

GUIDED PRACTICE

Vocabulary Check ✓

1. Complete this statement of the rational zero theorem: If a polynomial function has integer coefficients, then every rational zero of the function has the form $\frac{p}{q}$, where p is a factor of the ? and q is a factor of the ?.

Concept Check ✓

2. For each polynomial function, decide whether you can use the rational zero theorem to find its zeros. Explain why or why not.

a. $f(x) = 6x^2 - 8x + 4$ b. $f(x) = 0.3x^2 + 2x + 4.5$ c. $f(x) = \frac{1}{4}x^2 - x + \frac{7}{8}$

3. Describe a method you can use to shorten the list of possible rational zeros when using the rational zero theorem.

Skill Check ✓

List the possible rational zeros of f using the rational zero theorem.

4. $f(x) = x^3 + 14x^2 + 41x - 56$

5. $f(x) = x^3 - 17x^2 + 54x + 72$

6. $f(x) = 2x^3 + 7x^2 - 7x + 30$

7. $f(x) = 5x^4 + 12x^3 - 16x^2 + 10$

Find all the real zeros of the function.

8. $f(x) = x^3 - 3x^2 - 6x + 8$

9. $f(x) = x^3 + 4x^2 - x - 4$

10. $f(x) = 2x^3 - 5x^2 - 2x + 5$

11. $f(x) = 2x^3 - x^2 - 15x + 18$

12. $f(x) = x^3 + 4x^2 + x - 6$

13. $f(x) = x^3 + 5x^2 - x - 5$

14. **CRAFTS** Suppose you have 18 cubic inches of wax and you want to make a candle in the shape of a pyramid with a square base. If you want the height of the candle to be 3 inches greater than the length of each side of the base, what should the dimensions of the candle be?

PRACTICE AND APPLICATIONS

STUDENT HELP

▶ **Extra Practice**
to help you master
skills is on p. 948.

LISTING RATIONAL ZEROS List the possible rational zeros of f using the rational zero theorem.

15. $f(x) = x^4 + 2x^2 - 24$

16. $f(x) = 2x^3 + 5x^2 - 6x - 1$

17. $f(x) = 2x^5 + x^2 + 16$

18. $f(x) = 2x^3 + 9x^2 - 53x - 60$

19. $f(x) = 6x^4 - 3x^3 + x + 10$

20. $f(x) = 4x^3 + 5x^2 - 3$

21. $f(x) = 8x^2 - 12x - 3$

22. $f(x) = 3x^4 + 2x^3 - x + 15$

USING SYNTHETIC DIVISION Use synthetic division to decide which of the following are zeros of the function: 1, -1, 2, -2.

23. $f(x) = x^3 + 7x^2 - 4x - 28$

24. $f(x) = x^3 + 5x^2 + 2x - 8$

25. $f(x) = x^4 + 3x^3 - 7x^2 - 27x - 18$

26. $f(x) = 2x^4 - 9x^3 + 8x^2 + 9x - 10$

27. $f(x) = x^4 + 3x^3 + 3x^2 - 3x - 4$

28. $f(x) = 3x^4 + 3x^3 + 2x^2 + 5x - 10$

29. $f(x) = x^3 - 3x^2 + 4x - 12$

30. $f(x) = x^3 + x^2 - 11x + 10$

31. $f(x) = x^6 - 2x^4 - 11x^2 + 12$

32. $f(x) = x^5 - x^4 - 2x^3 - x^2 + x + 2$

STUDENT HELP

▶ HOMEWORK HELP

Example 1: Exs. 15–32

Example 2: Exs. 33–58

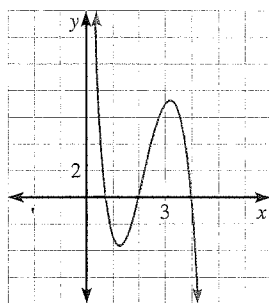
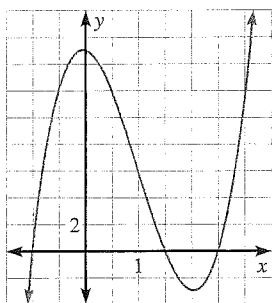
Example 3: Exs. 59–64

FINDING REAL ZEROS Find all the real zeros of the function.

