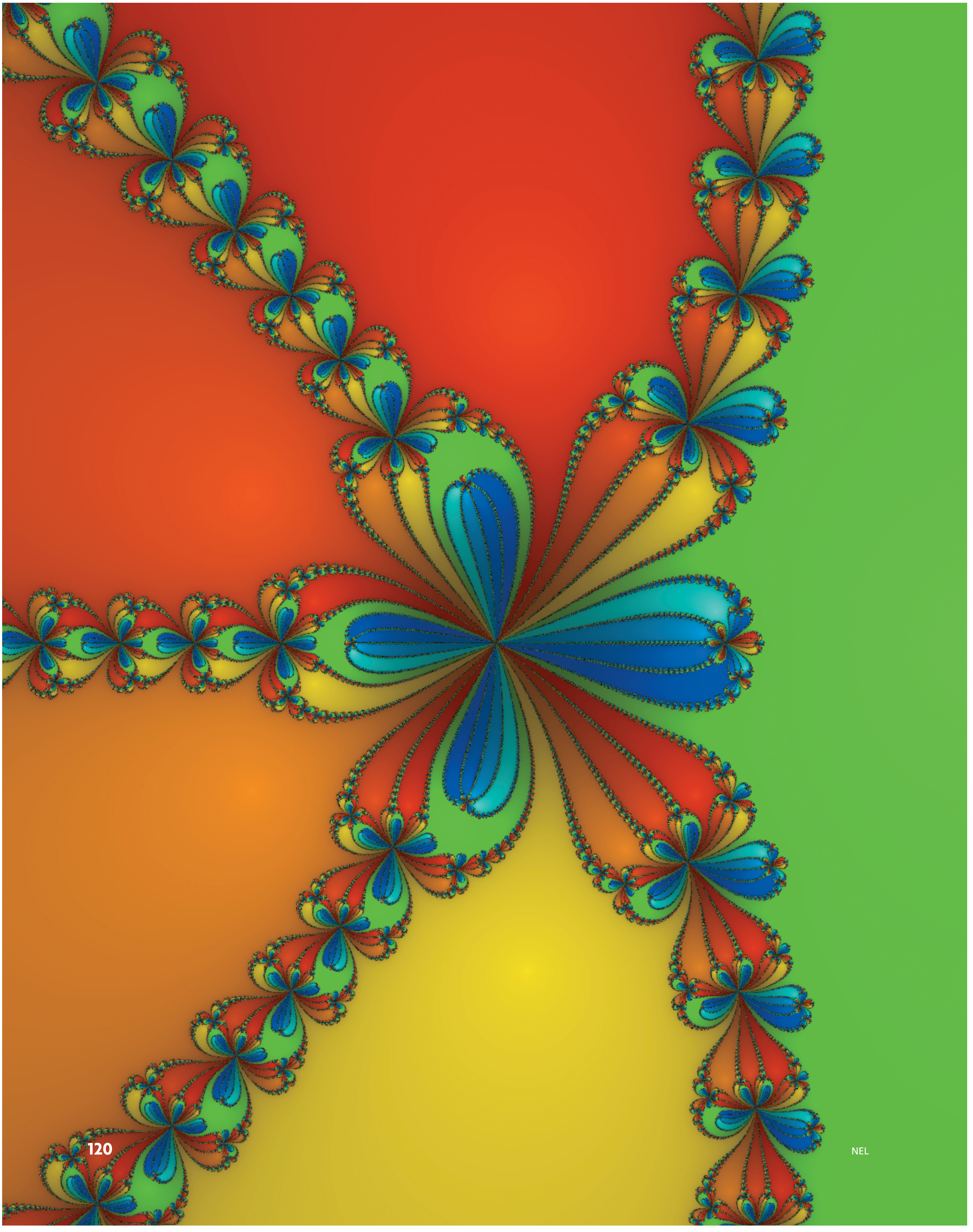
