Sep 27-10:15 AM

Recall: a term is a product of numbers and variables. Terms are separated by addition or subtraction signs.

Example: State the number of terms in the following polynomials.

$5x^2 - 6x - 3$ 3

$54x - 7x^2$ 2

$\frac{-124x^8y^5z^3}{23}$ 1

$(x-2)$ 2

$3x(x-2)$

$\frac{3x(x-2)}{7x}$

$6x - \frac{3x(x-2)}{7x}$

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Recall: Simplify or Expand means to multiply and remove the brackets.

For example:

Expand $3x(x-2)$

$3x^2 - 6x$

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

$x^2 - 5x + 2x - 10$ $\quad x^2 - 3x - 10$

Reversing this process is called dividing or factoring.

For example:

Factor $3x^2 - 6x = 3x(x-2)$

$x^2 - 3x - 10 = (x+2)(x-5)$

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The process of factoring with polynomials is similar to factoring with numbers.

Example

Determine the GCF of $16x^2y$ and $24x^2y^3$.

16 & 24 $\quad x^2 \& x^2 \quad y \& y^3$

GCF 8

$16 = 2 \times 2 \times 2 \times 2$

$24 = 2 \times 2 \times 2 \times 3$

x^2

$x \cdot x$

$x \cdot x$

y

y

$y \cdot y \cdot y$

GCF: $8x^2y$

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The process of factoring with polynomials is similar to factoring with numbers.

Example
Determine the GCF of $16x^2y$ and $24x^2y^3$.

Solution
Method 1: Use Prime Factorization

List the prime factorization of the numerical coefficients.
16 = (2)(2)(2)(2)
24 = (2)(2)(2)(3)

Numerical GCF = (2)(2)(2) = 8

List the prime factorization of the variables.

$x^2y = (x)(x)(y)$
$x^2y^3 = (x)(x)(y)(y)(y)$

Variable GCF = $(x)(x)(y) = x^2y$

Therefore, the GCF of $16x^2y$ and $24x^2y^3$ is $8x^2y$.

Method 2: List the Factors

Write the factors of each term.

$16x2y$: 1, 2, 4, 8, 16, x, x^2, y
$24x2y3$: 1, 2, 3, 4, 6, 8, 12, 24, x, x^2, y, y^2, y^3

The greatest common factors are 8, x^2, and y.

Therefore, the GCF of $16x^2y$ and $24x^2y^3$ is $8x^2y$.

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Your Turn
Determine the GCF of each pair of terms.

a) $5m^2n$ and $15mn^2$ **b)** $48ab^3c$ and $36a^2b^2c^2$

$5m^2n + 15mn^2$

$5 + 15 \quad m^2 \; m \quad n + n^2$

$5 = 5$
$15 = 5 \cdot 3$

$m \quad m \cdot m$

$n \quad n \cdot n$

GCF: $5mn$

$a \quad 4a^2 \quad b^3 \quad 4b^2$

$a \quad a \quad b \cdot b \cdot b \quad b \cdot b$

$48ab^3c \qquad 36a^2b^2c^2$

2|36
2|18
3|9
3|3
1

2|48
2|24
2|12
2|6
3|3
1

GCF: $12ab^2c$

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Example 2
Write $7a^2b - 28ab + 14ab^2$ in factored form.

$7a^2b - 28ab + 14ab^2$

$7 = 7$
$28 = 7 \cdot 2 \cdot 2$
$14 = 7 \cdot 2$

$a^2 = a \cdot a$
$a = a$
$a = a$

$b = b$
$b = b$
$b^2 = b \cdot b$

$7ab\left(\frac{7a^2b}{7ab} - \frac{28ab}{7ab} + \frac{14ab^2}{7ab}\right)$

$7ab(1a - 4 + 2b)$

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Example 2
Write $7a^2b - 28ab + 14ab^2$ in factored form.

Solution
Ask the questions: How many terms are there? What is common in each term?

There are 3 terms.
Identify the GCF of the numerical coefficients by listing the prime factorization for each coefficient.
$7 = 7$
$28 = (2)(2)(7)$
$14 = (2)(7)$
The GCF is 7.

Identify the GCF of the variables.
$a^2b = (a)(a)(b)$
$ab = (a)(b)$
$ab^2 = (a)(b)(b)$
The GCF is ab.

Therefore, the GCF of $7a^2b - 28ab + 14ab^2$ is $7ab$.

Divide each term by the GCF.

$7a^2b - 28ab + 14ab^2 = 7ab(a - 4 + 2b)$

Check:
Multiply.
$7ab(a - 4 + 2b) = (7ab)(a) + (7ab)(-4) + (7ab)(2b)$
$= 7a^2b - 28ab + 14ab^2$

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Your Turn

Write each polynomial in factored form.

a) $27r^2s^2 - 18r^3s^2 - 36rs^3$

$9rs^2(3r - 2r^2 - 4s)$

$9rs^2(3r-2r^2-4s)$

b) $4np^2 + 10n^4p - 12n^3p$

$2np(2p + 5n^3 - 6n^2)$

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Recall terms are separated by plus or minus signs.

State the number of terms in each polynomial:

$3x + 2y$ ☐

$3x^2 + 2(y-1)$ ☐

$3x^2(y-1) + 2(y-1)$ ☐

$\frac{3x^2(y-1)}{2w} + 2(y-1)$ ☐

$\frac{3x^2(y-1)}{2w} + \frac{2(y-1)}{5t}$ ☐

$3x(x+5) - 4y(x+5) + 5xy(x+5)$ ☐

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Example 3

Write the expression in factored form.

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

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

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Example 3

Write the expression in factored form.

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

Solution

How many terms are there? What is common in each term?

The GCF in $3x(x - 4)$ and $5(x - 4)$ is $(x - 4)$.

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

$= (x - 4)(3x + 5)$

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Your Turn

Write each expression in factored form.

a) $4(x + 5) - 3x(x + 5)$

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

b) $12b(a - 7) + (a - 7)$

$(a-7)(12b+1)$

c) $(x - 6)(5x+2)+(x+3)(5x+2)$

$(5x+2)[(x-4)+(x+3)]$

d) $3x(x+5)-4y(x+5)+5xy(x+5)$

$(x+5)(3x-4y+5xy)$

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Your Turn

a) $a^2 + 8ab + 2a + 16b$

b) $ax + a + bx + b$

c) $x^2 + y - xy - x$

d) $x^3 + x + 2x^2 + 2$

e) $yz - xy + y2 - xz$

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Common Factoring With Fractions

When the polynomial being factored contains a fraction, it is advantageous to factor out the fraction so the remaining factor has integral coefficients.

Example 5
Factor the following:

a) $\frac{1}{2}a^2 - 5a$

b) $x^2 - \frac{5}{2}x^2 + \frac{7}{4}x$

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Example 5
Factor the following:

a) $\frac{1}{2}a^2 - 5a$

Solution

$$\frac{1}{2}a(a-10)$$

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Your Turn

a) $9x^2 + \frac{1}{6}x$

b) $\frac{3}{4}x^2 - 10$

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Assignment: Page 220 #2 odd letters, #4-6 odd letters, 8, 9, 11-12 odd letters, 16
Challenge: Page 220#19

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