

3.5 Exercises

Factor out the greatest common factor. See Examples 1–6.

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|--|---|
| –1. $15k + 30$ | 2. $7m - 21$ |
| 3. $6p^2 + 4p$ | 4. $12a^3 + 9a^2$ |
| –5. $8m^2p - 4mp^2$ | 6. $12z^2 - 6zw^3$ |
| 7. $5xy - 8xy^2$ | 8. $4ab + 2a^2b$ |
| –9. $8m^4 + 6m^3 - 4m^2$ | 10. $2p^5 + 4p^6 - 8p^3$ |
| 11. $10t^5 - 8t^4 - 16t^3$ | 12. $6p^3 - 18p^2 + 9p^4$ |
| –13. $6r^2s - 3rs^2 - 9r^3s$ | 14. $5p^3t^2 + 25p^2t^3 + 10p^3t^4$ |
| 15. $2x^2y - 3xy^2 + 4x^2y^2$ | 16. $14a^3b^2 + 7a^2b - 21a^5b^3$ |
| –17. $12km^3 - 24k^3m^2 + 36k^2m^4$ | 18. $15m^3p^3 - 6m^3p^4 + 9mp^3$ |
| 19. $144z^{11}m^4 + 16z^3m^5 - 32z^4m^5$ | 20. $39a^5b^3 - 26a^7b^2 + 52a^8b^5$ |
| –21. $16z^2n^6 + 64zn^7 - 32z^3n^3$ | 22. $5r^3s^5 + 10r^2s^2 - 15r^4s^2$ |
| 23. $15a^3b + 12a^2c - 3ad^4$ | 24. $20m^4y + 30m^2y^2 + 50m^3z^2$ |
| –25. $9x^2y^2z^4 - 18x^3y^2z$ | 26. $30m^5p^5q^3 + 20m^6p^4q^2$ |
| 27. $12p^5q^6 + 5r^2s^2 + 24p^3r^2$ | 28. $2m^8k^8 + 7q^4p^5 + 14m^6p^3$ |
| –29. $14a^3b^2 + 7a^2b - 21a^5b^3 + 42ab^4$ | 30. $12km^3 - 24k^3m^2 + 36k^2m^4 - 60k^4m^3$ |
| 31. $-15m^3p^3 - 6m^3p^4 - 9mp^3 + 30m^2p^3$ | 32. $-25x^3y^2 - 20x^4y^3 + 15x^5y^4 - 50x^6y^2$ |
| –33. $(m - 9)(m + 1) + (m - 9)(m + 2)$ | 34. $(a + 5)(a - 6) + (a + 5)(a - 1)$ |
| 35. $(3k - 7)(k + 2) + (3k - 7)(k + 5)$ | 36. $(5m - 11)(2m + 5) + (5m - 11)(m + 5)$ |
| –37. $(r - 6)(2r + 1) - (r - 6)(r + 3)$ | 38. $(y + 2)(2y + 3) - (y + 2)(y + 1)$ |
| 39. $m^5(r + s) + m^5(t + u)$ | $\left\{ \begin{array}{l} 40. z^3(k + m) + z^3(p + q) \\ 42. 2(t - s) + 4(t - s)^2 - (t - s)^3 \\ 44. 6(a + 2b)^2 - 4(a + 2b)^3 + 12(a + 2b)^4 \\ 46. -9a^2(p + q) - 3a^3(p + q)^2 + 6a(p + q)^3 \end{array} \right.$ |
| 41. $4(3 - x)^2 - (3 - x)^3 + 3(3 - x)$ | |
| 43. $15(2z + 1)^3 + 10(2z + 1)^2 - 25(2z + 1)$ | |
| 45. $5(m + p)^3 - 10(m + p)^2 - 15(m + p)^4$ | |

Factor each of the following polynomials twice. First, use a common factor with a positive coefficient, and then use a common factor with a negative coefficient. See Example 6.

