Study Guide and Intervention
Modeling Cubic Functions

Example 1 Write a function rule.

Write an equation for the function.

LEVELS, x	PROCESS	NUMBER OF CANS, y
1	1	1
2	1 + 4	5
3	1 + 4 + 9	14
4	1 + 4 + 9 + 16	30
5	1 + 4 + 9 + 16 + 25	55
6	1 + 4 + 9 + 16 + 25 + 36	91

Solution

Step 1 Calculate the finite differences.

	LEVELS, x	PROCESS	NUMBER OF CANS, y			
	0	0	0			
$\Delta x = 1 - 0 = 1$				+1		
	1	1	1		+3	
$\Delta x = 2 - 1 = 1$				+4		+2
	2	1 + 4	5		+5	
$\Delta x = 3 - 2 = 1$				+9		+2
	3	1 + 4 + 9	14		+7	
$\Delta x = 4 - 3 = 1$				+16		+2
	4	1 + 4 + 9 + 16	30		+9	
$\Delta x = 5 - 4 = 1$				+25		+2
	5	1 + 4 + 9 + 16 + 25	55		+11	
$\Delta x = 6 - 5 = 1$				+36		
	6	1 + 4 + 9 + 16 + 25 + 36	91			

Step 2 Use the finite differences to calculate the values of a, b, c, and d in the cubic function rule $f(x) = ax^3 + bx^2 + cx + d$.

$$\Delta^3 y = 2,\ 6a = 2;\ a = \frac{1}{3}$$

$$\Delta^2 y = 3,\ 6a + 2b = 3;\ 2 + 2b = 3;\ 2b = 1;\ b = \frac{1}{2}$$

$$\Delta y = 1,\ a + b + c = 1;\ \frac{1}{3} + \frac{1}{2} + c = 1;\ c = \frac{1}{6}$$

$$y\text{-int} = d = 0$$

Step 3 Write the cubic function rule with the values of a, b, c, and d:

$$f(x) = \frac{1}{3}x^3 + \frac{1}{2}x^2 + \frac{1}{6}x$$

Exercises

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

1.

x	y
0	3
1	6
2	12
3	24
4	48
5	96

2.

x	y
0	2.25
1	8.75
2	15.25
3	21.75
4	28.25
5	34.75

3.

x	y
0	20
1	50
2	125
3	312.5
4	781.25
5	1953.125

Study Guide and Intervention
Writing Quadratic Functions (cont.)

Exercises

For questions 4-6, use finite differences to determine the function that best models the data.

4.

x	y
0	–1
1	0
2	11
3	50
4	135
5	284

5.

x	y
0	0
1	14
2	72
3	198
4	416
5	750

6.

x	y
0	1
1	6
2	15
3	31
4	57
5	96

For questions 7 - 9, use the following information.

HEIGHT OF BOX (INCHES), x	1	2	3	4	5	x
VOLUME OF BOX (CUBIC INCHES), V	28	176	540	1,216	2,300	

7. Write a cubic function to represent the relationship between x and V.

8. Determine the volume of a box with a height of 6 inches.

9. What would be the volume of a box with a height of 2.5 inches?