

## Section 5.6 Multiplication of Polynomials and Special Products

### Section 5.6 Practice Exercises

1. (a)  $5 - 2x$

(b) squares;  $a^2 - b^2$

(c) perfect;  $a^2 + 2ab + b^2$

3.  $2y^2 - 4y^2 = -2y^2$

5.  $(2y^2)(-4y^2) = -8y^4$

7.  $7uvw^2 + uvw^2 = 8uvw^2$

9.  $(7uvw^2)(uvw^2) = 7u^2v^2w^4$

11.  $-2(6y) = -12y$

13.  $7(3p) = 21p$

15.  $(a^{13}b^4)(12ab^4) = 12a^{13+1}b^{4+4} = 12a^{14}b^8$

17.  $(2c^7d)(-c^3d^{11}) = -2c^{7+3}d^{1+11} = -2c^{10}d^{12}$

19.  $8pq(2pq - 3p + 5q)$   
 $= 8pq(2pq) - 8pq(3p) + 8pq(5q)$   
 $= 16p^2q^2 - 24p^2q + 40pq^2$

21.  $(k^2 - 13k - 6)(-4k)$   
 $= k^2(-4k) - 13k(-4k) - 6(-4k)$   
 $= -4k^3 + 52k^2 + 24k$

23.  $-15pq(3p^2 + p^3q^2 - 2q)$   
 $= -15pq(3p^2) - 15pq(p^3q^2) - 15pq(-2q)$   
 $= -45p^3q - 15p^4q^3 + 30pq^2$

25.  $(y - 10)(y + 9) = y^2 + 9y - 10y - 90$   
 $= y^2 - y - 90$

27.  $(m - 12)(m - 2) = m^2 - 2m - 12m + 24$   
 $= m^2 - 14m + 24$

29.  $(3p - 2)(4p + 1) = 3p^2 + 3p - 8p - 2$   
 $= 3p^2 - 5p - 2$

31.  $(8 - 4w)(-3w + 2)$   
 $= (-4w + 8)(-3w + 2)$   
 $= 12w^2 - 8w - 24w + 16$   
 $= 12w^2 - 32w + 16$

33.  $(p - 3w)(p - 11w)$   
 $= p^2 - 11pw - 3pw + 33w^2$   
 $= p^2 - 14pw + 33w^2$

35.  $(6x - 1)(2x + 5)$   
 $= 6x(2x) + 5(6x) - 2x - 5$   
 $= 12x^2 + 28x - 5$

37.  $(4a - 9)(1.5a - 2)$   
 $= 4a(1.5a) - 8a - 13.5a + 18$   
 $= 6a^2 - 21.5a + 18$

39.  $(3t - 7)(1 + 3t^2)$   
 $= (3t - 7)(3t^2 + 1)$

$$= 9t^3 + 3t - 21t^2 - 7$$

$$= 9t^3 - 21t^2 + 3t - 7$$

$$\begin{aligned} 41. & 3(3m+4n)(m+2n) \\ &= 3[3m(m)+6mn+4mn+4n(2n)] \\ &= 3[3m^2+10mn+8n^2] \\ &= 9m^2+30mn+24n^2 \end{aligned}$$

$$\begin{aligned} 43. & (5s+3)(s^2+s-2) \\ &= 5s(s^2)+5s(s)-5s(2)+3s^2+3s-6 \\ &= 5s^3+5s^2-10s+3s^2+3s-6 \\ &= 5s^3+8s^2-7s-6 \end{aligned}$$

$$\begin{aligned} 45. & (3w-2)(9w^2+6w+4) \\ &= 3w(9w^2)+3w(6w)+12w \\ & \quad -2(9w^2)-12w-8 \\ &= 27w^3+18w^2+12w-18w^2-12w-8 \\ &= 27w^3-8 \end{aligned}$$

$$\begin{aligned} 47. & (p^2+p-5)(p^2+4p-1) \\ &= p^4+4p^3-p^2+p^3+4p^2 \\ & \quad -p-5p^2-20p+5 \\ &= p^4+5p^3-2p^2-21p+5 \end{aligned}$$

$$\begin{aligned} 49. & \quad 3a^2-4a+9 \\ & \times \frac{2a-5}{6a^3-8a^2+18a} \\ & + \frac{-15a^2+20a-45}{6a^3-23a^2+38a-45} \end{aligned}$$