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| 47. $24z^2 - 48z$ | 48. $39p^3 - 65p^4$ |
| 49. $-2x^5 + 6x^3 + 4x^2$ | 50. $-5a^3 + 10a^4 - 15a^5$ |
| 51. $-32a^4m^5 - 16a^2m^3 - 64a^5m^6$ | 52. $-144z^{11}n^5 + 16z^3n^{11} - 32z^4n^7$ |

Factor by grouping. See Examples 7–9.

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|-----------------------------------|-----------------------------------|
| 53. $pq + 3rq + pm + 3rm$ | 54. $5x + 5a + 9bx + 9ab$ |
| 55. $2b + 2c + ab + ac$ | 56. $3am + 3ap + 2bm + 2bp$ |
| 57. $p^2 + pq - 3py - 3yq$ | 58. $r^2 + 6rs - 3rt - 18st$ |
| 59. $a^2b^2 + 2b^2 - 5a^2 - 10$ | 60. $m^2r^2 + 8r^2 - 3m^2 - 24$ |
| 61. $x^2 - 3x + 2x - 6$ | 62. $y^2 - 8y + 4y - 32$ |
| 63. $3r^2 - 2r + 15r - 10$ | 64. $2a^2 - 6a + 7a - 21$ |
| 65. $21y^2 + 14y - 15y - 10$ | 66. $18q^2 + 9q - 4q - 2$ |
| 67. $16p^2 + 6pq - 8pq - 3q^2$ | 68. $8r^2 + 6rs - 12rs - 9s^2$ |
| 69. $14m^2 + 21mq - 2mq - 3q^2$ | 70. $10y^2 + 4yz - 5y - 2z$ |
| 71. $3a^3 + 3ab^2 + 2a^2b + 2b^3$ | 72. $16m^3 - 4m^2p^2 - 4mp + p^3$ |
| 73. $1 - a + ab - b$ | 74. $2ab^2 - 8b^2 + a - 4$ |
| 75. $8 - 6y^3 - 12y + 9y^4$ | 76. $x^3y^2 + x^3 - 3y^2 - 3$ |

Factor each of the following polynomials. Assume that all variables used as exponents represent positive integers.

77. $p^{6m} - 2p^{4m}$

79. $q^{3k} + 2q^{2k} + 3q^k$

81. $y^{r+5} + y^{r+4} + y^{r+2}$

83. $(3k - 7)(k + 2) - (7 - 3k)(2k + 1)$

85. $r^p m^p + q^p m^p - r^p z^p - q^p z^p$

78. $4r^{3z} + 8r^{5z}$

80. $z^{2x} - z^x + z^{3x}$

82. $8k^{2z+3} + 2k^{2z+1} + 12k^{2z}$

84. $(5z + 1)(3z - 5) + (2z - 7)(5 - 3z)$

86. $6a^2 b^z - 10b^z - 3a^2 c^z + 5c^z$

Factor out the greatest common factor.

87. $3m^{-5} + m^{-3}$

89. $3p^{-3} + 2p^{-2} - 4p^{-1}$

88. $k^{-2} + 2k^{-4}$

90. $-5y^{-3} + 8y^{-2} + y^{-1}$

Review Exercises Find each product by the FOIL method. See Section 3.4.

91. $(2m - 1)(3m + 2)$

92. $(4p + 5)(3p - 7)$

93. $(8r + 5s)(2r - 3s)$

94. $(7y - 2x)(3y + 5x)$

95. $(9z - 7a)(2z + 5a)$

96. $(8p + 3q)(4p - q)$

97. $(2r - 5s)(7r + 3s)$

98. $(2a + 7b)(3a + 5b)$

3.6 Exercises

Factor each of the following trinomials. See Examples 1–9.

