

5.3 Factoring Polynomials

- GCF AC-method Difference of Squares
 Grouping / Punnett Square Cubes Quadratic Formula

Things to remember when factoring polynomials:



- ALWAYS factor out the GCF first... then look at your options.
- After you factor once, you may not be done!! Try to factor any non-linear factors.
- You can solve for x using radicals any time there is only one x term and a number.
- If you have a quadratic you can't use AC on, you can use the quadratic formula.
- You're better at this than you think you are.

Factoring by Grouping or Punnett Square • Factor the following. Then list all solutions.
If all solutions are real, sketch the polynomial.

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|-----------------------------|------------------------------|------------------------------|
| 1. $x^3 - 5x^2 - 9x + 45$ | 2. $x^3 - 2x^2 - 4x + 8$ | 3. $x^3 + 2x^2 + 7x + 14$ |
| 4. $3x^3 - 12x^2 + 2x - 8$ | 5. $5x^3 + 5x^2 + x + 1$ | 6. $2x^3 - 12x^2 + 5x - 30$ |
| 7. $x^4 - 2x^3 - 4x^2 + 8x$ | 8. $x^4 - 5x^3 - 9x^2 + 45x$ | 9. $x^4 + x^3 - 16x^2 - 16x$ |
| 10. $4x^3 - 4x^2 - 9x + 9$ | 11. $16x^3 - 48x^2 - x + 3$ | 12. $9x^3 + 18x^2 - 4x - 8$ |
| 13. $3x^3 + 6x^2 - 4x - 24$ | 14. $3x^3 - x^2 + 3x - 1$ | 15. $x^3 + 7x^2 + 4x + 28$ |
| 16. $-x^3 - 4x^2 + 2x + 8$ | 17. $2x^3 + 8x^2 + 4x = -16$ | 18. $-x^3 - x^2 + 16x + 16$ |

Factoring Quartic Polynomials • Factor completely. List all solutions.
If all solutions are real, sketch the polynomial.

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|--------------------------|----------------------|--------------------------|------------------------|
| 19. $16x^4 - 81$ | 20. $x^4 - 16$ | 21. $x^4 - x^2 - 12$ | 22. $x^4 + 6x^2 + 5$ |
| 23. $x^4 - 10x^2 + 9$ | 24. $x^4 - 5x^2 + 6$ | 25. $x^4 - 10x^2 + 24$ | 26. $x^4 - 10x^2 + 16$ |
| 27. $2x^4 + 16x^2 + 25$ | 28. $-x^4 - x^2 + 6$ | 29. $2x^4 - 200x^2$ | 30. $8x^4 - 18x^2$ |
| 31. $27x^4 - 3x^2$ | 32. $3x^4 - 3$ | 33. $-x^4 - 10x^2 - 21$ | 34. $x^4 + 7x^2 - 18$ |
| 35. $x^4 - 3x^2 = -2x^2$ | 36. $x^4 + 5x^2 = 6$ | 37. $x^4 + 2x^3 = 10x^2$ | 38. $x^2 + 4 = -4x$ |

Factoring the Sum or Difference of Cubes. Factor complexly. Find the solutions. Use the quadratic formula on the quadratic term. No graph necessary.

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|-----------------|-----------------|-------------------|-----------------|
| 39. $x^3 + 512$ | 40. $27x^3 - 1$ | 41. $27x^3 - 216$ | 42. $8x^3 - 27$ |
| 43. $x^3 + 64$ | 44. $2x^3 + 54$ | 45. $2x^3 - 250$ | 46. $4x^3 - 32$ |
| 47. $27x^3 + 1$ | 48. $64x^3 - 1$ | 49. $x^4 - 27x$ | 50. $2x^3 - 54$ |

Factor any way you can. Get all factors. Then get all intercepts. Sketch if all solutions are real.

51. $3x^4 + 12x^2 = 6x$

52. $2x^3 - 5x^2 = 3x$

53. $x^3 - 3x^2 - 9x = -15$

54. $x^3 + 2x - 3x - 6$

55. $x^3 = 8x - 2x^2$

56. $x^4 = 16$

57. $x(x^2 + 8) = 8(x + 1)$

58. $3x^2 = 22x$

59. $-x^3 - x^2 + 9x + 9$

60. $-x^3 + 1 = 2x^2$

61. $x^4 - 2x^3 - 5x^2 + 1$

62. $2x^2 = -6x$

63. $x^3 + 5x^2 = 9$

64. $x^3 + 10x^2 + 24x$

65. $x^3 = 9x$

66. $-x^3 + 4x$

67. $x^5 - x$

68. $-2x^4 + 2x^2$

69. $x^3 + 4x$

70. $x^5 - 6x^3 + 5x$

71. $x^4 - 25$

72. $x^3 + 8x^2 - 4x - 32$

73. $2x^3 + 3x^2 - 4x - 6$

74. $2x^5 - 18x$

Applications:

75. The volume V of a container is 61 in.^3 . The width, the length, and the height are x , $x - 2$, and $x + 3$ respectively. What are the container's dimensions?

76. The volume V of a container is 84 ft^3 . The width, the length, and the height are x , $x + 1$, and $x - 4$ respectively. What are the container's dimensions?

77. The product of three consecutive integers is 720. What are the numbers?

78. The product of three consecutive integers: $n - 1$, n , and $n + 1$ is -336 . What are the integers?

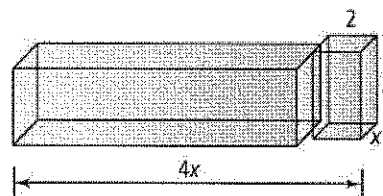
79. The height of a box is 3 cm less than the width. The length is 2 cm less than the width. The volume is 50 cm^3 . What is the width of the box?

80. Your sister is 8 years older than you. Your mother is 25 years older than your sister. The product of all three ages is 18,816. How old is your mother?

81. Your mother is 25 years older than you. Your father is 3 years older than your mother. The product of all three ages is 32,130. How old is your father?

83. Imagine a rectangular block of cheese. You cut a 2-inch wide chunk from the right side. The remaining cheese has a volume of 224 in.^3 .

- What are the dimensions of the new block?
- What are the dimensions of the old block?
- What is the original volume?
- What is the volume of the cut slice?



84. Time is precious from here until the midterm. I don't want to waste class time showing you how to push a few buttons on your calculator (we all have different models) when there are hundreds of videos of how to do it online. Please look online for guides or videos on how to find the maximums/minimums and zeros of a polynomial on YOUR specific calculator. Put the function $y = x^3 - 3x^2 + 2$ and find the zeros, maxes and mins. If you find a helpful video on how to do it, feel free to post it on our Schoology site to share it with the rest of the class!