$$\begin{aligned} 51. & \quad 4x^2-12xy+9y^2 \\ & \times \frac{2x-3y}{8x^3-24x^2y+18xy^2} \\ & + \frac{-12x^2y+36xy^2-27y^3}{8x^3-36x^2y+54xy^2-27y^3} \end{aligned}$$

$$\begin{aligned} 53. & \quad 6x+2y \\ & \times \frac{0.2x+1.2y}{1.2x^2+0.4xy} \\ & + \frac{7.2xy+2.4y^2}{1.2x^2+7.6xy+2.4y^2} \end{aligned}$$

$$\begin{aligned} 55. & (y-6)(y+6) = (y)^2 - (6)^2 \\ & = y^2 - 36 \end{aligned}$$

$$\begin{aligned} 56. & (x+3)(x-3) = (x)^2 - (3)^2 \\ & = x^2 - 9 \end{aligned}$$

$$\begin{aligned} 57. & (3a-4b)(3a+4b) = (3a)^2 - (4b)^2 \\ & = 9a^2 - 16b^2 \end{aligned}$$

$$\begin{aligned} 59. & (9k+6)(9k-6) = (9k)^2 - 6^2 \\ & = 81k^2 - 36 \end{aligned}$$

$$\begin{aligned} 61. & \left(\frac{2}{3}t-3\right)\left(\frac{2}{3}t-3\right) = \left(\frac{2}{3}t\right)^2 - (3)^2 \\ & = \frac{4}{9}t^2 - 9 \end{aligned}$$

$$\begin{aligned} 63. & (u^3+5v)(u^3-5v) = (u^3)^2 - (5v)^2 \\ & = u^6 - 25v^2 \end{aligned}$$

$$65. \left(\frac{2}{3}-p\right)\left(\frac{2}{3}+p\right) = \left(\frac{2}{3}\right)^2 - p^2 = \frac{4}{9} - p^2$$

$$\begin{aligned} 67. & (a+5)^2 = a^2 + 2a(5) + (5)^2 \\ & = a^2 + 10a + 25 \end{aligned}$$

$$69. (x-y)^2 = x^2 - 2xy + y^2$$

$$\begin{aligned} 71. & (2c+5)^2 = (2c)^2 + 2(2c)(5) + 5^2 \\ & = 4c^2 + 20c + 25 \end{aligned}$$

$$\begin{aligned} 73. & (3t^2-4s)^2 = (3t^2)^2 - 2(3t^2)(4s) + (4s)^2 \\ & = 9t^4 - 24st^2 + 16s^2 \end{aligned}$$

$$\begin{aligned} 75. & (7-t)^2 = 7^2 - 2(7)(t) + t^2 \\ & = 49 - 14t + t^2 \\ & = t^2 - 14t + 49 \end{aligned}$$

$$\begin{aligned} 77. & (3+4q)^2 = 3^2 + 2(3)(4q) + (4q)^2 \\ & = 9 + 24q + 16q^2 \\ & = 16q^2 + 24q + 9 \end{aligned}$$

$$79. (a) (2+4)^2 = (6)^2 = 36$$

$$(b) 2^2 + 4^2 = 4 + 16 = 20$$

$$(c) (a+b)^2 \neq a^2 + b^2 \text{ in general}$$

$$\begin{aligned} 81. & A = (2x+5)(2x-5) \\ & = (2x)^2 - 5^2 \\ & = 4x^2 - 25 \end{aligned}$$

83.  $A = (4p + 5)^2$   
 $= (4p)^2 + 2(4p)(5) + 5^2$   
 $= 16p^2 + 40p + 25$

85.  $V = s^3$   
 $= (3p - 5)^3$   
 $= (3p - 5)(3p - 5)^2$   
 $= (3p - 5)(9p^2 - 30p + 25)$   
 $= 27p^3 - 90p^2 + 75p - 45p^2$   
 $\quad + 150p - 125$   
 $= 27p^3 - 135p^2 + 225p - 125$

87.  $A = \frac{1}{2}bh$   
 $= \frac{1}{2}(5a^3 - 2)(6a^2)$   
 $= \frac{1}{2}(30a^5 - 12a^2)$   
 $= 15a^5 - 6a^2$

89.  $(7x + y)(7x - y) = (7x)^2 - y^2 = 49x^2 - y^2$

91.  $(5s + 3t)^2 = (5s)^2 + 2(5s)(3t) + (3t)^2$   
 $= 25s^2 + 30st + 9t^2$

93.  $(7x - 3y)(3x - 8y)$   
 $= 7x(3x) - 7x(8y) - 3y(3x) + 3y(8y)$   
 $= 21x^2 - 65xy + 24y^2$