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|------------------------------------|---------------------------|-----------------------------------|---------------------------|
| 1. $c^2 + 4c - 5$ | 2. $d^2 + 9d + 8$ | 3. $p^2 + 6p + 8$ | 4. $m^2 + 15m + 56$ |
| 5. $a^2 - a - 12$ | 6. $z^2 + 2z - 35$ | 7. $r^2 - r - 20$ | 8. $y^2 - 2y - 35$ |
| 9. $x^2 - 3x - 40$ | 10. $a^2 - 6a - 16$ | 11. $k^2 - kn - 6n^2$ | 12. $a^2 + 3ab - 18b^2$ |
| 13. $y^2 - 3yx - 10x^2$ | 14. $p^2 - 2pq - 15q^2$ | 15. $a^2b^2 - 7ab + 12$ | 16. $y^2w^2 + 4yw - 21$ |
| 17. $5y^2 + y - 6$ | 18. $2r^2 - r - 3$ | 19. $3m^2 + 7m + 2$ | 20. $3y^2 + 14y + 8$ |
| 21. $8y^2 + 13y - 6$ | 22. $6x^2 + 13x + 6$ | 23. $18x^2 - 3x - 10$ | 24. $12m^2 - 8m - 15$ |
| 25. $35p^2 - 4p - 15$ | 26. $6m^2 - 17m - 14$ | 27. $12a^2 + 8ab - 15b^2$ | 28. $3m^2 + 7mk + 2k^2$ |
| 29. $4k^2 - 12ka + 9a^2$ | 30. $18a^2 - 3ab - 28b^2$ | 31. $35x^2 - 41xy - 24y^2$ | 32. $10a^2 + ab - 3b^2$ |
| 33. $8m^2 - 14mp - 39p^2$ | 34. $6x^2 - 5xy - 39y^2$ | 35. $6k^2p^2 + 13kp + 6$ | 36. $15z^2x^2 - 22zx - 5$ |
| 37. $12m^2 + 14m - 40$ | 38. $36t^2 + 30t - 50$ | 39. $18a^2 - 15a - 18$ | 40. $100r^2 - 90r + 20$ |
| 41. $6a^3 + 12a^2 - 90a$ | 42. $3m^4 + 6m^3 - 72m^2$ | 43. $13y^3 + 39y^2 - 52y$ | 44. $4p^3 + 24p^2 - 64p$ |
| 45. $2x^3y^3 - 48x^2y^4 + 288xy^5$ | | 46. $6m^3n^2 - 24m^2n^3 - 30mn^4$ | |

Factor each of the following. See Examples 10 and 11.

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|------------------------|------------------------|-------------------------|
| 47. $3x^4 - 14x^2 - 5$ | 48. $3p^4 - 8p^2 - 3$ | 49. $z^4 - 7z^2 - 30$ |
| 50. $k^4 + k^2 - 12$ | 51. $6x^4 + 5x^2 - 25$ | 52. $6a^4 - 11a^2 - 10$ |

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53. $12p^4 + 28p^2r - 5r^2$
 55. $4x^4 + 33x^2a^2 - 27a^4$

Find a polynomial that can be factored as follows.

57. $(3q + 7h)(q - 2h)$
 59. $-9a(a - 5b)(2a + 7b)$

Factor each of the following. Assume that all variables used as exponents represent positive integers. See Examples 10 and 11.

61. $6(p + 3)^2 + 13(p + 3) + 5$
 63. $6(z + k)^2 - 7(z + k) - 5$
 65. $a^2(a + b)^2 - ab(a + b)^2 - 6b^2(a + b)^2$
 67. $p^2(p + q) + 4pq(p + q) + 3q^2(p + q)$
 69. $z^2(z - x) - zx(x - z) - 2x^2(z - x)$
 71. $p^{2n} - p^n - 6$
 73. $6z^{4r} - 5z^{2r} - 4$
 75. $36k^{3r} + 30k^{2r} + 4k^r$

Review Exercises Simplify. See Section 3.2.

77. -5^0 78. $\left(\frac{5}{4}\right)^{-2}$

Find each product. See Section 3.4.

