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Worksheet 7.1: Multiplying Binomials

Binomials: Binomials are algebraic expressions with two terms.

Examine the following algebraic expressions. Circle all the binomials:
 $x^2 + 2x - 3$ $3xy$ $4x + 2$ $8a$ $x^2 + y$ $5b + 7$

Recall: Distributive Property
 When expanding brackets, we distribute the property of the number or math operation outside the brackets to every term inside the brackets.
 e.g. $3(x + 4) = 3x + 12$ and $-2(x + 1) = -2x - 2$

How do we expand $(x + 1)(x + 2)$?

FOIL

$(x + 1)(x + 2)$
 $= (x)(x) + (x)(2) + (1)(x) + (1)(2)$ → Multiply the terms on the left to every single term on the right.
 $= x^2 + 2x + x + 2$
 $= x^2 + 3x + 2$ → Collect like terms.

Example 1:
 (a) $(x + 2)(x + 3) = x^2 + 5x + 6$
 (b) $(y - 3)(y + 4) = y^2 + y - 12$
 (c) $(a + 7)(a - 2) = a^2 + 5a - 14$
 (d) $(2m - 5)(3m + 2) = 6m^2 - 11m - 10$
 (e) $(n - 10)(3n - 5) = 3n^2 - 39n + 50$
 (f) $(2x - 3)(5x - 7) = 10x^2 - 29x + 21$

Answers: 1. (b) $x^2 + 2x - 3$, (c) $x^2 + y$, (e) $5b + 7$, (f) $2x^2 - 3x + 2$, (g) $3x^2 - 39x + 50$, (h) $10x^2 - 29x + 21$, (i) $2x^2 + 9x - 14$, (j) $x^2 - 4y - 45$, (k) $x^2 + 4x - 5$, (l) $y^2 - 13y + 42$, (m) $2x^2 - 7x + 3$, (n) $3x^2 - 16x + 5$, (o) $4x^2 + 10x - 3$, (p) $10x^2 - 29x + 21$, (q) $12x^2 - 34x + 20$, (r) $15x^2 - 27x + 10$

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To multiply monomials: **multiply the signs**; **multiply the numbers**; **multiply the variables**

Simplify.

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

4. $(x + 5)(x - 1)$ 5. $(y - 5)(y - 7)$

6. $(2x + 1)(x + 3)$ 7. $(x + 5)(3x + 1)$

8. $(4x - 1)(2x + 3)$ 9. $(5x + 3)(2x - 7)$

10. $(6x - 5)(2x - 4)$ 11. $(3x - 2)(5x - 5)$

Answers: 1. (a) $x^2 + 9x + 20$, (b) $y^2 - 9y + 18$, (c) $a^2 + 6a - 7$, (d) $2m^2 + 2m - 12$, (e) $3x^2 - 39x + 50$, (f) $10x^2 - 29x + 21$, (g) $2x^2 + 9x - 14$, (h) $x^2 - 4y - 45$, (i) $x^2 + 4x - 5$, (j) $y^2 - 13y + 42$, (k) $2x^2 - 7x + 3$, (l) $3x^2 - 16x + 5$, (m) $4x^2 + 10x - 3$, (n) $10x^2 - 29x + 21$, (o) $12x^2 - 34x + 20$, (p) $15x^2 - 27x + 10$

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Worksheet 7.2: Perfect Squares of a Binomial

Perfect Square of a Binomial: If $a^2 - 4x + 4$, and $a^2 - y \times y$ then $(x + 1)^2 = (x + 1)(x + 1)$ and $(x - 1)^2 = (x - 1)(x - 1)$

Example 1:
 (a) Simplify $(x + 2)^2$
 $= (x + 2)(x + 2)$
 $= (x)(x) + (x)(2) + (2)(x) + (2)(2)$
 $= x^2 + 2x + 2x + 4$
 $= x^2 + 4x + 4$ → It's called a "Perfect Square Trinomial" because its first term is a perfect square and its last term is also a perfect square.

