

Complete Solutions Manual

Finite Mathematics

SIXTH EDITION

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Solutions Section 0.1

Section 0.1

$$\begin{aligned} 1. & 2(4 + (-1))(2 \cdot -4) \\ &= 2(3)(-8) = (6)(-8) = -48 \end{aligned}$$

$$\begin{aligned} 2. & 3 + ([4 - 2] \cdot 9) \\ &= 3 + (2 \times 9) = 3 + 18 = 21 \end{aligned}$$

$$\begin{aligned} 3. & 20 / (3 \cdot 4) - 1 \\ &= \frac{20}{12} - 1 = \frac{5}{3} - 1 = \frac{2}{3} \end{aligned}$$

$$\begin{aligned} 4. & 2 - (3 \cdot 4) / 10 \\ &= 2 - \frac{12}{10} = 2 - \frac{6}{5} = \frac{4}{5} \end{aligned}$$

$$\begin{aligned} 5. & \frac{3 + ([3 + (-5)])}{3 - 2 \times 2} = \frac{3 + (-2)}{3 - 4} \\ &= \frac{1}{-1} = -1 \end{aligned}$$

$$\begin{aligned} 6. & \frac{12 - (1 - 4)}{2(5 - 1) \cdot 2 - 1} = \frac{12 - (-3)}{16 - 1} \\ &= \frac{15}{15} = 1 \end{aligned}$$

$$\begin{aligned} 7. & (2 - 5 \cdot (-1)) / 1 - 2 \cdot (-1) \\ &= \frac{2 - 5 \cdot (-1)}{1} - 2 \cdot (-1) \\ &= \frac{2+5}{1} + 2 = 7 + 2 = 9 \end{aligned}$$

$$\begin{aligned} 8. & 2 - 5 \cdot (-1) / (1 - 2 \cdot (-1)) \\ &= 2 - \frac{5 \cdot (-1)}{1 - 2 \cdot (-1)} \\ &= 2 - \frac{-5}{1 + 2} = 2 + \frac{5}{3} = \frac{11}{3} \end{aligned}$$

$$9. 2 \cdot (-1)^2 / 2 = \frac{2 \times (-1)^2}{2} = \frac{2 \times 1}{2} = \frac{2}{2} = 1$$

$$10. 2 + 4 \cdot 3^2 = 2 + 4 \times 9 = 2 + 36 = 38$$

$$11. 2 \cdot 4^2 + 1 = 2 \times 16 + 1 = 32 + 1 = 33$$

$$\begin{aligned} 12. & 1 - 3 \cdot (-2)^2 \times 2 = 1 - 3 \times 4 \times 2 \\ &= 1 - 24 = -23 \end{aligned}$$

$$\begin{aligned} 13. & 3^2 + 2^2 + 1 \\ &= 9 + 4 + 1 = 14 \end{aligned}$$

$$14. 2^{\wedge}(2^2 - 2) = 2^{(2^2 - 2)} = 2^{4 - 2} = 2^2 = 4$$

$$\begin{aligned} 15. & \frac{3 - 2(-3)^2}{-6(4 - 1)^2} = \frac{3 - 2 \times 9}{-6(3)^2} = \frac{3 - 18}{6 \times 9} \\ &= \frac{-15}{54} = \frac{5}{18} \end{aligned}$$

$$\begin{aligned} 16. & \frac{1 - 2(1 - 4)^2}{2(5 - 1)^2 \cdot 2} = \frac{1 - 2(-3)^2}{2(4)^2 \cdot 2} = \frac{1 - 2 \times 9}{2 \times 16 \times 2} \\ &= \frac{1 - 18}{64} = -\frac{17}{64} \end{aligned}$$

$$\begin{aligned} 17. & 10 \cdot (1 + 1/10)^3 \\ &= 10 \left(1 + \frac{1}{10}\right)^3 = 10(1.1)^3 \\ &= 10 \times 1.331 = 13.31 \end{aligned}$$

$$\begin{aligned} 18. & 121 / (1 + 1/10)^2 \\ &= \frac{121}{\left(1 + \frac{1}{10}\right)^2} = \frac{121}{1.1^2} = \frac{121}{1.21} = 100 \end{aligned}$$

$$\begin{aligned} 19. & 3 \left[\frac{-2 \cdot 3^2}{-(4 - 1)^2} \right] = 3 \left[\frac{-2 \times 9}{-3^2} \right] = 3 \left[\frac{-18}{-9} \right] \\ &= 3 \times 2 = 6 \end{aligned}$$

$$\begin{aligned} 20. & - \left[\frac{8(1 - 4)^2}{-9(5 - 1)^2} \right] = - \left[\frac{8(-3)^2}{-9(4)^2} \right] \\ &= - \left[\frac{8 \times 9}{-9 \times 16} \right] = - \left(\frac{72}{-144} \right) = - \left(-\frac{1}{2} \right) = \frac{1}{2} \end{aligned}$$

$$\begin{aligned} 21. & 3 \left[1 - \left(-\frac{1}{2} \right)^2 \right]^2 + 1 = 3 \left[1 - \frac{1}{4} \right]^2 + 1 \\ &= 3 \left[\frac{3}{4} \right]^2 + 1 = 3 \left[\frac{9}{16} \right] + 1 = \frac{27}{16} + 1 = \frac{43}{16} \end{aligned}$$

$$\begin{aligned} 22. & 3 \left[\frac{1}{9} - \left(\frac{2}{3} \right)^2 \right]^2 + 1 = 3 \left[\frac{1}{9} - \frac{4}{9} \right]^2 + 1 \\ &= 3 \left[\frac{-3}{9} \right]^2 + 1 = 3 \left[\frac{-1}{3} \right]^2 + 1 \\ &= 3 \left[\frac{1}{9} \right] + 1 = \frac{3}{9} + 1 = \frac{4}{3} \end{aligned}$$

$$23. (1/2)^{\wedge}2 - 1/2^{\wedge}2$$

Solutions Section 0.1

$$= \left[\frac{1}{2}\right]^2 - \frac{1}{2^2} = \frac{1}{4} - \frac{1}{4} = 0$$

$$\begin{aligned} 24. \quad & 2 / (1^2) - (2/1)^2 \\ &= \frac{2}{1^2} - \left[\frac{2}{1}\right]^2 = \frac{2}{1} - \frac{4}{1} = -2 \end{aligned}$$

$$25. \quad 3 \times (2-5) = 3 * (2-5)$$

$$26. \quad 4 + \frac{5}{9} = 4 + 5/9 \quad \text{or} \quad 4 + (5/9)$$

$$27. \quad \frac{3}{2-5} = 3 / (2-5)$$

Note $3/2-5$ is wrong, since it corresponds to $\frac{3}{2} - 5$.

$$28. \quad \frac{4-1}{3} = (4-1) / 3$$

$$29. \quad \frac{3-1}{8+6} = (3-1) / (8+6)$$

Note $3-1/8-6$ is wrong, since it corresponds to $3 - \frac{1}{8} - 6$.

$$30. \quad 3 + \frac{3}{2-9} = 3 + 3 / (2-9)$$

$$31. \quad 3 - \frac{4+7}{8} = 3 - (4+7) / 8$$

$$32. \quad \frac{4 \times 2}{\left[\frac{2}{3}\right]} = 4 * 2 / (2/3) \quad \text{or} \quad (4 * 2) / (2/3)$$

$$33. \quad \frac{2}{3+x} - xy^2 = 2 / (3+x) - x * y^2$$

$$34. \quad 3 + \frac{3+x}{xy} = 3 + (3+x) / (x*y)$$

$$\begin{aligned} 35. \quad & 3.1x^3 - 4x^{-2} - \frac{60}{x^2-1} \\ &= 3.1x^3 - 4x^{(-2)} - 60 / (x^2-1) \end{aligned}$$

$$\begin{aligned} 36. \quad & 2.1x^{-3} - x^{-1} + \frac{x^2-3}{2} \\ &= 2.1x^{(-3)} - x^{(-1)} + (x^2-3) / 2 \end{aligned}$$

$$37. \quad \frac{\left[\frac{2}{3}\right]}{5} = (2/3) / 5$$

Note that we use only (round) parentheses in technology formulas, and not brackets.