81. $(2m - 5)(2m + 5)$ 82. $(3p + 2q)(3p - 2q)$ 83. $(5a - 3b)^2$
 84. $(2z + 5x)^2$ 85. $(y - 2)(y^2 + 2y + 4)$ 86. $(5a + 3)(25a^2 - 15a + 9)$

54. $2y^4 + xy^2 - 6x^2$
 56. $2p^4 + 31p^2q^2 - 16q^4$

58. $(5p - 2q)(3p + 4q)$
 60. $12z^2(5z + x)(2z - x)$

62. $10(m - 5)^2 - 9(m - 5) - 9$
 64. $3(r + m)^2 - 10(r + m) - 25$
 66. $m^2(m - p) + mp(m - p) - 2p^2(m - p)$
 68. $2k^2(5 - y) - 7k(5 - y) + 5(5 - y)$
 70. $r^2(r - s) - 5rs(s - r) - 6s^2(r - s)$
 72. $k^{2y} + 4k^y - 5$
 74. $12a^{4p} + 11a^{2p} + 2$
 76. $30y^{7a} - 26y^{6a} - 40y^{5a}$

79. $\frac{(m^2p)^{-1}}{mp^2}$ 80. $\frac{(2rs)^3}{(r^{-1}s)^2}$

3.7 Exercises

Factor each of the following. See Examples 1–4.

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| 1. $x^2 - 25$ | 2. $9 - p^2$ | 3. $36m^2 - 25$ |
| 4. $4x^2 - 49$ | 5. $16y^2 - 81q^2$ | 6. $9m^2 - 100r^2$ |
| 7. $16 - 25a^2b^2$ | 8. $49 - 64x^2z^2$ | 9. $a^4 - 4b^4$ |
| 10. $m^2p^2 - 49r^2s^2$ | 11. $x^2 + 4x + 4$ | 12. $y^2 + 6y + 9$ |
| 13. $a^2 - 10a + 25$ | 14. $b^2 - 8b + 16$ | 15. $9r^2 - 6rs + s^2$ |
| 16. $4a^2 - 20ab + 25b^2$ | 17. $25x^2y^2 - 20xy + 4$ | 18. $9k^2q^2 + 24kq + 16$ |
| 19. $72m^2 - 120mp + 50p^2$ | 20. $100y^2 - 100yz + 25z^2$ | 21. $8a^3 + 1$ |
| 22. $125a^3 - 1$ | 23. $27x^3 - 64y^3$ | 24. $8a^3 + 125m^3$ |
| 25. $64x^3 + 125y^3$ | 26. $216z^3 - x^3$ | 27. $125m^3 - 8p^3$ |
| 28. $64y^3 - 1331x^3$ | 29. $1000 + 27r^3s^3$ | 30. $343 + 1000a^3b^3$ |
| 31. $64v^6 + 1$ | 32. $m^6 - 8$ | |

Factor each of the following.

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| 33. $(x + y)^2 - 16$ | 34. $(a + b)^2 - 100$ | 35. $25 - (r + 3s)^2$ |
| 36. $81 - (2k + z)^2$ | 37. $m^2 - (3p - 5)^2$ | 38. $w^2 - (2z - 3)^2$ |
| 39. $(a + b)^2 - (a - b)^2$ | 40. $(c - d)^2 - (c + d)^2$ | 41. $(a + b)^2 + 2(a + b) + 1$ |
| 42. $(x + y)^2 + 6(x + y) + 9$ | 43. $(m - p)^2 + 4(m - p) + 4$ | 44. $(w - r)^2 + 8(w - r) + 16$ |
| 45. $p^2 - 6p + 9 - r^2$ | 46. $k^2 - 10k + 25 - z^2$ | 47. $9y^2 - 30y + 25 - 16x^2$ |
| 48. $25a^2 - 20a + 4 - 9b^2$ | 49. $r^2 - 16s^2 + 24s - 9$ | 50. $t^2 - 16u^2 + 8u - 1$ |
| 51. $64 - (a - b)^3$ | 52. $(r + 1)^3 - 1$ | 53. $(p - 5)^3 + 125$ |
| 54. $m^3 + (m + 3)^3$ | 55. $a^3 - (a - 4)^3$ | 56. $(p + q)^3 - (p - q)^3$ |

Find a value of b or c so that the following will be perfect squares.