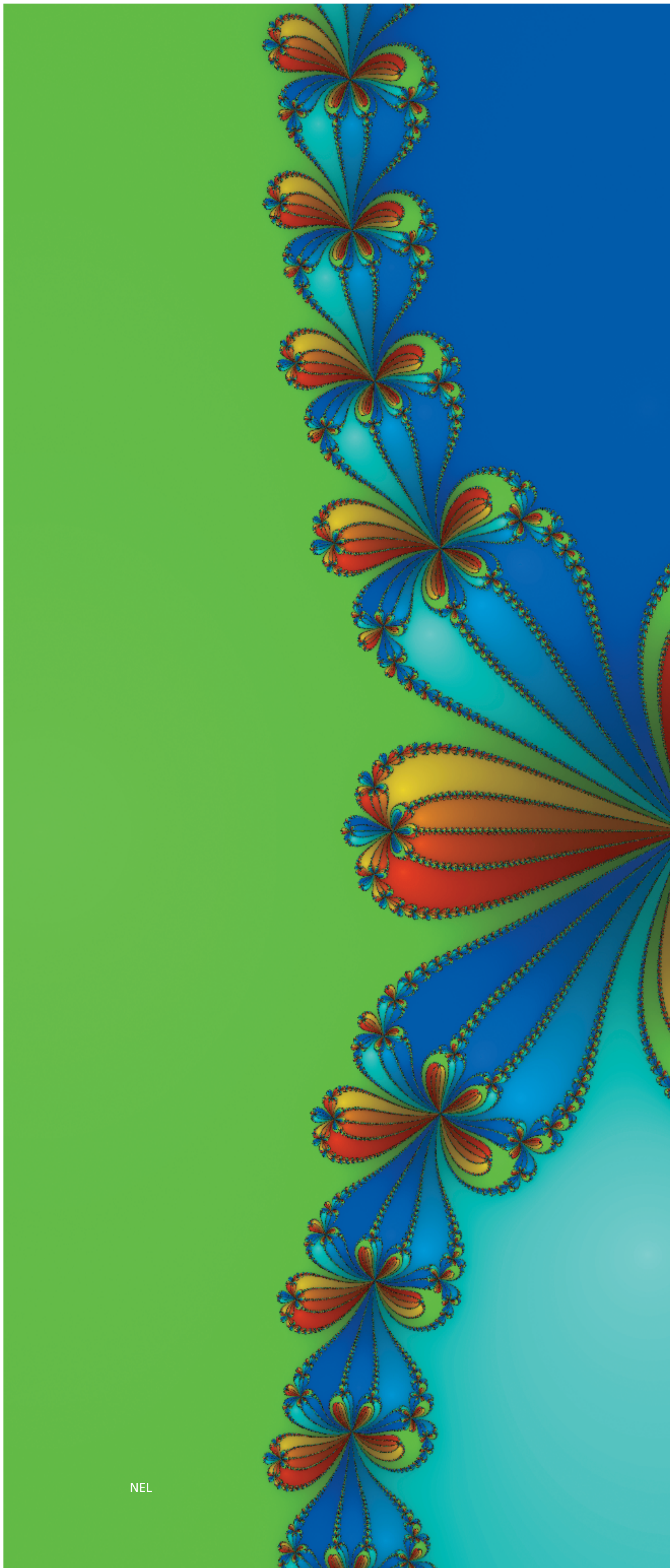




