

3) Find the zeros and multiplicity of $f(x) = (2x-3)^3(x+4)^2$

degree 5
odd/positive

$x = -4$, mult 2
bounce

$x = \frac{3}{2}$, mult 3
through

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13. $x^2 + 4x + 3$	14. $x^2 - 2x + 2$	Answers to Section 6.3 HW, p. 324	
15. $x^2 - 11x + 37, R -128$	16. $x^2 + 2x + 5$		
17. $x^2 - x - 6$	18. $-2x^2 + 9x - 19, R 40$	Period 6	
19. $x + 1, R 4$	20. $3x^2 + 8x - 3$		
21. $x^2 - 3x + 9$	22. $6x - 2, R -4$		
23. $y = (x + 1)(x + 3)(x - 2)$			
24. $y = (x + 3)(x - 4)(x - 3)$			
25. $\ell = x + 3$ and $h = x$			
26. 18	27. 0	28. 0	29. 12
30. 168	31. 10	32. 51	33. 0

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27) $a = -2$ $P(-2) =$

$$\begin{array}{r|rrrr} -2 & 1 & 4 & 4 & 0 \\ & \downarrow & -2 & -4 & 0 \\ \hline & 1 & 2 & 0 & 0 \end{array}$$

$P(-2) = 0$

$P(-2) = (-2)^3 + 4(-2)^2 + 4(-2) = 0$

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47. yes 48. yes 49. yes 50. no
 51. no
 52. $x^3 - x^2 + 1$
 53. $x^3 - 2x^2 - 2x + 4$, R -35
 54. $x^3 - 2x^2 - x + 6$
 55. $x^3 - 4x^2 + x$
 61. R 13 62. J 64. $x = -1, 1, 7$

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Answers for Lesson 6-5 Exercises **Period 4**
 1. $\pm 1, \pm 2; 1$
 2. $\pm 1, \pm 2, \pm 3, \pm 6; 1, -2, -3$
 3. $\pm 1, \pm 2, \pm 4; -1$
 4. $\pm \frac{1}{2}, \pm 1, \pm 2, \pm 4, \pm 8$ 7. $2, \pm i\sqrt{5}$ 8. $5, \pm i\sqrt{7}$
 5. $\pm 1, \pm 2, \pm 4, \pm 8, \pm 16$ 9. $-3, 1, \frac{7}{2}$ 10. $-5, \frac{1 \pm \sqrt{3}}{2}$
 11. $\pm \frac{1}{2}, \pm 3$ 12. $1, -2, \frac{1 \pm \sqrt{7}}{3}$
 13. $-\sqrt{5}, \sqrt{13}$ 14. $4 + \sqrt{6}, -\sqrt{3}$
 15. $1 + \sqrt{10}, 2 - \sqrt{2}$ 16. $1 - i, 5i$
 17. $2 - 3i, -6i$ 18. $4 + i, 3 - 7i$

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19. $x^3 - x^2 + 9x - 9 = 0$ 20. $x^3 + 3x^2 - 8x + 10 = 0$
 21. $x^3 - 2x^2 + 16x - 32 = 0$ 22. $x^3 - 3x^2 - 8x + 30 = 0$
 23. $x^3 - 6x^2 + 4x - 24 = 0$ 24. $x^3 - x^2 + 2 = 0$
 25. $\pm \frac{1}{12}, \pm \frac{1}{6}, \pm \frac{1}{4}, \pm \frac{1}{2}, \pm \frac{1}{3}, \pm \frac{2}{3}, \pm \frac{3}{4}, \pm 1, \pm \frac{3}{2}, \pm 2, \pm 3, \pm 6; \frac{1}{2}, \frac{3}{2}, \frac{2}{3}$

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Section 6.4
Solving Polynomial Equations

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Solve with a calculator.

$$x^3 - 19x = -2x^2 + 20$$

Get into $y =$ _____

Graph

Set up Window

How do you find the zeros?

