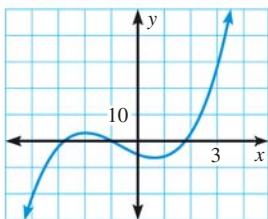
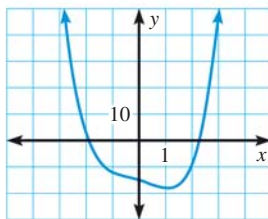


CLASSIFYING ZEROS Determine the numbers of positive real zeros, negative real zeros, and imaginary zeros for the function with the given degree and graph. Explain your reasoning.

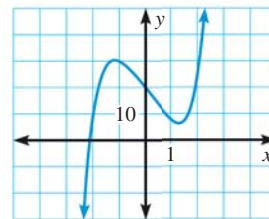
53. Degree: 3



54. Degree: 4



55. Degree: 5



CHALLENGE Show that the given number is a zero of the given function but that the conjugate of the number is *not* a zero.

56. $f(x) = x^3 - 2x^2 + 2x + 5i$; $2 - i$

57. $g(x) = x^3 + 2x^2 + 2i - 2$; $-1 + i$

58. Explain why the results of Exercises 56 and 57 do not contradict the complex conjugate theorem on page 380.

PROBLEM SOLVING

EXAMPLE 6

on p. 383
for Exs. 59–62

59. **BUSINESS** For the 12 years that a grocery store has been open, its annual revenue R (in millions of dollars) can be modeled by the function

$$R = 0.0001(-t^4 + 12t^3 - 77t^2 + 600t + 13,650)$$

where t is the number of years since the store opened. In which year(s) was the revenue \$1.5 million?

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60. **ENVIRONMENT** From 1990 to 2003, the number N of inland lakes in Michigan infested with zebra mussels can be modeled by the function

$$N = -0.028t^4 + 0.59t^3 - 2.5t^2 + 8.3t - 2.5$$

where t is the number of years since 1990. In which year did the number of infested inland lakes first reach 120?

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Pipe clogged with zebra mussels

61. **PHYSIOLOGY** A study group found that a person's score S on a step-climbing exercise test was related to his or her amount of hemoglobin x (in grams per 100 milliliters of blood) by this function:

$$S = -0.015x^3 + 0.6x^2 - 2.4x + 19$$

Given that the normal range of hemoglobin is 12–18 grams per 100 milliliters of blood, what is the most likely amount of hemoglobin for a person who scores 75?

62. **POPULATION** From 1890 to 2000, the American Indian, Eskimo, and Aleut population P (in thousands) can be modeled by the function

$$P = 0.0035t^3 - 0.235t^2 + 4.87t + 243$$

where t is the number of years since 1890. In which year did the population first reach 722,000?