Chapter

3

Polynomial Functions

GOALS

You will be able to

- Identify and describe key characteristics of polynomial functions
- Divide one polynomial by another polynomial
- Factor polynomial expressions
- Solve problems that involve polynomial equations and inequalities graphically and algebraically

? A fractal object displays properties of self-similarity. The fractal shown was created using a computer, the polynomial function $f(z) = 35z^9 - 180z^7 + 378z^5 - 420z^3 + 315z$, and a process called iteration. How can you estimate the number of zeros that this polynomial function has?

3 Getting Started

Study Aid

- For help, see the Review of Essential Skills found at the Nelson Advanced Functions website.

Question	Appendix
1	R-2
2	R-3
3	R-6
4	R-8
5	R-9

SKILLS AND CONCEPTS You Need

1. Expand and simplify each of the following expressions.

a) $2x^2(3x - 11)$
b) $(x - 4)(x + 6)$
c) $4x(2x - 5)(3x + 2)$
d) $(5x - 4)(x^2 + 7x - 8)$

2. Factor each of the following expressions completely.

a) $x^2 + 3x - 28$
b) $2x^2 - 18x + 28$

3. Solve each of the following equations. Round your answer to two decimal places, if necessary.

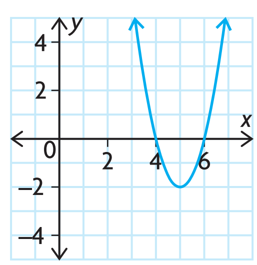
a) $3x + 7 = x - 5$
b) $(x + 3)(2x - 9) = 0$
c) $x^2 + 11x + 24 = 0$
d) $6x^2 + 22x = 8$

4. Describe the transformations that must be applied to $y = x^2$ to create the graph of each of the following functions.

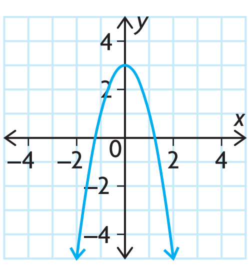
a) $y = \frac{1}{4}(x - 3)^2 + 9$
b) $y = \left(\frac{1}{2}x\right)^2 - 7$

5. Write the equation of each function shown below.

a)



b)



6. Graph each of the following functions.

a) $y = 3(x + 5)^2 - 4$
b) $y = 2x^2 - 12x + 5$

7. Use finite differences to classify each set of data as linear, quadratic, or other.

a)

x	y
−2	56.4
−1	50.6
0	45
1	39.6
2	34.4

b)

x	y
−2	11
−1	5
0	2
1	7
2	13

c)

x	y
−2	2
−1	6
0	18
1	54
2	162

d)

x	y
−2	7
−1	6.5
0	6
1	5.5
2	5

8. Create a concept web that shows the connections between each of the following for the function $f(x) = 3x^2 + 24x + 36$: the y-intercept, factored form, vertex form, axis of symmetry, direction of opening, zeroes, minimum value, value of the discriminant, and translations of the parent function.
On each arrow, write a brief description of the process you would use to obtain the information.

APPLYING What You Know

Examining Patterns

YOU WILL NEED

- graph paper

In the late 18th century, seven-year-old Carl Friedrich Gauss noticed a pattern that allowed him to determine the sum of the numbers from 1 to 100 very quickly. He realized that you could add 1 and 100, and then multiply by half of the largest number (50) to get 5050.

? Are there formulas for calculating the sum of the first n natural numbers and the sums of consecutive squares of natural numbers?

A. Copy and complete each table, then calculate the **finite differences** until they are constant.

B. Graph each relationship in part A on graph paper.

C. Use your graphs and finite differences to make a **conjecture** about the type of model that would fit the data in each table (linear, quadratic, or other).

D. Use a graphing calculator and the regression operation to verify your conjectures in part C.

E. Use the equations you found in part D to calculate the sum of the first five natural numbers and the sum of the squares of the first five natural numbers.

F. Verify that your calculations in part E are correct by comparing your sums with the values in both tables when $n = 5$.

G. Use the equation you found to verify that the sum of the natural numbers from 1 to 100 is 5050.

H. Use the equation you found to determine the sum of the squares of the natural numbers from 1 to 100.

Table 1

n	Sum up to n ($f(n)$)
1	1
2	$1 + 2 = 3$
3	$1 + 2 + 3 = 6$
4	
5	
6	
7	
8	
9	
10	

Table 2

n	Sum of the squares up to n^2 ($g(n)$)
1	1
2	$1^2 + 2^2 = 5$
3	$1^2 + 2^2 + 3^2 = 14$
4	
5	
6	
7	
8	
9	
10	