GUIDED PRACTICE

Vocabulary Check ✓

1. Describe what first-order differences and second-order differences are.

Concept Check ✓

2. How many points do you need to determine a quartic function?
3. Why can't you use finite differences to find a model for the data in Example 4?

Skill Check ✓

4. Write the cubic function whose graph passes through (3, 0), (−1, 0), (−2, 0), and (1, 2).

Show that the *n*th-order finite differences for the given function of degree *n* are nonzero and constant.

5. $f(x) = 5x^2 - 2x + 1$
6. $f(x) = x^3 + x^2 - 1$
7. $f(x) = x^4 + 2x$
8. $f(x) = 2x^3 - 12x^2 - 5x + 3$

Use finite differences to determine the degree of the polynomial function that will fit the data.

9.

x	1	2	3	4	5	6
$f(x)$	−1	3	3	5	15	39

10.

x	1	2	3	4	5	6
$f(x)$	0	8	12	12	8	0

Find a polynomial function that fits the data.

11.

x	1	2	3	4	5	6
$f(x)$	6	15	22	21	6	−29

12.

x	1	2	3	4	5	6
$f(x)$	−1	−4	−3	8	35	84

13. GEOMETRY CONNECTION Find a polynomial function that gives the number of diagonals of a polygon with *n* sides.

Number of sides, n	3	4	5	6	7	8
Number of diagonals, d	0	2	5	9	14	20

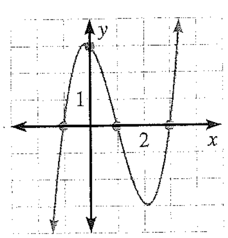
PRACTICE AND APPLICATIONS

STUDENT HELP

Extra Practice to help you master skills is on p. 949.

WRITING CUBIC FUNCTIONS **Write the cubic function whose graph is shown.**

14.



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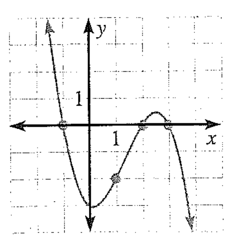
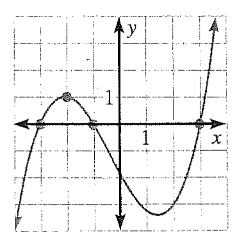


16.



FINDING A CUBIC MODEL **Write a cubic function whose graph passes through the given points.**

17. (−1, 0), (−2, 0), (0, 0), (1, −3)
18. (3, 0), (2, 0), (−3, 0), (1, −1)
19. (1, 0), (3, 0), (−2, 0), (2, 1)
20. (−1, 0), (−4, 0), (4, 0), (0, 3)
21. (3, 0), (2, 0), (−1, 0), (1, 4)
22. (0, 0), (−3, 0), (5, 0), (−2, 3)

STUDENT HELP

HOMEWORK HELP
Example 1: Exs. 14–22
Example 2: Exs. 23–31, 44, 45
Example 3: Exs. 32–43, 46
Example 4: Exs. 47–49

FINDING FINITE DIFFERENCES **Show that the *n*th-order differences for the given function of degree *n* are nonzero and constant.**

23. $f(x) = x^2 - 3x + 7$ **24.** $f(x) = 2x^3 - 5x^2 - x$ **25.** $f(x) = -x^3 + 3x^2 - 2x - 3$

26. $f(x) = x^4 - 3x^3$ **27.** $f(x) = 2x^4 - 20x$ **28.** $f(x) = -4x^2 + x + 6$

29. $f(x) = -x^4 + 5x^2$ **30.** $f(x) = 3x^3 - 5x^2 - 2$ **31.** $f(x) = -3x^2 + 4x + 2$

FINDING A MODEL **Use finite differences and a system of equations to find a polynomial function that fits the data. You may want to use a calculator.**

32.

x	1	2	3	4	5	6
f(x)	−4	0	10	26	48	76

33.

x	1	2	3	4	5	6
f(x)	17	28	33	32	25	12

34.

x	1	2	3	4	5	6
f(x)	−4	−6	−2	14	48	106

35.

x	1	2	3	4	5	6
f(x)	−2	−6	−6	4	30	78

36.

x	1	2	3	4	5	6
f(x)	−3	−8	−15	−21	−23	−18

37.

x	1	2	3	4	5	6
f(x)	2	20	58	122	218	352

38.

x	1	2	3	4	5	6
f(x)	−5	0	9	16	15	0

39.

x	1	2	3	4	5	6
f(x)	−2	1	−4	−5	10	53

40.

x	1	2	3	4	5	6
f(x)	20	−2	−4	2	4	−10

41.

x	1	2	3	4	5	6
f(x)	2	−5	−4	−1	−2	−13

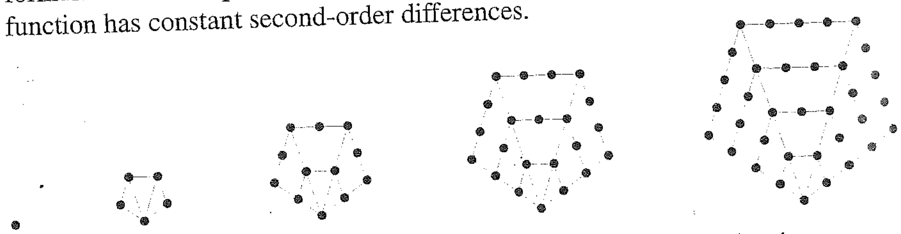
42.

x	1	2	3	4	5	6
f(x)	26	−4	−2	2	2	16

43.

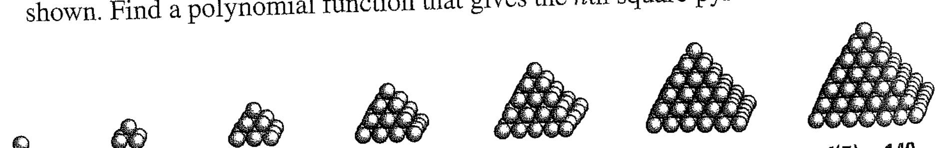
x	1	2	3	4	5	6
f(x)	0	6	2	6	12	−10

44. PENTAGONAL NUMBERS The dot patterns show pentagonal numbers. A formula for the *n*th pentagonal number is $f(n) = \frac{1}{2}n(3n - 1)$. Show that this function has constant second-order differences.



45. HEXAGONAL NUMBERS A formula for the *n*th hexagonal number is $f(n) = n(2n - 1)$. Show that this function has constant second-order differences.

46. SQUARE PYRAMIDAL NUMBERS The first six square pyramidal numbers are shown. Find a polynomial function that gives the *n*th square pyramidal number.



$f(1) = 1$ $f(2) = 5$ $f(3) = 14$ $f(4) = 30$ $f(5) = 55$ $f(6) = 91$ $f(7) = 140$