$$38. \quad \frac{2}{\left[\frac{3}{5}\right]} = 2 / (3/5)$$

$$39. \quad 3^{4-5} \times 6 = 3^{(4-5)} * 6$$

Note that the entire exponent is in parentheses.

$$40. \quad \frac{2}{3+5^{7-9}} = 2 / (3+5^{(7-9)})$$

$$41. \quad 3 \left[1 + \frac{4}{100} \right]^{-3} = 3 * (1 + 4/100)^{(-3)}$$

Note that we use only (round) parentheses in technology formulas, and not brackets.

$$42. \quad 3 \left[\frac{1+4}{100} \right]^{-3} = 3 * ((1+4) / 100)^{(-3)}$$

$$43. \quad 3^{2x-1} + 4^x - 1 = 3^{(2*x-1)} + 4^x - 1$$

Note that the entire exponent of 3 is in parentheses.

$$44. \quad 2^{x^2} - (2^{2x})^2 = 2^{(x^2)} - (2^{(2*x)})^2$$

$$45. \quad 2^{2x^2-x+1} = 2^{(2x^2-x+1)}$$

Note that the entire exponent is in parentheses.

$$46. \quad 2^{2x^2-x} + 1 = 2^{(2x^2-x)} + 1$$

$$47. \quad \frac{4e^{-2x}}{2-3e^{-2x}} = 4 * e^{(-2*x)} / (2-3e^{(-2*x)})$$

$$\text{or} \quad 4 * (e^{(-2*x)}) / (2-3e^{(-2*x)})$$

$$\text{or} \quad (4 * e^{(-2*x)}) / (2-3e^{(-2*x)})$$

$$48. \quad \frac{e^{2x} + e^{-2x}}{e^{2x} - e^{-2x}}$$

$$= (e^{(2*x)} + e^{(-2*x)}) / (e^{(2*x)} - e^{(-2*x)})$$

$$49. \quad 3 \left[1 - \left(-\frac{1}{2} \right)^2 \right]^2 + 1 = 3 (1 - (-1/2)^2)^2 + 1$$

Note that we use only (round) parentheses in technology formulas, and not brackets.

Solutions Section 0.2

Section 0.2

1. $3^3 = 27$

2. $(-2)^3 = -8$

3. $-(2 \cdot 3)^2 = -(2^2 \cdot 3^2) = -(4 \cdot 9) = -36$ or
 $-(2 \cdot 3)^2 = -(6^2) = -36$

4. $(4 \cdot 2)^2 = 4^2 \cdot 2^2 = 16 \cdot 4 = 64$ or
 $(4 \cdot 2)^2 = 8^2 = 64$

5. $\left(\frac{-2}{3}\right)^2 = \frac{(-2)^2}{3^2} = \frac{4}{9}$

6. $\left(\frac{3}{2}\right)^3 = \frac{3^3}{2^3} = \frac{27}{8}$

7. $(-2)^{-3} = \frac{1}{(-2)^3} = \frac{1}{-8} = -\frac{1}{8}$

8. $-2^{-3} = -\frac{1}{2^3} = -\frac{1}{8}$

9. $\left(\frac{1}{4}\right)^{-2} = \frac{1}{(1/4)^2} = \frac{1}{1/4^2} = \frac{1}{1/16} = 16$

10. $\left(\frac{-2}{3}\right)^{-2} = \frac{1}{(-2/3)^2} = \frac{1}{4/9} = 9/4$

11. $2 \cdot 3^0 = 2 \cdot 1 = 2$

12. $3 \cdot (-2)^0 = 3 \cdot 1 = 3$

13. $2^3 2^2 = 2^{3+2} = 2^5 = 32$ or $2^3 2^2 = 8 \cdot 4 = 32$

14. $3^2 3 = 3^{2+1} = 3^3 = 27$ or $3^2 3 = 9 \cdot 3 = 27$

15. $2^2 2^{-1} 2^4 2^{-4} = 2^{2-1+4-4} = 2^1 = 2$

16. $5^2 5^{-3} 5^2 5^{-2} = 5^{2-3+2-2} = 5^{-1} = \frac{1}{5}$

17. $x^3 x^2 = x^{3+2} = x^5$

18. $x^4 x^{-1} = x^{4-1} = x^3$

19. $-x^2 x^{-3} y = -x^{2-3} y = -x^{-1} y = -\frac{y}{x}$

20. $-xy^{-1} x^{-1} = -x^{1-1} y^{-1} = -x^0 y^{-1} = -\frac{1}{y}$

21. $\frac{x^3}{x^4} = x^{3-4} = x^{-1} = \frac{1}{x}$

22. $\frac{y^5}{y^3} = y^{5-3} = y^2$

23. $\frac{x^2 y^2}{x^{-1} y} = x^{2-(-1)} y^{2-1} = x^3 y$

24. $\frac{x^{-1} y}{x^2 y^2} = x^{-1-2} y^{1-2} = x^{-3} y^{-1} = \frac{1}{x^3 y}$

25. $\frac{(xy^{-1} z^3)^2}{x^2 y z^2} = \frac{x^2 (y^{-1})^2 (z^3)^2}{x^2 y z^2} = x^{2-2} y^{-2-1} z^{6-2} =$
 $y^{-3} z^4 = \frac{z^4}{y^3}$

26. $\frac{x^2 y z^2}{(xyz^{-1})^{-1}} = \frac{x^2 y z^2}{x^{-1} y^{-1} z} = x^{2-(-1)} y^{1-(-1)} z^{2-1} = x^3 y^2 z$

27. $\left(\frac{xy^{-2} z}{x^{-1} z}\right)^3 = \frac{(xy^{-2} z)^3}{(x^{-1} z)^3} = \frac{x^3 y^{-6} z^3}{x^{-3} z^3} = x^{3-(-3)} y^{-6} z^{3-3} =$
 $x^6 y^{-6} = \frac{x^6}{y^6}$

28. $\left(\frac{x^2 y^{-1} z^0}{xyz}\right)^2 = \frac{x^4 y^{-2} z^0}{x^2 y^2 z^2} = x^{4-2} y^{-2-2} z^{-2} = x^2 y^{-4} z^{-2} =$
 $\frac{x^2}{y^4 z^2}$

29. $\left(\frac{x^{-1} y^{-2} z^2}{xy}\right)^{-2} = (x^{-1-1} y^{-2-1} z^2)^{-2} = (x^{-2} y^{-3} z^2)^{-2} =$
 $x^4 y^6 z^{-4} = \frac{x^4 y^6}{z^4}$

30. $\left(\frac{xy^{-2}}{x^2 y^{-1} z}\right)^{-3} = (x^{1-2} y^{-2+1} z^{-1})^{-3} = (x^{-1} y^{-1} z^{-1})^{-3} =$
 $x^3 y^3 z^3$

