Completion Example 11 Using the FOIL Method

Use the FOIL method to multiply the binomials: $(x+11)(3x-2)$

Solution

$$(x+11)(3x-2) = x\cdot\_\_\_\_\_ + x\cdot(\_\_\_\_\_) + 11\cdot\_\_\_\_\_ + 11\cdot(\_\_\_\_\_)$$
$$= \_\_\_\_\_x^2 + \_\_\_\_\_x - \_\_\_\_\_$$

Now work margin exercise 11.

11. Use the FOIL method to multiply the binomials:
$(2x-8)(5x-9)$

Completion Example Answers

2. $3x^2\cdot x^2 + 3x^2\cdot 12x + 3x^2(-5) = 3x^4 + 36x^3 - 15x^2$

4. $3x\cdot(5x+4) + 8\cdot(5x+4) = 3x\cdot 5x + 3x\cdot 4 + 8\cdot 5x + 8\cdot 4$
$= 15x^2 + 12x + 40x + 32 = 15x^2 + 52x + 32$

11. $x\cdot 3x + x\cdot(-2) + 11\cdot 3x + 11\cdot(-2) = 3x^2 + 31x - 22$

Margin Exercise Answers

1. $-18x^3 + 6x^2 + 18x$ **2.** $30x^7 - 15x^5 + 60x^3$ **3.** $12x^2 + 3x - 9$ **4.** $7x^2 - 23x - 20$

5. $12x^3 + 28x^2 + 2x - 2$ **6.** $x^4 - 16x^2 + 16x - 4$ **7.** $12x^3 + 27x^2 + 6x$ **8.** $x^3 - 5x^2 - 12x + 36$

9. $3x^2 + 25x + 28$ **10.** $8x^2 - 18x + 10$ **11.** $10x^2 - 58x + 72$

10.6 Exercises

Concept Check

Fill-in-the-Blank. Complete each sentence using information found in this section.

1. The _____ property is used to find the product of a monomial with a polynomial.
2. When multiplying two polynomials, the distributive property is applied by multiplying each ___ of one polynomial by each ___ of the other.
3. In the case of the product of two binomials, a mnemonic device called the ____ method is useful.
4. The FOIL method stands for First, _____, Inside, _____.
5. When multiplying polynomials, the last step is to combine ____ terms, if possible.

True/False. Determine whether each statement is true or false. If a statement is false, explain how it can be changed so the statement will be true. (**Note:** There may be more than one acceptable change.)

6. The distributive property can only be used to multiply a monomial and a polynomial.
7. The product of $(a+b)$ and $(c+d)$ is $ac+bd$.
8. The FOIL method is a way to remember one specific order that the distributive property can be applied.

Practice

Multiply and simplify, if necessary.