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| 57. $p^2 + 6p + c$ | 58. $y^2 - 14y + c$ | 59. $9z^2 - 30z + c$ |
| 60. $16r^2 + 24r + c$ | 61. $16q^2 + bq + 25$ | 62. $36x^2 + bx + 25$ |

Factor each of the following. Assume that all variables used as exponents represent positive integers.

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| 63. $16m^{4x} - 9$ | 64. $100m^{2q} - 81$ | 65. $64r^{8z} - 1$ |
| 66. $4 - 49x^{4y}$ | 67. $100m^{2z} - 9p^{8z}$ | 68. $16k^{8b} - 25m^{4b}$ |
| 69. $9a^{4z} - 30a^{2z} + 25$ | 70. $121p^{8k} + 44p^{4k} + 4$ | 71. $x^{3n} - 8$ |
| 72. $216 + b^{3k}$ | 73. $27z^{12y} + 125x^{6y}$ | 74. $1000k^{15r} - m^{21r}$ |

Review Exercises Factor completely. See Sections 3.5 and 3.6.

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| 75. $16y^2 - 24y + 32y^3$ | 76. $9z^2 - 10z^5 + z^7$ | 77. $xy + 2y + 4x + 8$ |
| 78. $a^2b^2 + 3b^2 + 2a^2 + 6$ | 79. $y^2 + y - 2$ | 80. $m^2 - 4m - 21$ |
| 81. $6r^2 + 19rz - 7z^2$ | 82. $10w^2 + 19wx + 6x^2$ | |

3.8 Exercises

Factor each of the following polynomials. Assume all variables used as exponents are positive integers.

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| 1. $100a^2 - 9b^2$ | 2. $10r^2 + 13r - 3$ | 3. $3p^4 - 3p^3 - 90p^2$ |
| 4. $k^4 - 16$ | 5. $3a^2pq + 3abpq - 90b^2pq$ | 6. $49z^2 - 16$ |
| 7. $225p^2 + 256$ | 8. $x^3 - 1000$ | 9. $6b^2 - 17b - 3$ |
| 10. $k^2 - 6k - 16$ | 11. $18m^3n + 3m^2n^2 - 6mn^3$ | 12. $6t^2 + 19tu - 77u^2$ |
| 13. $2p^2 + 11pq + 15q^2$ | 14. $40p - 32r$ | 15. $9m^2 - 45m + 18m^3$ |
| 16. $4k^2 + 28kr + 49r^2$ | 17. $54m^3 - 2000$ | 18. $mn - 2n - 5m - 10$ |
| 19. $2a^2 - 7a - 4$ | 20. $9m^2 - 30mn + 25n^2$ | 21. $kq - 9q + kr - 9r$ |
| 22. $56k^3 - 875$ | 23. $9r^2 + 100$ | 24. $16z^3x^2 - 32z^2x$ |
| 25. $8p^3 - 125$ | 26. $yx + yw + zx + zw$ | 27. $x^4 - 625$ |
| 28. $2m^2 - mn - 15n^2$ | 29. $p^3 + 64$ | 30. $48y^2z^3 - 28y^3z^4$ |
| 31. $64m^2 - 625$ | 32. $14z^2 - 3zk - 2k^2$ | 33. $12z^3 - 6z^2 + 18z$ |
| 34. $225k^2 - 36r^2$ | 35. $256b^2 - 400c^2$ | 36. $z^2 - zp - 20p^2$ |
| 37. $1000z^3 + 512$ | 38. $64m^2 - 25n^2$ | 39. $10r^2 + 23rs - 5s^2$ |
| 40. $12k^2 - 17kq - 5q^2$ | 41. $24p^3q + 52p^2q^2 + 20pq^3$ | 42. $32x^2 + 16x^3 - 24x^5$ |
| 43. $48k^4 - 243$ | 44. $14x^2 - 25xq - 25q^2$ | 45. $50p^2 - 162$ |
| 46. $y^2 + 3y - 10$ | 47. $12m^2rx + 4mnrx + 40n^2rx$ | 48. $18p^2 + 53pr - 35r^2$ |
| 49. $21a^2 - 5ab - 4b^2$ | 50. $(x - 2y)^2 - 4$ | 51. $(3m - n)^2 - 25$ |
| 52. $(5r + 2s)^2 - 6(5r + 2s) + 9$ | 53. $(p + 8q)^2 - 10(p + 8q) + 25$ | |
| 54. $z^4 - 9z^2 + 20$ | 55. $21m^4 - 32m^2 - 5$ | |
| 56. $(x - y)^3 - (27 - y)^3$ | 57. $z^{4x} - w^{2x}$ | |
| 58. $xy^2z^{-1} + x^2yz^{-2}$ ($z \neq 0$) | 59. $gh^3k^{-2} - g^2h^2k^{-3}$ ($k \neq 0$) | |
| 60. $2a^x + 4a^{2x} + 8a^{3x}$ | 61. $3m^{2k} - 7m^k - 6$ | |
| 62. $2p^{2a} + 10p^a - 28$ | 63. $m^2 - 4m + 4 - n^2 + 6n - 9$ | |
| 64. $x^{2p} - y^{2p}$ | 65. $15c^{4y} + 3c^{2y} - 6c^y$ | |
| 66. $k^2 + 2kp + p^2 - a^2 - 2ab - b^2$ | 67. $8 + (z + w)^3$ | |

