 14 = 6$
$\Delta^2 y = 26 - 20 = 6$

The second differences are all equal to 6 and are constant.

Step 4 **Calculate *a, b,* and *c* for the quadratic function $f(x) = ax^2 + bx + c$**

The second finite difference is 2a, so 2a = 6 and a = 3.

The first difference between x = 0 and x = 1 is equal to a + b, so a + b = 2. Since a = 3, b must equal -1.

Since the second finite difference is 6, and the first finite difference between x = 0 and x = 1 is found by subtracting 6 from the first finite difference between x = 1 and x = 2, 8, then the finite difference becomes 2 (8 – 6 = 2). Therefore, 1 – c = 2; c = -1.

Step 5 **Write the function with the values for a, b, and c.**

$f(x) = 3x^2 - x - 1$

Exercises

For questions 1-3, use finite differences to determine if the data sets represent linear, exponential, quadratic, or other type of function.

1.

x	$y = f(x)$
1	5
2	11
3	21
4	35
5	53

2.

x	$y = f(x)$
1	5
2	9
3	16
4	29
5	52

3.

x	$y = f(x)$
1	5
2	12
3	31
4	68
5	129

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Writing Quadratic Functions (cont.)

Exercises

For questions 4-5, the data sets shown in the tables represent quadratic functions. Use finite differences to determine the values a, b, and c and then write the function in standard form.

4.

x	$y = f(x)$
0	7
1	10
2	19
3	34

5.

x	$y = f(x)$
0	–1
1	5
2	19
3	41

For questions 6-8, the data sets shown in the tables represent quadratic functions. Use finite differences to determine f(0), the values a, b, and c and then write the function in standard form.

6.

x	$y = f(x)$
0	?
1	–1
2	5
3	13
4	23

7.

x	$y = f(x)$
0	?
1	3
2	16
3	41
4	78

8.

x	$y = f(x)$
0	?
1	–9
2	–8
3	–1
4	12

9. Using the pattern of second differences, determine the number of dots that would appear in the 5th figure.

FIGURE NUMBER, n	1	2	3	4	5	n
NUMBER OF DOTS, $D(n)$	1	6	15	28		

10. Write a quadratic function to represent the relationship between n and D(n).