1. $-3x^2\left(2x^3+5x\right)$

2. $5x^2\left(-4x^2+6\right)$

3. $4x^5\left(x^2-3x+1\right)$

4. $9x^3\left(2x^3-x^2+5x\right)$

5. $-1\left(y^5-8y+2\right)$

6. $-7\left(2y^4+3y^2+1\right)$

7. $-4x^3\left(x^5-2x^4+3x\right)$

8. $-2x^4\left(x^3-x^2+2x\right)$

9. $5x^3\left(5x^2-x+2\right)$

10. $-2x^2\left(x^3+5x-4\right)$

11. $a^2\left(a^5+2a^4-5a+1\right)$

12. $7t^3\left(-t^3+5t^2+2t+1\right)$

13. $(x+4)(x-3)$

14. $(x+7)(x-5)$

15. $(a+6)(a-8)$

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

17. $(x-2)(x-1)$

18. $(x-7)(x-8)$

19. $3(t+4)(t-5)$

20. $-4(x+6)(x-7)$

21. $x(x+3)(x+8)$

22. $t(t-4)(t-7)$

23. $(2x+1)(x-4)$

24. $(3x-1)(x+4)$

25. $(6x-1)(x+3)$

26. $(8x+15)(x+1)$

27. $(2x+3)(2x-3)$

28. $(3t+5)(3t-5)$

29. $(4x+1)(4x+1)$

30. $(5x-2)(5x-2)$

31. $(y+3)\left(y^2-y+4\right)$

32. $(2x+1)\left(x^2-7x+2\right)$

33.
$$\begin{array}{r} 3x+7 \\ \underline{x-5} \end{array}$$

34.
$$\begin{array}{r} 2x+6 \\ \underline{x+3} \end{array}$$

35.
$$\begin{array}{r} x^2+3x+1 \\ \underline{5x-9} \end{array}$$

36.
$$\begin{array}{r} 8x^2+3x-2 \\ \underline{-2x+7} \end{array}$$

37.
$$\begin{array}{r} 2x^2+3x+5 \\ \underline{x^2+2x-3} \end{array}$$

38.
$$\begin{array}{r} 6x^2-x+8 \\ \underline{2x^2+5x+6} \end{array}$$

39. $(3x-4)(x+2)$

40. $(t+6)(4t-7)$

41. $(2x+5)(x-1)$

42. $(5a-3)(a+4)$

43. $(7x+1)(x-2)$

44. $(x-2)(3x+8)$

45. $(2x+1)(3x-8)$

46. $(3x+7)(2x-5)$

47. $(2x+3)(2x+3)$

48. $(5y+2)(5y+2)$

49. $(x+3)(x^2-4)$

50. $(y^2+2)(y-4)$

51. $(2x+7)(2x-7)$

52. $(3x-4)(3x+4)$

53. $(x+1)(x^2-x+1)$

54. $(x-2)(x^2+2x+4)$

55. $(7a-2)(7a-2)$

56. $(5a-6)(5a-6)$

57. $x(x+3)(x+5)$

58. $x(x-8)(x+2)$

59. $2x(x-1)(3x+2)$

60. $3x(x+1)(2x+3)$

61. $(2x+3)(x^2-x-1)$

62. $(3x+1)(x^2-x+9)$

63. $(x+1)(x+2)(x+3)$

64. $(t-1)(t-2)(t-3)$

65. $(a^2+a-1)(a^2-a+1)$

66. $(y^2+y+2)(y^2+y-2)$

67. $(t^2+3t+2)^2$

68. $(a^2-4a+1)^2$

Simplify.

69. $3x(2x+1)-2(2x+1)$

70. $x(3x+4)+7(3x+4)$

71. $3a(3a-5)+5(3a-5)$

72. $6x(x-1)+5(x-1)$

73. $5x(-2x+7)-2(-2x+7)$

74. $y(y^2+1)-1(y^2+1)$

75. $x(x^2+3x+2)+2(x^2+3x+2)$

76. $4x(x^2-x+1)+3(x^2-x+1)$

77. $(y+6)(y-6)+(y+5)(y-5)$

78. $(y-2)(y+2)+(y-1)(y+1)$

79. $(2a+1)(a-5)+(a-4)(a-4)$

80. $(x+4)(2x+1)+(x-3)(x-2)$

81. $(x-3)(x+5)-(x+3)(x+2)$

82. $(t+3)(t+3)-(t-2)(t-2)$

83. $(2a+3)(a+1)-(a-2)(a-2)$

84. $(4t-3)(t+4)-(t-2)(3t+1)$

Applications

Solve.

85. A graphic artist is designing a poster to advertise an upcoming event. The only restrictions regarding the poster size is that it must have a length of $3x$ inches and a width of $2x + 5$ inches. Find a simplified expression for the area of the poster.

86. Armon works for a company that ships artwork worldwide. The size of each item varies, but all of the art is on square canvases. Armon's job is to make the wooden shipping crates for each piece of art. In order to protect the artwork, each crate must be 10 inches deep. The crate must also be 10 inches wider and 12 inches taller than the artwork. Letting x represent the length of one side of the artwork, find the volume of the rectangular shipping crate.

87. Theodore and Sarah have a small business selling custom-made T-shirts. They currently sell 150 shirts per month and charge \$10 per T-shirt. Sarah thinks they can increase their revenue by increasing their selling price, but Theodore knows from experience that each \$1 increase in price will decrease the number of T-shirts they sell by 8 shirts per month. Find an expression for the total monthly revenue Theodore and Sarah's business can generate if they change the selling price of their T-shirts. Let x represent number of \$1 increases in the price of the T-shirts.

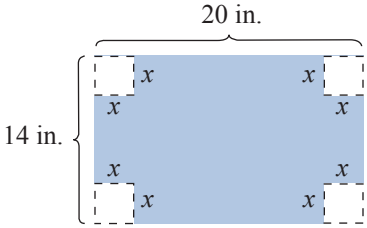
88. The smallest plot of land that you can rent at a community garden is 3 feet long by 4 feet wide.

a. Suppose you want to rent a plot of land that is x feet longer than the smallest available plot. What would the area of this plot of land be?

b. Suppose you want to rent a plot of land that is x feet wider than the smallest plot with a length of 3 feet. What would the area of this plot of land be?

c. Suppose you want to rent a plot of land that is x feet longer and x feet wider than the smallest plot of land. What would the area of this plot of land be?

89. Lee is making a box. He starts with a piece of cardboard that is 14 inches by 20 inches. He cuts a square with side length x from each corner of the box.



a. Write a polynomial function $A(x)$ to represent the area of the cardboard that remains after the corners are cut out.

b. When the sides of the box are folded up, what will be the side lengths of the base of the box?

c. Write a polynomial function $B(x)$ to represent the area of the base of the box when the sides are folded up.

d. The height of the box will be x inches. Write a polynomial function $V(x)$ to determine the volume of the box.

90. The glass portion of a sliding glass door has a ratio of height to width of 2 : 1. The framework around the window adds 8 inches to the width of the door and 10 inches to the height.

a. Write a polynomial expression to represent the width of the door, including the framework. Use the variable x to represent the width of the door.

b. Write a polynomial expression to represent the height of the door, including the framework.

c. Write a polynomial expression for the total area of the window, including the framework.

Writing & Thinking

91. We have seen how the distributive property is used to multiply polynomials.

a. Show how the distributive property can be used to find the following product.

$$\begin{array}{r} 75 \\ \times\, 93 \\ \hline \end{array}$$

(**Hint:** $75 = 70 + 5$ and $93 = 90 + 3$)

b. In the multiplication algorithm for multiplying whole numbers (as in the product above), we are told to "move to the left" when multiplying. For example:

$$\begin{array}{r} 75 \\ \times\, 93 \\ \hline 15 \\ 21 \\ 45 \\ 63 \\ \hline \end{array}$$

Why are the 21 and 45 moved one place to the left in the alignment?

When 9 and 7 are multiplied, we move the 63 two places left. Why?