31. $3x^{-4} = \frac{3}{x^4}$

Solutions Section 0.2

$$32. \frac{1}{2} x^{-4} = \frac{1}{2x^4}$$

$$33. \frac{3}{4} x^{-2/3} = \frac{3}{4x^{2/3}}$$

$$34. \frac{4}{5} y^{-3/4} = \frac{4}{5y^{3/4}}$$

$$35. 1 - \frac{0.3}{x^{-2}} - \frac{6}{5} x^{-1} = 1 - 0.3x^2 - \frac{6}{5x}$$

$$36. \frac{1}{3x^{-4}} + \frac{0.1x^{-2}}{3} = \frac{x^4}{3} + \frac{0.1}{3x^2}$$

$$37. \sqrt{4} = 2$$

$$38. \sqrt{5} \approx 2.236$$

$$39. \sqrt{\frac{1}{4}} = \frac{\sqrt{1}}{\sqrt{4}} = \frac{1}{2}$$

$$40. \sqrt{\frac{1}{9}} = \frac{\sqrt{1}}{\sqrt{9}} = \frac{1}{3}$$

$$41. \sqrt{\frac{16}{9}} = \frac{\sqrt{16}}{\sqrt{9}} = \frac{4}{3}$$

$$42. \sqrt{\frac{9}{4}} = \frac{\sqrt{9}}{\sqrt{4}} = \frac{3}{2}$$

$$43. \frac{\sqrt{4}}{5} = \frac{2}{5}$$

$$44. \frac{6}{\sqrt{25}} = \frac{6}{5}$$

$$45. \sqrt{9} + \sqrt{16} = 3 + 4 = 7$$

$$46. \sqrt{25} - \sqrt{16} = 5 - 4 = 1$$

$$47. \sqrt{9 + 16} = \sqrt{25} = 5$$

$$48. \sqrt{25 - 16} = \sqrt{9} = 3$$

$$49. \sqrt[3]{8 - 27} = \sqrt[3]{-19} \approx -2.668$$

$$50. \sqrt[4]{81 - 16} = \sqrt[4]{65} \approx 2.839$$

$$51. \sqrt[3]{\frac{27}{8}} = \frac{\sqrt[3]{27}}{\sqrt[3]{8}} = \frac{3}{2}$$

$$52. \sqrt[3]{8 \cdot 64} = \sqrt[3]{8} \cdot \sqrt[3]{64} = 2 \cdot 4 = 8$$

$$53. \sqrt{(-2)^2} = \sqrt{4} = 2$$

$$54. \sqrt{(-1)^2} = \sqrt{1} = 1$$

$$55. \sqrt{\frac{1}{4}(1 + 15)} = \sqrt{\frac{16}{4}} = \frac{\sqrt{16}}{\sqrt{4}} = \frac{4}{2} = 2$$

$$56. \sqrt{\frac{1}{9}(3 + 33)} = \sqrt{\frac{36}{9}} = \frac{\sqrt{36}}{\sqrt{9}} = \frac{6}{3} = 2$$

$$57. \sqrt{a^2 b^2} = \sqrt{a} \sqrt{b} = ab$$

$$58. \sqrt{\frac{a^2}{b^2}} = \frac{\sqrt{a^2}}{\sqrt{b^2}} = \frac{a}{b}$$

$$59. \sqrt{(x + 9)^2} = x + 9 \text{ (} x + 9 > 0 \text{ because } x \text{ is positive)}$$

$$60. (\sqrt{x + 9})^2 = x + 9$$

$$61. \sqrt[3]{x^3(a^3 + b^3)} = \sqrt[3]{x^3} \sqrt[3]{a^3 + b^3} = x \sqrt[3]{a^3 + b^3}$$

(Notice: *Not* $x(a + b)$.)

$$62. \sqrt[4]{\frac{x^4}{a^4 b^4}} = \frac{\sqrt[4]{x^4}}{\sqrt[4]{a^4} \sqrt[4]{b^4}} = \frac{x}{ab}$$

$$63. \sqrt{\frac{4xy^3}{x^2 y}} = \sqrt{\frac{4y^2}{x}} = \frac{\sqrt{4} \sqrt{y^2}}{\sqrt{x}} = \frac{2y}{\sqrt{x}}$$

Solutions Section 0.2

$$64. \sqrt{\frac{4(x^2 + y^2)}{c^2}} = \frac{\sqrt{4} \sqrt{x^2 + y^2}}{\sqrt{c^2}} = \frac{2\sqrt{x^2 + y^2}}{c}$$

(Notice: *Not* $2(x + y)/c$.)

$$65. \sqrt{3} = 3^{1/2}$$

$$66. \sqrt{8} = 8^{1/2}$$

$$67. \sqrt{x^3} = x^{3/2}$$

$$68. \sqrt[3]{x^2} = x^{2/3}$$

$$69. \sqrt[3]{xy^2} = (xy^2)^{1/3}$$

$$70. \sqrt{x^2y} = (x^2y)^{1/2}$$

$$71. \frac{x^2}{\sqrt{x}} = \frac{x^2}{x^{1/2}} = x^{2-1/2} = x^{3/2}$$

$$72. \frac{x}{\sqrt{x}} = \frac{x}{x^{1/2}} = x^{1-1/2} = x^{1/2}$$

$$73. \frac{3}{5x^2} = \frac{3}{5} x^{-2}$$

$$74. \frac{2}{5x^{-3}} = \frac{2}{5} x^3$$

$$75. \frac{3x^{-1.2}}{2} - \frac{1}{3x^{2.1}} = \frac{3}{2} x^{-1.2} - \frac{1}{3} x^{-2.1}$$

$$76. \frac{2}{3x^{-1.2}} - \frac{x^{2.1}}{3} = \frac{2}{3} x^{1.2} - \frac{1}{3} x^{2.1}$$

$$77. \frac{2x}{3} - \frac{x^{0.1}}{2} + \frac{4}{3x^{1.1}} = \frac{2}{3} x - \frac{1}{2} x^{0.1} + \frac{4}{3} x^{-1.1}$$

$$78. \frac{4x^2}{3} + \frac{x^{3/2}}{6} - \frac{2}{3x^2} = \frac{4}{3} x^2 + \frac{1}{6} x^{3/2} - \frac{2}{3} x^{-2}$$

$$79. \frac{3\sqrt{x}}{4} - \frac{5}{3\sqrt{x}} + \frac{4}{3x\sqrt{x}} = \frac{3x^{1/2}}{4} - \frac{5}{3x^{1/2}} + \frac{4}{3xx^{1/2}} = \frac{3}{4} x^{1/2} - \frac{5}{3} x^{-1/2} + \frac{4}{3} x^{-3/2}$$

$$80. \frac{3}{5\sqrt{x}} - \frac{5\sqrt{x}}{8} + \frac{7}{2\sqrt[3]{x}} = \frac{3}{5x^{1/2}} - \frac{5x^{1/2}}{8} + \frac{7}{2x^{1/3}} = \frac{3}{5} x^{-1/2} - \frac{5}{8} x^{1/2} + \frac{7}{2} x^{-1/3}$$

$$81. \frac{3\sqrt[5]{x^2}}{4} - \frac{7}{2\sqrt{x^3}} = \frac{3x^{2/5}}{4} - \frac{7}{2x^{3/2}} = \frac{3}{4} x^{2/5} - \frac{7}{2} x^{-3/2}$$

$$82. \frac{1}{8x\sqrt{x}} - \frac{2}{3\sqrt[5]{x^3}} = \frac{1}{8x^{3/2}} - \frac{2}{3x^{3/5}} = \frac{1}{8} x^{-3/2} - \frac{2}{3} x^{-3/5}$$

$$83. \frac{1}{(x^2 + 1)^3} - \frac{3}{4\sqrt[3]{(x^2 + 1)}} = \frac{1}{(x^2 + 1)^3} - \frac{3}{4(x^2 + 1)^{1/3}} = (x^2 + 1)^{-3} - \frac{3}{4} (x^2 + 1)^{-1/3}$$

$$84. \frac{2}{3(x^2 + 1)^{-3}} - \frac{3\sqrt[3]{(x^2 + 1)^7}}{4} = \frac{2}{3} (x^2 + 1)^3 - \frac{3}{4} (x^2 + 1)^{7/3}$$

$$85. 2^{2/3} = \sqrt[3]{2^2}$$

$$86. 3^{4/5} = \sqrt[5]{3^4}$$

$$87. x^{4/3} = \sqrt[3]{x^4}$$

$$88. y^{7/4} = \sqrt[4]{y^7}$$

$$89. (x^{1/2} y^{1/3})^{1/5} = \sqrt[5]{\sqrt{x} \sqrt[3]{y}}$$

$$90. x^{-1/3} y^{3/2} = \frac{y^{3/2}}{x^{1/3}} = \frac{\sqrt[3]{y^3}}{\sqrt[3]{x}}$$

