THINK AND DISCUSS

1. Explain how to recognize the multiplicity of a root of a polynomial in factored form.

2. GET ORGANIZED Copy and complete the graphic organizer. Give roots that satisfy each theorem and write a polynomial equation that has those roots.

Know it! Note

Theorem	Roots	Polynomial
Rational Root Theorem		
Irrational Root Theorem		

4-1 Exercises

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Homework Help

GUIDED PRACTICE

1. Vocabulary Explain how *multiplicity* is related to the word *multiple*.

SEE EXAMPLE 1 Solve each polynomial equation by factoring.

2. $2x^4 + 16x^3 + 32x^2 = 0$ **3.** $x^4 - 37x^2 + 36 = 0$ **4.** $4x^7 - 28x^6 = -48x^5$

5. $3x^4 + 11x^3 = 4x^2$ **6.** $2x^3 - 12x^2 = 32x - 192$ **7.** $x^4 + 100 = 29x^2$

SEE EXAMPLE 2 Identify the roots of each equation. State the multiplicity of each root.

8. $2x^5 + 12x^4 + 16x^3 - 12x^2 - 18x = 0$ **9.** $x^6 - 12x^4 + 48x^2 - 64 = 0$

SEE EXAMPLE 3 **10. Storage** A cedar chest has a length that is 3 feet longer than its width and a height that is 1 foot longer than its width. The volume of the chest is 30 cubic feet. What is the width?

SEE EXAMPLE 4 Identify all of the real roots of each equation.

11. $x^3 + 6x^2 - 5x - 30 = 0$ **12.** $3x^3 - 18x^2 - 9x + 132 = 0$

13. $2x^3 - 42x + 40 = 0$ **14.** $x^4 - 9x^2 + 20 = 0$

PRACTICE AND PROBLEM SOLVING

Independent Practice

For Exercises	See Example
15–20	1
21–22	2
23	3
24–26	4

Solve each polynomial equation by factoring.

15. $x^3 + 3x^2 - 9x = 27$ **16.** $4x^5 - 8x^3 + 4x = 0$ **17.** $10x^3 - 640x = 0$

18. $x^4 - 12x^2 = -36$ **19.** $2x^3 - 5x^2 - 4x + 10 = 0$ **20.** $4x^3 + 7x^2 - 5x = 6$

Identify the roots of each equation. State the multiplicity of each root.

21. $8x^5 - 192x^4 + 1536x^3 - 4096x^2 = 0$ **22.** $x^4 + 2x^3 - 11x^2 - 12x + 36 = 0$

23. Measurement An open box is to be made from a square piece of material with a side length of 10 inches by cutting equal squares from the corners and turning up the sides. What size of square would you cut out if the volume of the box must be 48 cubic inches?