(b) Simplify $(x - 2)^2$
 $= (x - 2)(x - 2)$
 $= (x)(x) - (x)(2) - (2)(x) + (2)(2)$
 $= x^2 - 2x - 2x + 4$
 $= x^2 - 4x + 4$

(c) Simplify $(3x + 2)^2$
 $= (3x + 2)(3x + 2)$
 $= (3x)(3x) + (3x)(2) + (2)(3x) + (2)(2)$
 $= 9x^2 + 6x + 6x + 4$
 $= 9x^2 + 12x + 4$

(d) Simplify $(3x - 2)^2$
 $= (3x - 2)(3x - 2)$
 $= (3x)(3x) - (3x)(2) - (2)(3x) + (2)(2)$
 $= 9x^2 - 6x - 6x + 4$
 $= 9x^2 - 12x + 4$

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Simplify.

1. $(x + 5)^2$
 $= (x + 5)(x + 5)$
 $= x^2 + 5x + 5x + 25$
 $= x^2 + 10x + 25$

2. $(y + 5)^2$

3. $(x - 6)^2$
 $= (x - 6)(x - 6)$
 $= x^2 - 6x - 6x + 36$
 $= x^2 - 12x + 36$

4. $(y - 4)^2$

5. $(x - 5)^2$

6. $(3x + 1)^2$

7. $(4x - 5)^2$

8. $(6x - 7)^2$

9. $(x + 6)(x - 4)$

10. $(2x - 6)(2x + 6)$

Answers: 1. $x^2 + 10x + 25$; 2. $y^2 + 10y + 25$; 3. $x^2 - 12x + 36$; 4. $y^2 - 8y + 16$; 5. $x^2 - 10x + 25$; 6. $9x^2 + 12x + 4$; 7. $16x^2 - 40x + 25$; 8. $36x^2 - 84x + 49$; 9. $x^2 - 16$; 10. $4x^2 - 36$

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
Worksheet 7.3: Algebraic Modelling of Area


The area of any rectangle can be found using the formula $A = lw$ where A is the area of the rectangle, l is the length of the rectangle, and w is the width of the rectangle.

The area of any square can be found using the formula $A = s^2$ where A is the area of the square, and s is the side length of the square.

1. Write a simplified algebraic expression to represent the area of each figure.

(a) 
 $A = (x + 4)(x + 3)$
 $= x^2 + 3x + 4x + 12$
 $= x^2 + 7x + 12$

(b) 
 $A = (x + 2)^2$
 $= x^2 + 4x + 4$

(c) 
 $A = (2x + 3)(2x - 9)$
 $= 4x^2 - 18x - 18x + 27$
 $= 4x^2 - 36x + 27$

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2. There is a rectangular parking lot near George Harvey C.I. If $x + 7$ represents the length of the parking lot and $x - 2$ represents the width of the parking lot, write a simplified algebraic expression for the area of the parking lot.

Area = $(x + 7)(x - 2)$

3. A flower garden has a shape of a square. If $2x + 3$ represents the side length of the garden, write a simplified algebraic expression for the area of the flower garden.

4. Mr. Cho's bedroom is rectangular in shape. The length of her room can be represented as $3x - 2$, and the width of her room can be represented as $2x + 5$. Write a simplified algebraic expression to represent the area of her room.

5. Ms. Cho saw a table at a furniture store as shown on the right. She wants to make the table on her own and tries to cut out a piece of wood as the table top. If the side length of the table top can be represented as $3x - 7$, write a simplified algebraic expression for the area of table top.



Answers: 1. (a) $x^2 + 7x + 12$, (b) $x^2 + 4x + 4$, (c) $4x^2 - 36x + 27$; 2. $x^2 - 5x - 14$; 3. $4x^2 + 12x + 9$; 4. $6x^2 - 11x - 10$; 5. $9x^2 - 42x + 49$

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