Solutions Section 0.2

$$91. -\frac{3}{2}x^{-1/4} = -\frac{3}{2x^{1/4}} = -\frac{3}{2\sqrt[4]{x}}$$

$$92. \frac{4}{5}x^{3/2} = \frac{4\sqrt{x^3}}{5}$$

$$93. 0.2x^{-2/3} + \frac{3}{7x^{-1/2}} = \frac{0.2}{x^{2/3}} + \frac{3x^{1/2}}{7} = \frac{0.2}{\sqrt[3]{x^2}} + \frac{3\sqrt{x}}{7}$$

$$94. \frac{3.1}{x^{-4/3}} - \frac{11}{7}x^{-1/7} = 3.1x^{4/3} - \frac{11}{7x^{1/7}} = 3.1\sqrt[3]{x^4} - \frac{11}{7\sqrt[7]{x}}$$

$$95. \frac{3}{4(1-x)^{5/2}} = \frac{3}{4\sqrt{(1-x)^5}}$$

$$96. \frac{9}{4(1-x)^{-7/3}} = \frac{9(1-x)^{7/3}}{4} = \frac{9\sqrt[3]{(1-x)^7}}{4}$$

$$97. 4^{-1/2}4^{7/2} = 4^{-1/2+7/2} = 4^3 = 64$$

$$98. \frac{2^{1/a}}{2^{2/a}} = 2^{1/a-2/a} = 2^{-1/a} = \frac{1}{2^{1/a}}$$

$$99. 3^{2/3}3^{-1/6} = 3^{2/3-1/6} = 3^{1/2} = \sqrt{3}$$

$$100. 2^{1/3}2^{-1}2^{2/3}2^{-1/3} = 2^{1/3-1+2/3-1/3} = 2^{-1/3} = \frac{1}{2^{1/3}}$$

$$101. \frac{x^{3/2}}{x^{5/2}} = x^{3/2-5/2} = x^{-1} = \frac{1}{x}$$

$$102. \frac{y^{5/4}}{y^{3/4}} = y^{5/4-3/4} = y^{1/2} = \sqrt{y}$$

$$103. \frac{x^{1/2}y^2}{x^{-1/2}y} = x^{1/2+1/2}y^{2-1} = xy$$

$$104. \frac{x^{-1/2}y}{x^2y^{3/2}} = x^{-1/2-2}y^{1-3/2} = x^{-5/2}y^{-1/2}$$

$$105. \left(\frac{x}{y}\right)^{1/3} \left(\frac{y}{x}\right)^{2/3} = \left(\frac{y}{x}\right)^{-1/3} \left(\frac{y}{x}\right)^{2/3} = \left(\frac{y}{x}\right)^{1/3}$$

$$106. \left(\frac{x}{y}\right)^{-1/3} \left(\frac{y}{x}\right)^{1/3} = \left(\frac{y}{x}\right)^{1/3} \left(\frac{y}{x}\right)^{1/3} = \left(\frac{y}{x}\right)^{2/3}$$

$$107. x^2 - 16 = 0, x^2 = 16, x = \pm\sqrt{16} = \pm 4$$

$$108. x^2 - 1 = 0, x^2 = 1, x = \pm\sqrt{1} = \pm 1$$

$$109. x^2 - \frac{4}{9} = 0, x^2 = \frac{4}{9}, x = \pm\sqrt{\frac{4}{9}} = \pm \frac{2}{3}$$

$$110. x^2 - \frac{1}{10} = 0, x^2 = \frac{1}{10}, x = \pm\sqrt{\frac{1}{10}} = \pm \frac{1}{\sqrt{10}} \approx \pm 0.3162$$

$$111. x^2 - (1 + 2x)^2 = 0, x^2 = (1 + 2x)^2, x = \pm(1 + 2x); \text{ if } x = 1 + 2x \text{ then } -x = 1, x = -1; \text{ if } x = -(1 + 2x) \text{ then } 3x = -1, x = -1/3. \text{ So, } x = -1 \text{ or } -1/3.$$

$$112. x^2 - (2 - 3x)^2 = 0, x^2 = (2 - 3x)^2, x = \pm(2 - 3x); \text{ if } x = 2 - 3x \text{ then } 4x = 2, x = 1/2; \text{ if } x = -(2 - 3x) \text{ then } -2x = -2, x = 1. \text{ So, } x = 1 \text{ or } 1/2.$$

$$113. x^5 + 32 = 0, x^5 = -32, x = \sqrt[5]{-32} = -2$$

$$114. x^4 - 81 = 0, x^4 = 81, x = \pm\sqrt[4]{81} = \pm 3$$

$$115. x^{1/2} - 4 = 0, x^{1/2} = 4, x = 4^2 = 16$$

$$116. x^{1/3} - 2 = 0, x^{1/3} = 2, x = 2^3 = 8$$

$$117. 1 - \frac{1}{x^2} = 0, 1 = \frac{1}{x^2}, x^2 = 1, x = \pm\sqrt{1} = \pm 1$$

$$118. \frac{2}{x^3} - \frac{6}{x^4} = 0, \frac{2}{x^3} = \frac{6}{x^4}, 2x^4 = 6x^3, 2x = 6, x = 3$$

$$119. (x - 4)^{-1/3} = 2, x - 4 = 2^{-3} = \frac{1}{8},$$

$$x = 4 + \frac{1}{8} = \frac{33}{8}$$

$$120. (x - 4)^{2/3} + 1 = 5, (x - 4)^{2/3} = 4, x - 4 = \pm 4^{3/2} = \pm 8, x = 4 \pm 8 = -4 \text{ or } 12$$

Solutions Section 0.3

Section 0.3

$$1. x(4x + 6) = 4x^2 + 6x$$

$$2. (4y - 2)y = 4y^2 - 2y$$

$$3. (2x - y)y = 2xy - y^2$$

$$4. x(3x + y) = 3x^2 + xy$$

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

$$6. (y + 3)(y + 4) = y^2 + 3y + 4y + 12 = y^2 + 7y + 12$$

$$7. (2y + 3)(y + 5) = 2y^2 + 3y + 10y + 15 = 2y^2 + 13y + 15$$

$$8. (2x - 2)(3x - 4) = 6x^2 - 6x - 8x + 8 = 6x^2 - 14x + 8$$

$$9. (2x - 3)^2 = 4x^2 - 12x + 9$$

$$10. (3x + 1)^2 = 9x^2 + 6x + 1$$

$$11. \left(x + \frac{1}{x}\right)^2 = x^2 + 2 + \frac{1}{x^2}$$

$$12. \left(y - \frac{1}{y}\right)^2 = y^2 - 2 + \frac{1}{y^2}$$

$$13. (2x - 3)(2x + 3) = (2x)^2 - 3^2 = 4x^2 - 9$$

$$14. (4 + 2x)(4 - 2x) = 4^2 - (2x)^2 = 16 - 4x^2$$

$$15. \left(y - \frac{1}{y}\right)\left(y + \frac{1}{y}\right) = y^2 - \left(\frac{1}{y}\right)^2 = y^2 - \frac{1}{y^2}$$

$$16. (x - x^2)(x + x^2) = x^2 - (x^2)^2 = x^2 - x^4$$

$$17. (x^2 + x - 1)(2x + 4) = (x^2 + x - 1)2x + (x^2 + x - 1)4 = 2x^3 + 2x^2 - 2x + 4x^2 + 4x - 4 = 2x^3 + 6x^2 + 2x - 4$$

$$18. (3x + 1)(2x^2 - x + 1) = 3x(2x^2 - x + 1) + 1(2x^2 - x + 1) = 6x^3 - 3x^2 + 3x + 2x^2 - x + 1 = 6x^3 - x^2 + 2x + 1$$