Review Exercises Simplify. See Section 3.1.

68. $\frac{2^4 \cdot 2^{-3}}{2^{-2}}$

69. $\frac{3^6 \cdot 3^{-1}}{3^3}$

70. $\frac{p^5 p^{-2}}{p^{-1} p^4}$ ($p \neq 0$)

71. $\frac{2k^{-1}k}{k^2 k^{-2}}$ ($k \neq 0$)

Solve each equation. See Section 2.1.

72. $3x + 1 = 13$

73. $5r - 2 = 8$

74. $-2q + 3 = 7$

75. $-a + 4 = 5$

76. $4p = 0$

77. $-9r = 0$

78. $-2z + 8 = 9$

79. $1 - 3y = 5$

Section 3.5 (page 126)

1. $15(k+2)$ 3. $2p(3p+2)$ 5. $4mp(2m-p)$ 7. $xy(5-8y)$ 9. $2m^2(4m^2+3m-2)$
 11. $2i^3(5i^2-4i-8)$ 13. $3rs(2r-s-3r^2)$ 15. $xy(2x-3y+4xy)$
 17. $12km^2(m-2k^2+3km^2)$ 19. $16z^3m^4(9z^8+m-2zm)$ 21. $16zn^3(zn^3+4n^4-2z^2)$
 23. $3a(5a^2b+4ac-d^4)$ 25. $9x^2y^2z(z^3-2x)$ 27. No common factor other than 1
 29. $7ab(2a^2b+a-3a^4b^2+6b^3)$ 31. $3mp^3(-5m^2-2m^2p-3+10m)$ or $-3mp^3(5m^2+2m^2p+3-10m)$ 33. $(m-9)(2m+3)$ 35. $(3k-7)(2k+7)$
 37. $(r-6)(r-2)$ 39. $m^5(r+s+t+u)$ 41. $(3-x)(6+2x-x^2)$
 43. $20z(2z+1)(3z+4)$ 45. $5(m+p)^2(m+p-2-3m^2-6mp-3p^2)$
 47. $24z(z-2)$ or $-24z(-z+2)$ 49. $2x^2(-x^3+3x+2)$ or $-2x^2(x^3-3x-2)$
 51. $16a^2m^3(-2a^2m^2-1-4a^3m^3)$ or $-16a^2m^3(2a^2m^2+1+4a^3m^3)$ 53. $(p+3r)(q+m)$
 55. $(b+c)(2+a)$ 57. $(p+q)(p-3y)$ 59. $(a^2+2)(b^2-5)$ 61. $(x-3)(x+2)$
 63. $(3r-2)(r+a)$ 65. $(3y+2)(7y-5)$ 67. $(8p+3q)(2p-q)$ 69. $(2m+3q)(7m-q)$