Round to two decimal places

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1) Solve by factoring: $x^4 - 6x^2 - 27 = 0$

Factors of -27

Add to -6

-9 and +3

$$(x^2 - 9)(x^2 + 3) = 0$$

$$(x-3)(x+3)(x^2+3) = 0$$

$$x-3=0 \quad x+3=0 \quad x^2+3=0$$

$$x=3 \quad x=-3 \quad \sqrt{x^2} = \sqrt{-3}$$

$$x = \pm i\sqrt{3}$$

Step 1:

Step 2:

Step 3:

Step 4:

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2) Solve by factoring: $x^4 - 4x^2 - 45 = 0$
 $(x^2 - 9)(x^2 + 5) = 0$
 $x^2 - 9 = 0$ $x^2 + 5 = 0$
 $\sqrt{x^2} = \sqrt{9}$ $x = \pm 3$ $\sqrt{x^2} = \sqrt{-5}$
 $x = \pm i\sqrt{5}$

3) Solve by factoring: $x^4 - 49 = 0$
 F. of -49 , A. to 0
 $(x^2 - 7)(x^2 + 7) = 0$

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4) $x^3 + 3x^2 - 4x - 12 = 0$
 $x^2(x+3) - 4(x+3) = 0$ Step 1:
 $(x+3)(x^2 - 4) = 0$ Step 2:
 $x+3 = 0$ $x^2 - 4 = 0$
 $x = -3$ $x^2 = 4$
 $x = \pm 2$
 Step 3:

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Sum and Differences of Cubes

Properties	Sum and Difference of Cubes
	$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
	$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

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$$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

Example: Factor $x^3 + 8$

$$a = x \quad (x+2)(x^2 - 2x + 4)$$

$$b = 2$$

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

Example: Factor $x^3 - 27$

$$a = x \quad (x-3)(x^2 + 3x + 9)$$

$$b = 3$$

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Factor

1) $x^3 + 125$

2) $8x^3 - 27$

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Solve: $x^3 - 8 = 0$

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Homework

p. 330
 (3-7 odd, 13-25 odds,
44-49 all, 54-59)

solve by graphing.

GCF

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⑦ $4x^3 = 4x^2 + 3x$

$4x^3 - 4x^2 - 3x = 0$

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Practice by Example Solve each equation by graphing. Check your answers.

Examples 1 and 2 (pages 322 and 323)

1. $4x^2 - 4x = -10$ **2.** $3x^2 - 6x^2 - 9x = 0$ **3.** $4x^2 - 8x^2 + 4x = 0$

4. $6x^2 - 48x$ **5.** $x^3 + 3x^2 - 2x = 0$ **6.** $2x^3 = 5x^2 + 7x$

7. $4x^3 = 4x^2 + 3x$ **8.** $2x^4 - 5x^3 - 3x^2 = 0$ **9.** $x^2 - 8x + 7 = 0$

10. Savings The polynomial $1600x^3 + 1200x^2 + 800x$ represents your savings, with interest, from a summer job after three years. The annual interest rate equals $x = 1$. Find the interest rate needed so that you will have \$4000 at the end of three years.

11. Geometry The volume V of a container is modeled by the function $V(x) = x^3 - 3x^2 - 4x$. Let x , $x + 1$, and $x - 4$ represent the width, the length, and the height respectively. The container has a volume of 20 m^3 . Find the container's dimensions.

Example 3 (page 328) **Factor each expression.**

12. $x^3 + 64$ **13.** $x^3 - 1000$ **14.** $125x^3 - 27$

Example 4 (page 329) **Solve each equation.**

15. $x^3 - 27 = 0$ **16.** $x^3 + 64 = 0$ **17.** $x^3 - 125 = 0$

18. $2x^3 + 2 = 0$ **19.** $8x^3 - 1 = 0$ **20.** $64x^3 + 8 = 0$

Example 5 (page 329) **Factor each expression.**

21. $x^4 - 8x^2 + 7$ **22.** $x^4 + 8x^2 - 20$ **23.** $x^4 - 3x^2 + 12$

24. $x^4 - 5x^2 + 4$ **25.** $x^4 - 1$ **26.** $4x^4 - 6x^2 + 2$

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Solve each equation.

42. $125x^3 + 216 = 0$	43. $81x^3 - 192 = 0$	44. $x^4 - 64 = 0$
45. $-2x^4 + 46x^2 = -100$	46. $27 = -x^4 - 12x^2$	47. $x^5 - 5x^3 + 4x = 0$
48. $x^4 - 100 = 0$	49. $5x^3 = 5x^2 + 12x$	50. $64 - x^3 = 0$
51. $x^3 - 6x^2 + 6x = 0$	52. $2x^3 = 5x^2 + 12x$	53. $3x^4 + 12x^2 - 15 = 0$
54. $x^3 + 3x^2 - 4x - 12 = 0$	55. $x^3 - 5x^2 + 3x + 9 = 0$	
56. $4x^3 - 16x^2 + 12x = 0$	57. $2x^4 - 14x^3 + 12x^2 = 0$	
58. $4x^4 - 2x^2 - 4 = 2$	59. $9x^4 - 9x^2 + 2 = 20$	

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