$$1 = 6x^3 - x^2 + 2x + 1$$

$$19. (x^2 - 2x + 1)^2 = (x^2 - 2x + 1)(x^2 - 2x + 1) = x^2(x^2 - 2x + 1) - 2x(x^2 - 2x + 1) + (x^2 - 2x + 1) = x^4 - 2x^3 + x^2 - 2x^3 + 4x^2 - 2x + x^2 - 2x + 1 = x^4 - 4x^3 + 6x^2 - 4x + 1$$

$$20. (x + y - xy)^2 = (x + y - xy)(x + y - xy) = x(x + y - xy) + y(x + y - xy) - xy(x + y - xy) = x^2 + xy - x^2y + xy + y^2 - xy^2 - x^2y - xy^2 + x^2y^2 = x^2 + y^2 - 2x^2y - 2xy^2 + 2xy + x^2y^2$$

$$21. (y^3 + 2y^2 + y)(y^2 + 2y - 1) = y^3(y^2 + 2y - 1) + 2y^2(y^2 + 2y - 1) + y(y^2 + 2y - 1) = y^5 + 2y^4 - y^3 + 2y^4 + 4y^3 - 2y^2 + y^3 + 2y^2 - y = y^5 + 4y^4 + 4y^3 - y$$

$$22. (x^3 - 2x^2 + 4)(3x^2 - x + 2) = x^3(3x^2 - x + 2) - 2x^2(3x^2 - x + 2) + 4(3x^2 - x + 2) = 3x^5 - x^4 + 2x^3 - 6x^4 + 2x^3 - 4x^2 + 12x^2 - 4x + 8 = 3x^5 - 7x^4 + 4x^3 + 8x^2 - 4x + 8$$

$$23. (x + 1)(x + 2) + (x + 1)(x + 3) = (x + 1)(x + 2 + x + 3) = (x + 1)(2x + 5)$$

$$24. (x + 1)(x + 2)^2 + (x + 1)^2(x + 2) = (x + 1)(x + 2)(x + 2 + x + 1) = (x + 1)(x + 2)(2x + 3)$$

$$25. (x^2 + 1)^5(x + 3)^4 + (x^2 + 1)^6(x + 3)^3 = (x^2 + 1)^5(x + 3)^3(x + 3 + x^2 + 1) = (x^2 + 1)^5(x + 3)^3(x^2 + x + 4)$$

$$26. 10x(x^2 + 1)^4(x^3 + 1)^5 + 15x^2(x^2 + 1)^5 \cdot (x^3 + 1)^4 = 5x(x^2 + 1)^4(x^3 + 1)^4[2(x^3 + 1) + 3x(x^2 + 1)] = 5x(x^2 + 1)^4(x^3 + 1)^4(5x^3 + 3x + 2)$$

$$27. (x^3 + 1)\sqrt{x + 1} - (x^3 + 1)^2\sqrt{x + 1} = (x^3 + 1)\sqrt{x + 1} [1 - (x^3 + 1)] = -x^3(x^3 + 1)\sqrt{x + 1}$$

$$28. (x^2 + 1)\sqrt{x + 1} - \sqrt{(x + 1)^3} = \sqrt{x + 1} \cdot [x^2 + 1 - \sqrt{(x + 1)^2}] = \sqrt{x + 1} [x^2 + 1 - (x + 1)] = (x^2 - x)\sqrt{x + 1} = x(x - 1)\sqrt{x + 1}$$

$$29. \sqrt{(x + 1)^3} + \sqrt{(x + 1)^5} = \sqrt{(x + 1)^3} \cdot [1 + \sqrt{(x + 1)^2}] = \sqrt{(x + 1)^3} (1 + x + 1) =$$

Solutions Section 0.3

$$(x + 2)\sqrt{(x + 1)^3}$$

$$\begin{aligned} 30. (x^2 + 1)\sqrt[3]{(x + 1)^4} - \sqrt[3]{(x + 1)^7} &= \\ \sqrt[3]{(x + 1)^4} [x^2 + 1 - \sqrt[3]{(x + 1)^3}] &= \\ \sqrt[3]{(x + 1)^4} [x^2 + 1 - (x + 1)] &= \\ (x^2 - x)\sqrt[3]{(x + 1)^4} = x(x - 1)\sqrt[3]{(x + 1)^4} \end{aligned}$$

$$31. (a) 2x + 3x^2 = x(2 + 3x) \quad (b) x(2 + 3x) = 0; x = 0 \text{ or } 2 + 3x = 0; x = 0 \text{ or } -2/3$$

$$32. (a) y^2 - 4y = y(y - 4) \quad (b) y(y - 4) = 0; y = 0 \text{ or } y - 4 = 0; y = 0 \text{ or } 4$$

$$\begin{aligned} 33. (a) 6x^3 - 2x^2 &= 2x^2(3x - 1) \\ (b) 2x^2(3x - 1) &= 0; x = 0 \text{ or } 3x - 1 = 0; x = 0 \text{ or } 1/3 \end{aligned}$$

$$34. (a) 3y^3 - 9y^2 = 3y^2(y - 3) \quad (b) 3y^2(y - 3) = 0; y = 0 \text{ or } y - 3 = 0; y = 0 \text{ or } 3$$

$$\begin{aligned} 35. (a) x^2 - 8x + 7 &= (x - 1)(x - 7) \\ (b) (x - 1)(x - 7) &= 0; x - 1 = 0 \text{ or } x - 7 = 0; x = 1 \text{ or } 7 \end{aligned}$$

$$\begin{aligned} 36. (a) y^2 + 6y + 8 &= (y + 2)(y + 4) \\ (b) (y + 2)(y + 4) &= 0; y + 2 = 0 \text{ or } y + 4 = 0; y = -2 \text{ or } -4 \end{aligned}$$

$$\begin{aligned} 37. (a) x^2 + x - 12 &= (x - 3)(x + 4) \\ (b) (x - 3)(x + 4) &= 0; x - 3 = 0 \text{ or } x + 4 = 0; x = 3 \text{ or } -4 \end{aligned}$$

$$\begin{aligned} 38. (a) y^2 + y - 6 &= (y - 2)(y + 3) \\ (b) (y - 2)(y + 3) &= 0; y - 2 = 0 \text{ or } y + 3 = 0; y = 2 \text{ or } -3 \end{aligned}$$

$$\begin{aligned} 39. (a) 2x^2 - 3x - 2 &= (2x + 1)(x - 2) \\ (b) (2x + 1)(x - 2) &= 0; 2x + 1 = 0 \text{ or } x - 2 = 0; x = -1/2 \text{ or } 2 \end{aligned}$$

$$\begin{aligned} 40. (a) 3y^2 - 8y - 3 &= (3y + 1)(y - 3) \\ (b) (3y + 1)(y - 3) &= 0; 3y + 1 = 0 \text{ or } y - 3 = 0; y = -1/3 \text{ or } 3 \end{aligned}$$

$$41. (a) 6x^2 + 13x + 6 = (2x + 3)(3x + 2)$$

$$(b) (2x + 3)(3x + 2) = 0; 2x + 3 = 0 \text{ or } 3x + 2 = 0; x = -3/2 \text{ or } -2/3$$

$$\begin{aligned} 42. (a) 6y^2 + 17y + 12 &= (3y + 4)(2y + 3) \\ (b) (3y + 4)(2y + 3) &= 0; 3y + 4 = 0 \text{ or } 2y + 3 = 0; y = -4/3 \text{ or } -3/2 \end{aligned}$$

$$\begin{aligned} 43. (a) 12x^2 + x - 6 &= (3x - 2)(4x + 3) \\ (b) (3x - 2)(4x + 3) &= 0; 3x - 2 = 0 \text{ or } 4x + 3 = 0; x = 2/3 \text{ or } -3/4 \end{aligned}$$

