Since $(3x(2x+5) = 6x^2+15x$ & $+4(2x+5) = +8x+20$

$(3x+4)(2x+5) = 6x^2+23x+20$

8-3: MULTIPLYING BINOMIALS

Lesson Objectives:

- *Multiply binomials*
- *Multiply trinomials by binomials*

1 Multiplying Two Binomials

One way to organize multiplying two binomials is to use FOIL, which stands for "First, Outer, Inner, Last." The term FOIL is a memory device for applying the Distributive Property to the product of two binomials.

EXAMPLE 1: MULTIPLYING USING FOIL

Simplify.

1. $(3x+4)(2x+5)$

F O I L

$6x^2+15x+8x+20$

$6x^2+23x+20$

2. $(3x-4)(2x+5)$

$6x^2+15x-8x-20$

$6x^2+7x-20$

3. $(3x+4)(2x-5)$

$6x^2-15x+8x-20$

$6x^2-7x-20$

4. $(3x-4)(2x-5)$

$6x^2-15x-8x+20$

$6x^2-23x+20$

	3x	+4
2x	$6x^2$	8x
+5	15x	20

$= 6x^2+23x+20$

5. $(4x+2)(3x-1)$

$12x^2-4x+6x-2$

$12x^2+2x-2$

6. $(6x-5)(3x+1)$

$18x^2+6x-15x-5$

$18x^2-9x-5$

7. $(3x-4)(3x+1)$

$9x^2+3x-12x-4$

$9x^2-9x-4$

8. $(3x+4)(3x-4)$

$9x^2-12x+12x-16$

$9x^2-16$

9. $(d+9)(d-11)$

$d^2-11d+9d-99$

$d^2-2d-99$

10. $(b+3)(2b-5)$

$2b^2+6-15$

11. $(2x-5)(x-4)$

$2x^2-8x-5x+20$

$2x^2-13x+20$

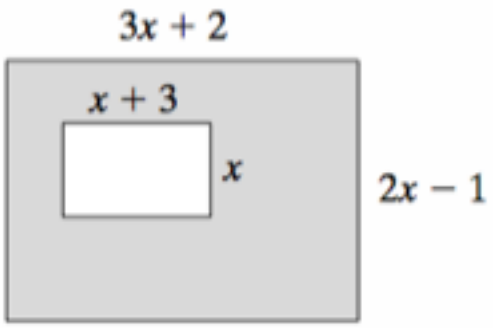
12. $(2x-3y)(4x+3y)$

$8x^2+6xy-12xy-9y^2$

$8x^2-6xy-9y^2$

EXAMPLE 2: APPLYING MULTIPLICATION OF POLYNOMIALS
Find the area of the shaded regions.

13.



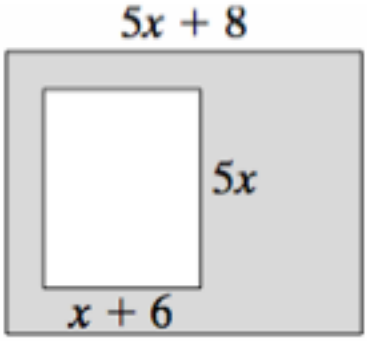
$A_{shaded} = A_{large} - A_{small}$

$(3x+2)(2x-1) - [x(x+3)]$

$6x^2 - 3x + 4x - 2 + [-x^2 + 3x]$

$5x^2 - 2x - 2$ units^2

14.



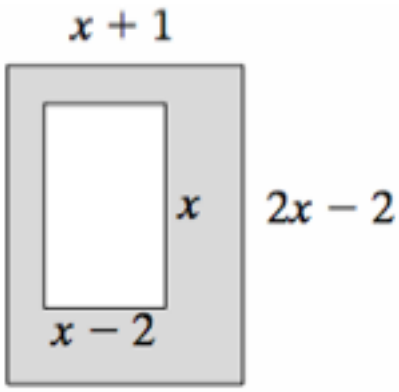
$A_{shaded} = A_{large} - A_{small}$

$(5x+8)(6x+2) - [5x(x+6)]$

$30x^2 + 10x + 48x + 16 + [-5x^2 + 30x]$

$25x^2 + 28x + 16$ units^2

15.



$A_{shaded} = A_{large} - A_{small}$

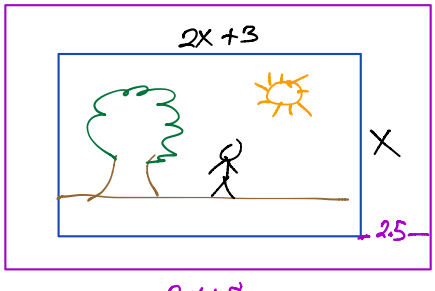
$= (x+1)(2x-2) - [x(x-2)]$

$= 2x^2 - 2x + 2x - 2 + [-x^2 + 2x]$

$= x^2 + 2x - 2$ units^2

16. The width of a rectangular painting is 3 in. more than twice the height. A frame that is 2.5 in. wide goes around the painting.

a) Write an expression for the combined area of the painting and frame.
b) Use the expression to find the combined area when the height of the painting is 12 in.
c) Use the expression to find the combined area when the height of the painting is 15 in.