 71. $(a^2+b^2)(3a+2b)$ 73. $(1-a)(1-b)$ 75. $(4-3y^3)(2-3y)$ 77. $p^{4m}(p^{2m}-2)$
 79. $q^k(q^{2k}+2q^k+3)$ 81. $y^{r+2}(y^3+y^2+1)$ 83. $3(3k-7)(k+1)$ 85. $(r^p+q^p)(m^p-z^p)$
 87. $m^{-5}(3+m^2)$ or $(m^2+3)/m^5$ 89. $p^{-3}(3+2p-4p^2)$ or $(-4p^2+2p+3)/p^3$ 91. $6m^2+m-2$
 93. $16r^2-14rs-15s^2$ 95. $18z^2+31za-35a^2$ 97. $14r^2-29rs-15s^2$

Section 3.6 (page 133)

1. $(c+5)(c-1)$ 3. $(p+2)(p+4)$ 5. $(a-4)(a+3)$ 7. $(r+4)(r-5)$
 9. $(x-8)(x+5)$ 11. $(k-3n)(k+2n)$ 13. $(y-5x)(y+2x)$ 15. $(ab-3)(ab-4)$
 17. $(5y+6)(y-1)$ 19. $(3m+1)(m+2)$ 21. $(8y-3)(y+2)$ 23. $(3x+2)(6x-5)$
 25. $(7p-5)(5p+3)$ 27. $(6a-5b)(2a+3b)$ 29. $(2k-3a)(2k-3a)$ or $(2k-3a)^2$
 31. $(7x+3y)(5x-8y)$ 33. $(2m+3p)(4m-13p)$ 35. $(3kp+2)(2kp+3)$
 37. $2(3m-4)(2m+5)$ 39. $3(2a-3)(3a+2)$ 41. $6a(a-3)(a+5)$
 43. $13y(y+4)(y-1)$ 45. $2xy^3(x-12y)(x-12y)$ or $2xy^3(x-12y)^2$ 47. $(3x^2+1)(x^2-5)$
 49. $(z^2+3)(z^2-10)$ 51. $(3x^2-5)(2x^2+5)$ 53. $(6p^2-r)(2p^2+5r)$
 55. $(4x^2-3a^2)(x^2+9a^2)$ 57. $3q^2+qh-14h^2$ 59. $-18a^3+27a^2b+315ab^2$
 61. $(3p+14)(2p+7)$ 63. $(3z+3k-5)(2z+2k+1)$ 65. $(a+b)^2(a-3b)(a+2b)$
 67. $(p+q)(p+3q)(p+q)$ or $(p+q)^2(p+3q)$ 69. $(z-x)(z-x)(z+2x)$ or $(z-x)^2(z+2x)$
 71. $(p^n-3)(p^n+2)$ 73. $(2z^{2r}+1)(3z^{2r}-4)$ 75. $2k^r(6k^r+1)(3k^r+2)$ 77. -1
 79. $1/(m^3p^3)$ 81. $4m^2-25$ 83. $25a^2-30ab+9b^2$ 85. y^3-8

Section 3.7 (page 137)