$$\begin{aligned} 44. (a) 20y^2 + 7y - 3 &= (4y - 1)(5y + 3) \\ (b) (4y - 1)(5y + 3) &= 0; 4y - 1 = 0 \text{ or } 5y + 3 = 0; y = 1/4 \text{ or } -3/5 \end{aligned}$$

$$\begin{aligned} 45. (a) x^2 + 4xy + 4y^2 &= (x + 2y)^2 \\ (b) (x + 2y)^2 &= 0; x + 2y = 0; x = -2y \end{aligned}$$

$$\begin{aligned} 46. (a) 4y^2 - 4xy + x^2 &= (2y - x)^2 \\ (b) (2y - x)^2 &= 0; 2y - x = 0; y = x/2 \end{aligned}$$

$$\begin{aligned} 47. (a) x^4 - 5x^2 + 4 &= (x^2 - 1)(x^2 - 4) = \\ (x - 1)(x + 1)(x - 2)(x + 2) &= \\ (b) (x - 1)(x + 1)(x - 2)(x + 2) &= 0; x - 1 = 0 \text{ or } x + 1 = 0 \text{ or } x - 2 = 0 \text{ or } x + 2 = 0; x = \pm 1 \text{ or } \pm 2 \end{aligned}$$

$$\begin{aligned} 48. (a) y^4 + 2y^2 - 3 &= (y^2 - 1)(y^2 + 3) = \\ (y - 1)(y + 1)(y^2 + 3) &= \\ (b) (y - 1)(y + 1)(y^2 + 3) &= 0; y - 1 = 0 \text{ or } y + 1 = 0 \text{ or } y^2 + 3 = 0; y = \pm 1 \text{ (Notice that } y^2 + 3 = 0 \text{ has no real solutions.)} \end{aligned}$$

Solutions Section 0.4

Section 0.4

$$1. \frac{x-4}{x+1} \cdot \frac{2x+1}{x-1} = \frac{(x-4)(2x+1)}{(x+1)(x-1)} = \frac{2x^2 - 7x - 4}{x^2 - 1}$$

$$2. \frac{2x-3}{x-2} \cdot \frac{x+3}{x+1} = \frac{(2x-3)(x+3)}{(x-2)(x+1)} = \frac{2x^2 + 3x - 9}{x^2 - x - 2}$$

$$3. \frac{x-4}{x+1} + \frac{2x+1}{x-1} = \frac{(x-4)(x-1) + (x+1)(2x+1)}{(x+1)(x-1)} = \frac{3x^2 - 2x + 5}{x^2 - 1}$$

$$4. \frac{2x-3}{x-2} + \frac{x+3}{x+1} = \frac{(2x-3)(x+1) + (x-2)(x+3)}{(x-2)(x+1)} = \frac{3x^2 - 9}{x^2 - x - 2}$$

$$5. \frac{x^2}{x+1} - \frac{x-1}{x+1} = \frac{x^2 - (x-1)}{x+1} = \frac{x^2 - x + 1}{x+1}$$

$$6. \frac{x^2-1}{x-2} - \frac{1}{x-1} = \frac{(x^2-1)(x-1) - (x-2)}{(x-2)(x-1)} = \frac{x^3 - x^2 - 2x + 3}{x^2 - 3x + 2}$$

$$7. \frac{1}{\left(\frac{x}{x-1}\right)} + x - 1 = \frac{x-1}{x} + x - 1 = \frac{x-1+x(x-1)}{x} = \frac{x^2-1}{x}$$

$$8. \frac{2}{\left(\frac{x-2}{x^2}\right)} - \frac{1}{x-2} = \frac{2x^2}{x-2} - \frac{1}{x-2} = \frac{2x^2-1}{x-2}$$

$$9. \frac{1}{x} \left(\frac{x-3}{xy} + \frac{1}{y} \right) = \frac{1}{x} \left(\frac{x-3+x}{xy} \right) = \frac{2x-3}{x^2y}$$

$$10. \frac{y^2}{x} \left(\frac{2x-3}{y} + \frac{x}{y} \right) = \frac{y^2}{x} \left(\frac{2x-3+x}{y} \right) = \frac{y^2(3x-3)}{xy} = \frac{y(3x-3)}{x} = \frac{3xy-3y}{x}$$

$$11. \frac{(x+1)^2(x+2)^3 - (x+1)^3(x+2)^2}{(x+2)^6} = \frac{(x+1)^2(x+2)^2[(x+2) - (x+1)]}{(x+2)^6} = \frac{(x+1)^2}{(x+2)^4}$$

$$12. \frac{6x(x^2+1)^2(x^3+2)^3 - 9x^2(x^2+1)^3(x^3+2)^2}{(x^3+2)^6} = \frac{3x(x^2+1)^2(x^3+2)^2[2(x^3+2) - 3x(x^2+1)]}{(x^3+2)^6} = \frac{3x(x^2+1)^2(-x^3-3x+4)}{(x^3+2)^4} = \frac{-3x(x^2+1)^2(x^3+3x-4)}{(x^3+2)^4}$$

$$13. \frac{(x^2-1)\sqrt{x^2+1} - \frac{x^4}{\sqrt{x^2+1}}}{x^2+1} = \frac{(x^2-1)(x^2+1) - x^4}{(x^2+1)\sqrt{x^2+1}} = \frac{-1}{\sqrt{(x^2+1)^3}}$$

$$14. \frac{x\sqrt{x^3-1} - \frac{3x^4}{\sqrt{x^3-1}}}{x^3-1} = \frac{x(x^3-1) - 3x^4}{(x^3-1)\sqrt{x^3-1}} = \frac{-2x^4-x}{\sqrt{(x^3-1)^3}} = \frac{-x(2x^3+1)}{\sqrt{(x^3-1)^3}}$$

$$15. \frac{\frac{1}{(x+y)^2} - \frac{1}{x^2}}{y} = \frac{x^2 - (x+y)^2}{yx^2(x+y)^2} = \frac{x^2 - x^2 - 2xy - y^2}{yx^2(x+y)^2} = \frac{-y(2x+y)}{yx^2(x+y)^2} = \frac{-(2x+y)}{x^2(x+y)^2}$$

$$16. \frac{\frac{1}{(x+y)^3} - \frac{1}{x^3}}{y} = \frac{x^3 - (x+y)^3}{yx^3(x+y)^3} = \frac{x^3 - x^3 - 3x^2y - 3xy^2 - y^3}{yx^3(x+y)^3} = \frac{-y(3x^2 + 3xy + y^2)}{yx^3(x+y)^3} = \frac{-(3x^2 + 3xy + y^2)}{x^3(x+y)^3}$$

Solutions Section 0.5

Section 0.5

1. $x + 1 = 0, x = -1$

2. $x - 3 = 1, x = 4$

3. $-x + 5 = 0, x = 5$

4. $2x + 4 = 1, 2x = -3, x = -3/2$

5. $4x - 5 = 8, 4x = 13, x = 13/4$

6. $\frac{3}{4}x + 1 = 0, \frac{3}{4}x = -1, x = -4/3$

7. $7x + 55 = 98, 7x = 43, x = 43/7$

8. $3x + 1 = x, 2x = -1, x = -1/2$

9. $x + 1 = 2x + 2, -x = 1, x = -1$

10. $x + 1 = 3x + 1, -2x = 0, x = 0$

11. $ax + b = c, ax = c - b, x = (c - b)/a$

12. $x - 1 = cx + d, (1 - c)x = d + 1, x = \frac{d + 1}{1 - c}$

13. $2x^2 + 7x - 4 = 0, (2x - 1)(x + 4) = 0, x = -4, \frac{1}{2}$

14. $x^2 + x + 1 = 0, \Delta = -3 < 0$, so this equation has no real solutions

15. $x^2 - x + 1 = 0, \Delta = -3 < 0$, so this equation has no real solutions

16. $2x^2 - 4x + 3 = 0, \Delta = -8 < 0$, so this equation has no real solutions

17. $2x^2 - 5 = 0, x^2 = \frac{5}{2}, x = \pm \sqrt{\frac{5}{2}}$

18. $3x^2 - 1 = 0, x^2 = \frac{1}{3}, x = \pm \frac{1}{\sqrt{3}}$

19. $-x^2 - 2x - 1 = 0, -(x + 1)^2 = 0, x = -1$

20. $2x^2 - x - 3 = 0, (2x - 3)(x + 1) = 0, x = 3/2, -1$

21. $\frac{1}{2}x^2 - x - \frac{3}{2} = 0, x^2 - 2x - 3 = 0, (x + 1)(x - 3) = 0, x = -1, 3$

