

3. "False solutions" to a rational or radical equation are also called roots.
4. Factorable polynomial equations can be solved using the property.
5. Discuss/Explain the power property of equality as it relates to rational exponents and properties of reciprocals. Use the equation $(x - 2)^{\frac{2}{3}} = 9$ for your discussion.
6. One factored form of an equation is shown. Discuss/Explain why $x = -8$ and $x = 1$ are not solutions to the equation, and what must be done to find the actual solutions: $2(x + 8)(x - 1) = -16$.

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▸ DEVELOPING YOUR SKILLS

Solve using the zero product property. Be sure each equation is in standard form and factor out any common factors before attempting to solve. Check all answers in the original equation.

7. $22x = x^3 - 9x^2$
8. $x^3 = 13x^2 - 42x$
9. $3x^3 = -7x^2 + 6x$
10. $7x^2 + 15x = 2x^3$
11. $2x^4 - 3x^3 = 9x^2$
12. $-7x^2 = 2x^4 - 9x^3$
13. $2x^4 - 16x = 0$
14. $x^4 + 64x = 0$
15. $x^3 - 4x = 5x^2 - 20$
16. $x^3 - 18 = 9x - 2x^2$
17. $4x - 12 = 3x^2 - x^3$
18. $x - 7 = 7x^2 - x^3$
19. $2x^3 - 12x^2 = 10x - 60$

Solve polynomial equations of higher degree

20. $9x + 81 = 27x^2 + 3x^3$
21. $x^4 - 7x^3 + 4x^2 = 28x$
22. $x^4 + 3x^3 + 9x^2 = -27x$
23. $x^4 - 81 = 0$
24. $x^4 - 1 = 0$

25. $x^4 - 256 = 0$

26. $x^4 - 625 = 0$

27. $x^6 - 2x^4 - x^2 + 2 = 0$

28. $x^6 - 3x^4 - 16x^2 + 48 = 0$

29. $x^5 - x^3 - 8x^2 + 8 = 0$

30. $x^5 - 9x^3 - x^2 + 9 = 0$

31. $x^6 - 1 = 0$

32. $x^6 - 64 = 0$

Solve each equation. Identify any extraneous roots.

33. $\frac{2}{x} + \frac{1}{x+1} = \frac{5}{x^2+x}$

34. $\frac{3}{m+3} - \frac{5}{m^2+3m} = \frac{1}{m}$

35. $\frac{21}{a+2} = \frac{3}{a-1}$

36. $\frac{4}{2y-3} = \frac{7}{3y-5}$

37. $\frac{1}{3y} - \frac{1}{4y} = \frac{1}{y^2}$

38. $\frac{3}{5x} - \frac{1}{2x} = \frac{1}{x^2}$

39. $x + \frac{14}{x-7} = 1 + \frac{2x}{x-7}$

40. $\frac{10}{x-5} + x = 1 + \frac{2x}{x-5}$

41. $\frac{6}{n+3} + \frac{20}{n^2+n-6} = \frac{5}{n-2}$

42. $\frac{7}{p+2} - \frac{1}{p^2+5p+6} = -\frac{2}{p+3}$

43. $\frac{a}{2a+1} - \frac{2a^2+5}{2a^2-5a-3} = \frac{3}{a-3}$

44. $\frac{-18}{6n^2-n-1} + \frac{3n}{2n-1} = \frac{4n}{3n+1}$

Solve for the variable indicated.

$$45. \frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}; \text{ for } f$$

$$46. \frac{1}{x} - \frac{1}{y} = \frac{1}{z}; \text{ for } z$$

$$47. I = \frac{E}{R + r}; \text{ for } r$$

$$48. q = \frac{pf}{p - f}; \text{ for } p$$

$$49. V = \frac{1}{3}\pi r^2 h; \text{ for } h$$

$$50. s = \frac{1}{2}gt^2; \text{ for } g$$

$$51. V = \frac{4}{3}\pi r^3; \text{ for } r^3$$

$$52. V = \frac{1}{3}\pi r^2 h; \text{ for } r^2$$

Solve each equation and check your solutions by *substitution*. Identify any extraneous roots.

$$53. \quad 1. -3\sqrt{3x - 5} = -9$$

$$2. x = \sqrt{3x + 1} + 3$$

$$54. \quad 1. -2\sqrt{4x - 1} = -10$$

$$2. -5 = \sqrt{5x - 1} - x$$

$$55. \quad 1. 2 = \sqrt[3]{3m - 1}$$

$$2. 2\sqrt[3]{7 - 3x} - 3 = -7$$

$$3. \frac{\sqrt[3]{2m + 3}}{-5} + 2 = 3$$

$$4. \sqrt[3]{2x - 9} = \sqrt[3]{3x + 7}$$

$$56. \quad 1. -3 = \sqrt[3]{5p + 2}$$

$$2. 3\sqrt[3]{3 - 4x} - 7 = -4$$

$$3. \frac{\sqrt[3]{6x - 7}}{4} - 5 = -6$$

$$4. 3\sqrt[3]{x + 3} = 2\sqrt[3]{2x + 17}$$

$$57. \quad 1. \sqrt{x - 9} + \sqrt{x} = 9$$

2. $x = 3 + \sqrt{23 - x}$

3. $\sqrt{x - 2} - \sqrt{2x} = -2$

4. $\sqrt{12x + 9} - \sqrt{24x} = -3$

Solve radical equations and equations with rational exponents

58. 1. $\sqrt{x + 7} - \sqrt{x} = 1$

2. $\sqrt{2x + 31} + x = 2$

3. $\sqrt{3x} = \sqrt{x - 3} + 3$

4. $\sqrt{3x + 4} - \sqrt{7x} = -2$

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Write the equation in simplified form, then solve. Check all answers by substitution.

59. $x^{\frac{3}{4}} + 17 = 9$

60. $-2x^{\frac{3}{4}} + 47 = -7$

61. $0.3x^{\frac{5}{8}} - 39 = 42$

62. $0.5x^{\frac{5}{8}} + 92 = -43$

63. $2(x + 5)^{\frac{3}{4}} - 11 = 7$

64. $-3(x - 2)^{\frac{3}{4}} + 29 = -19$

Solve each equation using a u -substitution. Check all answers.

65. $x^{\frac{3}{4}} - 2x^{\frac{1}{4}} - 15 = 0$

Solve equations in quadratic form

66. $x^3 - 9x^{\frac{3}{2}} + 8 = 0$

67. $x^4 - 24x^2 - 25 = 0$

68. $x^4 - 37x^2 + 36 = 0$

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

70. $(x^2 + x)^2 - 8(x^2 + x) + 12 = 0$

71. $x^{-2} - 3x^{-1} - 4 = 0$

72. $x^{-2} - 2x^{-1} - 35 = 0$

73. $x^{-4} - 13x^{-2} + 36 = 0$

Use a u -substitution to solve each radical equation.

74. $x - 3\sqrt{x + 4} + 4 = 0$