95.  $\left(\frac{2}{3}t + 2\right)(3t + 4)$   
 $= \frac{2}{3}t(3t) + \frac{2}{3}t(4) + 2(3t) + 2(4)$   
 $= 2t^2 + \frac{8}{3}t + 6t + 8$   
 $= 2t^2 + \frac{26}{3}t + 8$

97.  $-5(3x + 5)(2x - 1)$   
 $= -5[3x(2x) + 3x(-1) + 5(2x) + 5(-1)]$   
 $= -5[6x^2 - 3x + 10x - 5]$   
 $= -5[6x^2 + 7x - 5]$   
 $= -30x^2 - 35x + 25$

99.  $(3a - 2)(5a + 1 + 2a^2)$   
 $= 15a^2 + 3a + 6a^3 - 10a - 2 - 4a^2$   
 $= 6a^3 + 11a^2 - 7a - 2$

101.  $(y^2 + 2y + 4)(y - 5)$   
 $= y^3 - 5y^2 + 2y^2 - 10y + 4y - 20$   
 $= y^3 - 3y^2 - 6y - 20$

103.  $\left(\frac{1}{3}m - n\right)^2 = \left(\frac{1}{3}m\right)^2 - 2\left(\frac{1}{3}m\right)(n) + n^2$   
 $= \frac{1}{9}m^2 - \frac{2}{3}mn + n^2$

105.  $6w^2(7w - 14) = 6w^2(7w) - 6w^2(14)$   
 $= 42w^3 - 84w^2$

107.  $(4y - 8.1)(4y + 8.1)$   
 $= (4y)^2 - (8.1)^2 = 16y^2 - 65.61$

109.  $(3c^2 + 4)(7c^2 - 8)$   
 $= 3c^2(7c^2) - (3c^2)(8) + 4(7c^2) - 4(8)$   
 $= 21c^4 + 4c^2 - 32$

111.  $(3.1x + 4.5)^2$   
 $= (3.1x)^2 + 2(3.1x)(4.5) + (4.5)^2$   
 $= 9.61x^2 + 27.9x + 20.25$

113.  $(k - 4)^3 = (k - 4)(k - 4)^2$   
 $= (k - 4)(k^2 - 8k + 16)$   
 $= k^3 - 8k^2 + 16k - 4k^2 + 32k - 64$   
 $= k^3 - 12k^2 + 48k - 64$

115.  $(5x + 3)^3$   
 $= (5x + 3)^2(5x + 3)$   
 $= (25x^2 + 30x + 9)(5x + 3)$   
 $= 125x^3 + 75x^2 + 150x^2 + 90x$   
 $\quad + 45x + 27$   
 $= 125x^3 + 225x^2 + 135x + 27$

117.  $(y^2 + 2y + 1)(2y^2 - y + 3)$   
 $= 2y^4 - y^3 + 3y^2 + 4y^3 - 2y^2 + 6y$   
 $\quad + 2y^2 - y + 3$   
 $= 2y^4 + 3y^3 + 3y^2 + 5y + 3$

$$\begin{aligned} \mathbf{119.} \quad 2a(3a-4)(a+5) &= 2a(3a^2 + 11a - 20) \\ &= 6a^3 + 22a^2 - 40a \end{aligned}$$

$$\begin{aligned} \mathbf{121.} \quad (x-3)(2x+1)(x-4) \\ &= (x-3)(2x^2 - 7x - 4) \\ &= 2x^3 - 7x^2 - 4x - 6x^2 + 21x + 12 \\ &= 2x^3 - 13x^2 + 17x + 12 \end{aligned}$$

$$\mathbf{123.} \quad (3x+5)(a+b) = 6x^2 - 11x - 35$$

$$3ax = 6x^2 \quad \text{and} \quad 5b = -35$$

$$a = 2x \quad \text{and} \quad b = -7$$

So,  $a = 2$ ,  $b = -7$ , and the binomial is

$$y = 2x - 7.$$

$$\mathbf{125.} \quad x^2 + kx + 25 = x^2 + kx + 5^2$$

$$k = 2(5) = 10$$

or

$$x^2 + kx + 25 = x^2 + kx + (-5)^2$$

$$k = 2(-5) = -10$$

$$\mathbf{127.} \quad a^2 + ka + 16 = a^2 + ka + 4^2$$

$$k = 2(4) = 8$$

or

$$a^2 + ka + 16 = a^2 + ka + (-4)^2$$

$$k = 2(-4) = -8$$