22. $-\frac{1}{2}x^2 - \frac{1}{2}x + 1 = 0, x^2 + x - 2 = 0, (x + 2)(x - 1) = 0, x = -2, 1$

23. $x^2 - x = 1, x^2 - x - 1 = 0, x = \frac{1 \pm \sqrt{5}}{2}$ by the quadratic formula

24. $16x^2 = -24x - 9, 16x^2 + 24x + 9 = 0, (4x + 3)^2 = 0, x = -3/4$

25. $x = 2 - \frac{1}{x}, x^2 = 2x - 1, x^2 - 2x + 1 = 0, (x - 1)^2 = 0, x = 1$

26. $x + 4 = \frac{1}{x - 2}, (x + 4)(x - 2) = 1, x^2 + 2x - 8 = 1, x^2 + 2x - 9 = 0, x = \frac{-2 \pm \sqrt{40}}{2} = -1 \pm \sqrt{10}$ by the quadratic formula

27. $x^4 - 10x^2 + 9 = 0, (x^2 - 1)(x^2 - 9) = 0, x^2 = 1 \text{ or } x^2 = 9, x = \pm 1, \pm 3$

28. $x^4 - 2x^2 + 1 = 0, (x^2 - 1)^2 = 0, x = \pm 1$

29. $x^4 + x^2 - 1 = 0, x^2 = \frac{-1 \pm \sqrt{5}}{2}$ by the quadratic formula, $x = \pm \sqrt{\frac{-1 \pm \sqrt{5}}{2}}$

30. $x^3 + 2x^2 + x = 0, x(x^2 + 2x + 1) = 0, x(x + 1)^2 = 0, x = 0, -1$

31. $x^3 + 6x^2 + 11x + 6 = 0, (x + 1)(x + 2)(x + 3) = 0, x = -1, -2, -3$

32. $x^3 - 6x^2 + 12x - 8 = 0, (x - 2)^3 = 0, x = 2$

33. $x^3 + 4x^2 + 4x + 3 = 0,$

Solutions Section 0.5

$(x + 3)(x^2 + x + 1) = 0$, $x = -3$ (For $x^2 + x + 1 = 0$, $\Delta = -3 < 0$, so there are no real solutions to this quadratic equation.)

34. $y^3 + 64 = 0$, $y^3 = -64$, $y = \sqrt[3]{-64} = -4$

35. $x^3 - 1 = 0$, $x^3 = 1$, $x = \sqrt[3]{1} = 1$

36. $x^3 - 27 = 0$, $x^3 = 27$, $x = \sqrt[3]{27} = 3$

37. $y^3 + 3y^2 + 3y + 2 = 0$,
 $(y + 2)(y^2 + y + 1) = 0$, $y = -2$ (For $y^2 + y + 1 = 0$, $\Delta = -3 < 0$, so there are no real solutions to this quadratic equation.)

38. $y^3 - 2y^2 - 2y - 3 = 0$,
 $(y - 3)(y^2 + y + 1) = 0$, $y = 3$ (For $y^2 + y + 1 = 0$, $\Delta = -3 < 0$, so there are no real solutions to this quadratic equation.)

39. $x^3 - x^2 - 5x + 5 = 0$, $(x - 1)(x^2 - 5) = 0$,
 $x = 1, \pm\sqrt{5}$

40. $x^3 - x^2 - 3x + 3 = 0$, $(x - 1)(x^2 - 3) = 0$,
 $x = 1, \pm\sqrt{3}$

41. $2x^6 - x^4 - 2x^2 + 1 = 0$, $(2x^2 - 1)(x^4 - 1) = 0$,
 [or $(2x^2 - 1)(x^2 - 1)(x^2 + 1) = 0$; in any case, think of the cubic you get by substituting y for x^2], $x = \pm 1, \pm \frac{1}{\sqrt{2}}$

42. $3x^6 - x^4 - 12x^2 + 4 = 0$,
 $(3x^2 - 1)(x^4 - 4) = 0$, [or $(3x^2 - 1)(x^2 - 2)(x^2 + 2) = 0$], $x = \pm\sqrt{2}, \pm \frac{1}{\sqrt{3}}$

43. $(x^2 + 3x + 2)(x^2 - 5x + 6) = 0$,
 $(x + 2)(x + 1)(x - 2)(x - 3) = 0$, $x = -2, -1, 2, 3$

44. $(x^2 - 4x + 4)^2(x^2 + 6x + 5)^3 = 0$,
 $(x - 2)^4(x + 1)^3(x + 5)^3 = 0$, $x = -5, -1, 2$

Solutions Section 0.6

Section 0.6

1. $x^4 - 3x^3 = 0$, $x^3(x - 3) = 0$, $x = 0, 3$

2. $x^6 - 9x^4 = 0$, $x^4(x^2 - 9) = 0$, $x = 0, \pm 3$

3. $x^4 - 4x^2 = -4$, $x^4 - 4x^2 + 4 = 0$, $(x^2 - 2)^2 = 0$, $x = \pm\sqrt{2}$

4. $x^4 - x^2 = 6$, $x^4 - x^2 - 6 = 0$,
 $(x^2 - 3)(x^2 + 2) = 0$, $x = \pm\sqrt{3}$

5. $(x + 1)(x + 2) + (x + 1)(x + 3) = 0$,
 $(x + 1)(x + 2 + x + 3) = 0$, $(x + 1)(2x + 5) = 0$, $x = -1, -5/2$

6. $(x + 1)(x + 2)^2 + (x + 1)^2(x + 2) = 0$,
 $(x + 1)(x + 2)(x + 2 + x + 1) = 0$,
 $(x + 1)(x + 2)(2x + 3) = 0$, $x = -1, -2, -3/2$

7. $(x^2 + 1)^5(x + 3)^4 + (x^2 + 1)^6(x + 3)^3 = 0$,
 $(x^2 + 1)^5(x + 3)^3(x + 3 + x^2 + 1) = 0$,
 $(x^2 + 1)^5(x + 3)^3(x^2 + x + 4) = 0$, $x = -3$ (Neither $x^2 + 1 = 0$ nor $x^2 + x + 4 = 0$ has a real solution.)

8. $10x(x^2 + 1)^4(x^3 + 1)^5 - 10x^2(x^2 + 1)^5(x^3 + 1)^4 = 0$,
 $10x(x^2 + 1)^4(x^3 + 1)^4[x^3 + 1 - x(x^2 + 1)] = 0$,
 $10x(x^2 + 1)^4(x^3 + 1)^4(1 - x) = 0$, $x = -1, 0, 1$

9. $(x^3 + 1)\sqrt{x + 1} - (x^3 + 1)^2\sqrt{x + 1} = 0$,
 $(x^3 + 1)\sqrt{x + 1} [1 - (x^3 + 1)] = 0$,
 $-x^3(x^3 + 1)\sqrt{x + 1} = 0$, $x = 0, -1$

10. $(x^2 + 1)\sqrt{x + 1} - \sqrt{(x + 1)^3} = 0$,
 $\sqrt{x + 1} [x^2 + 1 - (x + 1)] = 0$, $(x^2 - x)\sqrt{x + 1} = 0$,
 $x(x - 1)\sqrt{x + 1} = 0$, $x = -1, 0, 1$

11. $\sqrt{(x + 1)^3} + \sqrt{(x + 1)^5} = 0$, $\sqrt{(x + 1)^3} (1 + x + 1) = 0$, $(x + 2)\sqrt{(x + 1)^3} = 0$, $x = -1$ ($x = -2$ is not a solution because $\sqrt{(x + 1)^3}$ is not defined for $x = -2$.)