1. $(x+5)(x-5)$ 3. $(6m+5)(6m-5)$ 5. $(4y+9q)(4y-9q)$ 7. $(4+5ab)(4-5ab)$
 9. $(a^2+2b^2)(a^2-2b^2)$ 11. $(x+2)^2$ 13. $(a-5)^2$ 15. $(3r-s)^2$ 17. $(5xy-2)^2$
 19. $2(6m-5p)^2$ 21. $(2a+1)(4a^2-2a+1)$ 23. $(3x-4y)(9x^2+12xy+16y^2)$
 25. $(4x+5y)(16x^2-20xy+25y^2)$ 27. $(5m-2p)(25m^2+10mp+4p^2)$
 29. $(10+3rs)(100-30rs+9r^2s^2)$ 31. $(4y^2+1)(16y^4-4y^2+1)$ 33. $(x+y+4)(x+y-4)$
 35. $(5+r+3s)(5-r-3s)$ 37. $(m+3p-5)(m-3p+5)$ 39. $4ab$ 41. $(a+b+1)^2$
 43. $(m-p+2)^2$ 45. $(p-3+r)(p-3-r)$ 47. $(3y-5+4x)(3y-5-4x)$
 49. $(r+4s-3)(r-4s+3)$ 51. $(4-a+b)(16+4a-4b+a^2-2ab+b^2)$
 53. $p(p^2-15p+75)$ 55. $4(3a^2-12a+16)$ 57. 9 59. 25 61. 40 or -40
 63. $(4m^{2x}+3)(4m^{2x}-3)$ 65. $(8r^{4z}+1)(8r^{4z}-1)$ 67. $(10m^z+3p^{4z})(10m^z-3p^{4z})$

69. $(3a^{2z}-5)^2$ 71. $(x^n-2)(x^{2n}+2x^n+4)$ 73. $(3z^{4y}+5x^{2y})(9z^{8y}-15z^{4y}x^{2y}+25x^{4y})$
 75. $8y(2y-3+4y^2)$ 77. $(x+2)(y+4)$ 79. $(y+2)(y-1)$ 81. $(3r-z)(2r+7z)$

Section 3.8 (page 141)

1. $(10a+3b)(10a-3b)$ 3. $3p^2(p-6)(p+5)$ 5. $3pq(a+6b)(a-5b)$ 7. Cannot be factored further
 9. $(6b+1)(b-3)$ 11. $3mn(3m+2n)(2m-n)$ 13. $(2p+5q)(p+3q)$
 15. $9m(m-5+2m^2)$ 17. $2(3m-10)(9m^2+30m+100)$ 19. $(2a+1)(a-4)$
 21. $(k-9)(q+r)$ 23. Cannot be factored further 25. $(2p-5)(4p^2+10p+25)$
 27. $(x-5)(x+5)(x^2+25)$ 29. $(p+4)(p^2-4p+16)$ 31. $(8m+25)(8m-25)$
 33. $6z(2z^2-z+3)$ 35. $16(4b+5c)(4b-5c)$ 37. $8(5z+4)(25z^2-20z+16)$
 39. $(5r-s)(2r+5s)$ 41. $4pq(2p+q)(3p+5q)$ 43. $3(4k^2+9)(2k+3)(2k-3)$
 45. $2(5p+9)(5p-9)$ 47. $4rx(3m^2+mn+10n^2)$ 49. $(7a-4b)(3a+b)$
 51. $(3m-n+5)(3m-n-5)$ 53. $(p+8q-5)^2$ 55. $(7m^2+1)(3m^2-5)$
 57. $(z^{2x}+w^x)(z^{2x}-w^x)$ 59. $gh^2k^{-3}(hk-g)$ 61. $(3m^k+2)(m^k-3)$
 63. $(m+n-5)(m-n+1)$ 65. $3c^y(5c^{3y}+c^y-2)$
 67. $(2+z+w)(4-2z-2w+z^2+2zw+w^2)$ 69. 9 71. 2 73. {2} 75. {-1}
 77. {0} 79. {-4/3}