a) $A_{frame} = (x+5)(2x+8)$

$2x^2 + 8x + 10x + 40$

$2x^2 + 18x + 40$ in^2

b) $x = 12$; $2(12)^2 + 18(12) + 40$

$288 + 216 + 40$

544 in^2

c) $x = 15$; $2(15)^2 + 18(15) + 40$

$450 + 270 + 40$

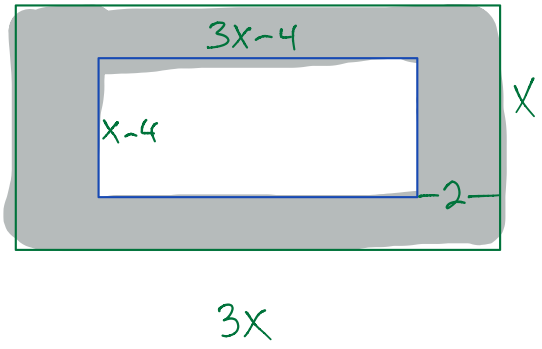
760 in^2

17. The Robertsons put a rectangular pool with a stone walkway around it in their backyard. The total length of the pool and walkway is 3 times the total width. The walkway is 2 ft. wide all around.

a) Write an expression for the area of the walkway.

b) Find the area of the walkway when the total width is 10 ft.

c) Find the area of the pool when the total width is 9 ft.



a) $A_{walkway} = A_{large} - A_{small}$

$x(3x) - [(x-4)(3x-4)]$

$3x^2 + [-3x^2 + 4x + 12x + 16]$

$16x - 16$ ft^2

b) $x = 10$;

$16(10) - 16$

144 ft^2

18. The Cutting Edge frame shop makes a mat by cutting out the inside of a rectangular board. Use the diagram to find the length and width of the original board if the area of the mat is 184 in^2.

$A_{mat} = A_{large} - A_{small}$

$(2x-3)(x+8) - [(2x-7)(x+4)]$

$2x^2 + 16x - 3x - 24 + [-2x^2 + 8x + 7x + 28]$

$12x + 4$

$12x + 4 = 184$

$-4 \quad -4$

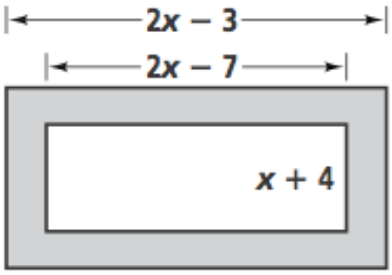
$\frac{12x}{12} = \frac{180}{12}$

$x = 15$

$2(15) - 3$

$30 - 3$

27 in



$15 + 8$

23 in

27 in x 23 in

2 Multiplying a Trinomial and a Binomial

FOIL works when you multiply two binomials but it is not helpful when multiplying a trinomial and a binomial. You can use the Distributive Property two find the SIX products and then simplify.

EXAMPLE 3: MULTIPLYING A TRINOMIAL AND A BINOMIAL

Simplify.

19. $(2x+7)(3x^2-2x+3)$

20. $(6n-8)(2n^2+n+7)$

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

$6x^3 - 4x^2 + 6x + 21x^2 - 14x + 21$

$6x^3 + 17x^2 - 8x + 21$

$(2x-9)(x^2-7x+1)$

22. $(2b-1)(b^2-3b+4)$

23. $(2y-3)(2y^2+y-4)$

24. $(x^2-7x+1)(2x-9)$

$2x^3-14x^2+2x-9x^2+63x-9$

$2x^3-23x^2+65x-9$

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

26. $(2n-3)(n^2-2n+5)$

$2n^3-4n^2+10n-3n^2+6n-15$

$2n^3-7n^2+16n-15$

27. $(5x-6)(4x^2-7x+6)$

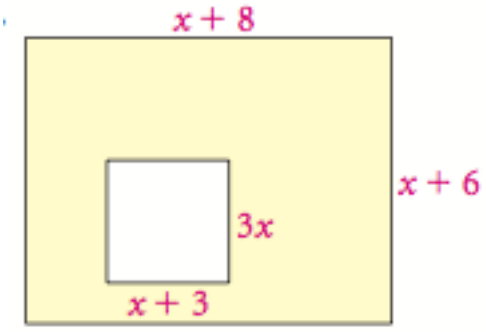
Name _____ ***8-3 Practice Worksheet*** Period _____

Simplify each product.

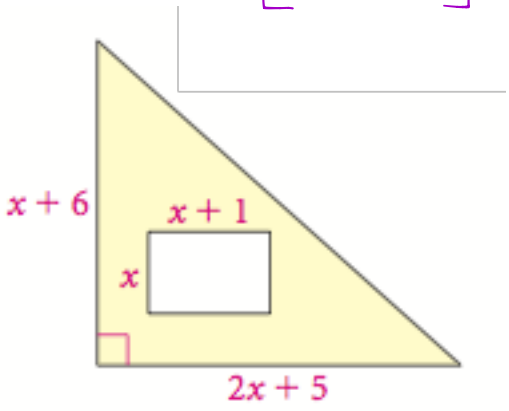
1. $(k+7)(k-6)$
2. $(2y+5)(y-3)$
3. $(x+6)(x-7)$
4. $(8w+2)(w+5)$
5. $(p-1)(p+10)$
6. $(a-4)(a^2-2a+1)$
7. $(12w^2-w-1)(4w-2)$
8. $(p^2-7)(p+8)$
9. $(3k^2+2)(k+5k^2)$
10. $(8q-3)(6q^2+2q+1)$

Find an expression for the area of each shaded region. Simplify.

11. $A_{rectangle}$ = (length)(width)



12. $A_{triangle}$ = (½)(base)(height)



13. You are planning a rectangular garden. Its length is twice its width *x*. You want a walkway 2 ft wide around the garden.

a) Write an expression for the area of the garden and walkway.

b) Write an expression for the area of the walkway only.

c) You have enough gravel to cover 76 ft² and want to use it all on the walkway. How big should you make the garden?