12. $(x^2 + 1)\sqrt[3]{(x + 1)^4} - \sqrt[3]{(x + 1)^7} = 0$,
 $\sqrt[3]{(x + 1)^4} [x^2 + 1 - (x + 1)] = 0$,

$(x^2 - x)\sqrt[3]{(x + 1)^4} = 0$, $x(x - 1)\sqrt[3]{(x + 1)^4} = 0$,
 $x = -1, 0, 1$

13. $(x + 1)^2(2x + 3) - (x + 1)(2x + 3)^2 = 0$,
 $(x + 1)(2x + 3)(x + 1 - 2x - 3) = 0$,
 $(x + 1)(2x + 3)(-x - 2) = 0$, $x = -2, -3/2, -1$

14. $(x^2 - 1)^2(x + 2)^3 - (x^2 - 1)^3(x + 2)^2 = 0$,
 $(x^2 - 1)^2(x + 2)^2(x + 2 - x^2 + 1) = 0$,
 $-(x^2 - 1)^2(x + 2)^2(x^2 - x - 3) = 0$, $x = -2, -1, 1$,
 $(1 \pm \sqrt{13})/2$

15. $\frac{(x + 1)^2(x + 2)^3 - (x + 1)^3(x + 2)^2}{(x + 2)^6} = 0$,
 $\frac{(x + 1)^2(x + 2)^2[(x + 2) - (x + 1)]}{(x + 2)^6} = 0$, $\frac{(x + 1)^2}{(x + 2)^4} = 0$,
 $0, (x + 1)^2 = 0$, $x = -1$

16. $\frac{6x(x^2 + 1)^2(x^2 + 2)^4 - 8x(x^2 + 1)^3(x^2 + 2)^3}{(x^2 + 2)^8} = 0$,
 $\frac{2x(x^2 + 1)^2(x^2 + 2)^3[3(x^2 + 2) - 4(x^2 + 1)]}{(x^2 + 2)^8} = 0$,
 $\frac{-2x(x^2 + 1)^2(x^2 - 2)}{(x^2 + 2)^5} = 0$,
 $-2x(x^2 + 1)^2(x^2 - 2) = 0$, $x = 0, \pm\sqrt{2}$

17. $\frac{2(x^2 - 1)\sqrt{x^2 + 1} - \frac{x^4}{\sqrt{x^2 + 1}}}{x^2 + 1} = 0$,
 $\frac{2(x^2 - 1)(x^2 + 1) - x^4}{(x^2 + 1)\sqrt{x^2 + 1}} = 0$, $\frac{x^4 - 2}{(x^2 + 1)\sqrt{x^2 + 1}} = 0$, $x^4 - 2 = 0$, $x = \pm\sqrt[4]{2}$

18. $\frac{4x\sqrt{x^3 - 1} - \frac{3x^4}{\sqrt{x^3 - 1}}}{x^3 - 1} = 0$,
 $\frac{4x(x^3 - 1) - 3x^4}{(x^3 - 1)\sqrt{x^3 - 1}} = 0$, $\frac{x^4 - 4x}{(x^3 - 1)\sqrt{x^3 - 1}} = 0$,
 $x^4 - 4x = 0$, $x(x^3 - 4) = 0$, $x = 0, \pm\sqrt[3]{4}$

19. $x - \frac{1}{x} = 0$, $x^2 - 1 = 0$, $x = \pm 1$

Solutions Section 0.6

$$20. 1 - \frac{4}{x^2} = 0, x^2 - 4 = 0, x = \pm 2$$

$$21. \frac{1}{x} - \frac{9}{x^3} = 0, x^2 - 9 = 0, x = \pm 3$$

$$22. \frac{1}{x^2} - \frac{1}{x+1} = 0, x+1-x^2 = 0,$$

$$x^2 - x - 1 = 0, x = (1 \pm \sqrt{5})/2$$

$$23. \frac{x-4}{x+1} - \frac{x}{x-1} = 0, \frac{(x-4)(x-1) - x(x+1)}{(x+1)(x-1)} =$$

$$0,$$

$$\frac{-6x+4}{(x+1)(x-1)} = 0, -6x+4 = 0, x = 2/3$$

$$24. \frac{2x-3}{x-1} - \frac{2x+3}{x+1} = 0,$$

$$\frac{(2x-3)(x+1) - (2x+3)(x-1)}{(x-1)(x+1)} = 0,$$

$$\frac{-2x}{(x-1)(x+1)} = 0, -2x = 0, x = 0$$

$$25. \frac{x+4}{x+1} + \frac{x+4}{3x} = 0, \frac{3x(x+4) + (x+1)(x+4)}{3x(x+1)} =$$

$$0, \frac{(x+4)(3x+x+1)}{3x(x+1)} = 0, \frac{(x+4)(4x+1)}{3x(x+1)} = 0, (x$$

$$+ 4)(4x+1) = 0, x = -4, -1/4$$

$$26. \frac{2x-3}{x} - \frac{2x-3}{x+1} = 0,$$

$$\frac{(2x-3)(x+1) - x(2x-3)}{x(x+1)} = 0,$$

$$\frac{(2x-3)(x+1-x)}{x(x+1)} = 0, \frac{2x-3}{x(x+1)} = 0,$$

$$2x-3 = 0, x = 3/2$$

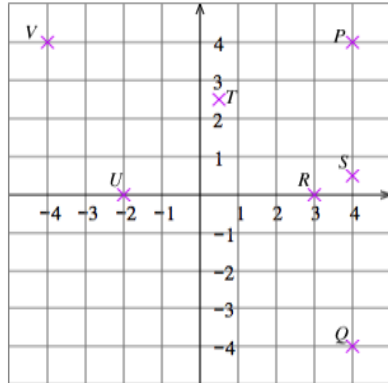
Solutions Section 0.7

Section 0.7

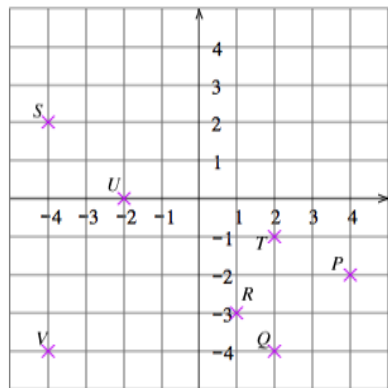
1. $P(0, 2)$, $Q(4, -2)$, $R(-2, 3)$, $S(-3.5, -1.5)$, $T(-2.5, 0)$, $U(2, 2.5)$

2. $P(-2, 2)$, $Q(3.5, 2)$, $R(0, -3)$, $S(-3.5, -1.5)$, $T(2.5, 0)$, $U(-2, 2.5)$

3.



4.

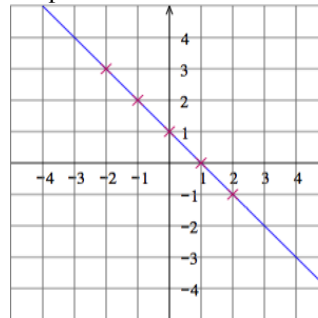


5. Solve the equation $x + y = 1$ for y to get $y = 1 - x$.

Then plot some points:

x	$y = 1 - x$
-2	3
-1	2
0	1
1	0
2	-1

Graph:



6. Solve the equation $y - x = -1$ for y to get $y = -1 + x$. Then plot some points:

x	$y = 4 + x$
-2	-3
-1	-2
0	-1
1	0
2	1

Graph:

