

## Factoring Polynomials

USING A GCF (Greatest Common Factor)

Review! Simplify the following:

- $a(3a + 7) =$  \_\_\_\_\_
- $-2m(m^2 + 6m - 1) =$  \_\_\_\_\_
- $5xy(x - 2y) =$  \_\_\_\_\_

What is factoring? Separate a polynomial into a product of factors.

Polynomials that cannot be factored are called prime

ex. 12  
+3  
6.2  
12.1

There will be several ways to factor; the approach we will take depends on the polynomial. Today, we will start by using the *greatest common factor (GCF)* of the polynomial.

Examples: Factor the following polynomials by finding the greatest common factor. Check your answers by re-distributing.

1. $3x + 12$ $3(x + 4)$ GCF: 3	2. $7y - 7$
3. $5x + 30y$ $5(x + 6y)$ GCF: 5	4. $8m + 36n$
5. $6a^2 + 27$	6. $4y^2 - 24y$
7. $21cd - 3d$ $3d(7c - 1)$ GCF: 3d	8. $14gh - 18h$
9. $15a^2b - 30ab$ $15ab(a - 2)$ GCF: 15ab	10. $16bc^2 + 24bc$
11. $ab - a$	12. $x^2 + 3xy$

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13. $18a^2bc^2 - 48abc^2$	14. $10x^2y^2 - 8xy$
15. $5x - 13y$ prime!	16. $2x^2y - 2xy^2 + 4xy$
17. $6y^4 + 14y^3 - 10y^2$ $2y^2(3y^2 + 7y - 5)$ GCF: $2y^2$	18. $12a^3b^4 - 36a^4b^3 - 6a^2b^2$
19. $14gh^2 + 28gh + 14h$	20. $18x^2yz - 24xz^2 + 36yz^2$
21. $m^3n - m^2n^2 + 5mn^3$ $mn(m^2 - mn + 5n^2)$ GCF: mn	22. $16xy^2 + 28xy + 8y$
23. $35a^2 - 20ab^2 + 15a$	24. $3a^3b^2c - 9a^2b^3c^2 + 15ab^4c^3$

Recap - Rules for finding a GCF of a polynomial!

- 1) Look at **coefficients** first.
- 2) A **variable must be common to all terms** to be a GCF.
- 3) If a variable is common to all terms, take the one with the **smallest exponent**.
- 4) Divide all terms by the GCF to get the remainder in parentheses.

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## Factoring Polynomials by Grouping (4 Terms)

Steps	Example
Step 1: Group the first two terms together and the last two terms together.	$(x^3 + 7x^2) + (2x + 14)$
Step 2: Factor out the GCF for each binomial.	$x^2(x+7) + 2(x+7)$
Step 3: The GCF from each binomial will become one factor and remaining binomial will be the other factor.	$(x^2+2)(x+7)$
Step 4: Use FOIL to check your answer.	$x^3 + 7x^2 + 2x + 14$

### Practice!

Factor each polynomial by grouping. Check your answer by FOIL.

$$1. 3x^3 + 15x^2 - 2x - 10$$

$$3x^2(x+5) - 2(x+5)$$

$$(x+5)(3x^2-2)$$

$$2. 8x^2 + 12x + 2xy + 3y$$

$$3. x^3 + 2x^2 - 5x - 10$$

$$x^2(x+2) - 5(x+2)$$

$$(x+2)(x^2-5) \quad \text{GCF: } (x+2)$$

$$4. x^4 + 4x^3 + 2x + 8$$

$$5. 6y^2 - 3y + 2yz - z$$

$$3y(2y-1) + z(2y-1)$$

$$(2y-1)(3y+z) \quad \text{GCF: } (2y-1)$$

$$6. x^2y + 3x^2 - 7y^2 - 21y$$

$$7. 10x^3 - 25x^2 + 4x - 10$$

$$8. 2x^2y + 6xy - x - 3$$

## FACTORING TRINOMIALS

$$ax^2 + bx + c$$

To factor a trinomial of the form above, you must find two integers that MULTIPLY TO C, AND ADD UP TO B.

Examples: Factor the following trinomials. Check your answers by FOIL.	
1. $x^2 + 7x + 12$ $(x+4)(x+3)$ $+b: 7 \quad xc: 12$ $3, 4$	2. $n^2 + 9n + 20$
3. $n^2 + 9n + 18$ $(n+6)(n+3)$ $+b: 9 \quad xc: 18$ $6, 3$	4. $a^2 + 10a + 24$
5. $k^2 + 6k + 5$	6. $y^2 + 2y + 1$
7. $n^2 + 3n - 18$ $(n+6)(n-3)$ $+b: 3 \quad xc: -18$ $6, -3$	8. $x^2 + 2x - 8$
9. $g^2 + 3g - 10$	10. $s^2 + 3s - 54$
11. $c^2 + 4c - 45$	12. $t^2 + 3t - 28$
13. $x^2 + 7x - 30$	14. $a^2 + 5a - 6$
15. $b^2 - 2b - 63$	16. $a^2 - 2a - 3$
17. $k^2 - 12k - 64$ $(k-16)(k+4)$ $+b: -12 \quad xc: -64$ $-16, 4$	18. $x^2 - 14x - 72$