33. $f(x) = x^3 - 8x^2 - 23x + 30$ 34. $f(x) = x^3 + 2x^2 - 11x - 12$
 35. $f(x) = x^3 - 7x^2 + 2x + 40$ 36. $f(x) = x^3 + x^2 - 2x - 2$
 37. $f(x) = x^3 + 72 - 5x^2 - 18x$ 38. $f(x) = x^3 + 9x^2 - 4x - 36$
 39. $f(x) = x^4 - 5x^3 + 7x^2 + 3x - 10$ 40. $f(x) = x^4 + x^3 + x^2 - 9x - 10$
 41. $f(x) = x^4 + x^3 - 11x^2 - 9x + 18$ 42. $f(x) = x^4 - 3x^3 + 6x^2 - 2x - 12$
 43. $f(x) = x^5 + x^4 - 9x^3 - 5x^2 - 36$ 44. $f(x) = x^5 - x^4 - 7x^3 + 11x^2 - 8x + 12$

ELIMINATING POSSIBLE ZEROS Use the graph to shorten the list of possible rational zeros. Then find all the real zeros of the function.

45. $f(x) = 4x^3 - 12x^2 - x + 15$ 46. $f(x) = -3x^3 + 20x^2 - 36x + 16$



FINDING REAL ZEROS Find all the real zeros of the function.

47. $f(x) = 2x^3 + 4x^2 - 2x - 4$ 48. $f(x) = 2x^3 - 5x^2 - 14x + 8$
 49. $f(x) = 2x^3 - 5x^2 - x + 6$ 50. $f(x) = 2x^3 + x^2 - 50x - 25$
 51. $f(x) = 2x^3 - x^2 - 32x + 16$ 52. $f(x) = 3x^3 + 12x^2 + 3x - 18$
 53. $f(x) = 2x^4 + 3x^3 - 3x^2 + 3x - 5$ 54. $f(x) = 3x^4 + 8x^3 + 14x^2 - 25$
 55. $f(x) = 2x^4 + x^3 - x^2 - x - 1$ 56. $f(x) = 3x^4 + 11x^3 + 11x^2 + x - 2$
 57. $f(x) = 2x^5 + x^4 - 32x - 16$ 58. $f(x) = 3x^5 + x^4 - 243x - 81$

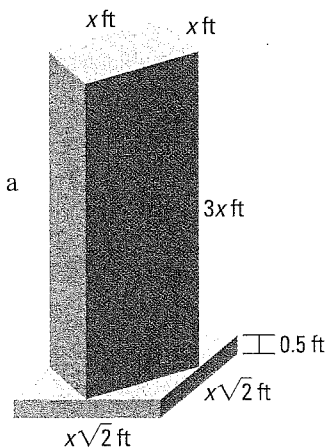
59. **HEALTH PRODUCT SALES** From 1990 to 1994, the mail order sales of health products in the United States can be modeled by

$$S = 10t^3 + 115t^2 + 25t + 2505$$

where S is the sales (in millions of dollars) and t is the number of years since 1990. In what year were about \$3885 million of health products sold? (*Hint*: First substitute 3885 for S , then divide both sides by 5.)

60. **MONUMENTS** You are designing a monument and a base as shown at the right. You will use 90 cubic feet of concrete for both pieces. Find the value of x .

61. **MOLTEN GLASS** At a factory, molten glass is poured into molds to make paperweights. Each mold is a rectangular prism whose height is 3 inches greater than the length of each side of the square base. A machine pours 20 cubic inches of liquid glass into each mold. What are the dimensions of the mold?



Ex. 60

STUDENT HELP

INTERNET
HOMEWORK HELP
 Visit our Web site
www.mcdougallittell.com
 for help with problem
 solving in Ex. 60.

FOCUS ON APPLICATIONS



REAL LIFE
MOLTEN GLASS
 In order for glass to melt so that it can be poured into a mold, it must be heated to temperatures between 1000°C and 2000°C.