Find the greatest common factor of the polynomial.

1. $9y + 3xy^3$
$3y(3y + xy^2)$

2. $6r^3s - 8rs$
$2rs(3r^2 - 4)$

3. $3x + 3xy - 3xz$
$3x(1 + y - z)$

4. $4y^2z + 4yz - 5y^3z$
$yz(4y + 4 - 5y^2)$

5. $5ab^3 - 5a^3b + 11a^3b$
$ab(5b^2 - 5a^2 + 11a^2)$

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

Warm Up

· find the Greatest Common factor -> what is the largest factor that the terms share

· factor must be in all terms in order to factor out.

· Once you have GCF -> divide each term by it.

Graph the function. Label the vertex and the axis of symmetry.

1. $y = 4x^2 + 4x - 5$
2. $y = -4x^2 + 5x$
3. $y = 5x^2 - 23x + 8$
4. $y = x^2 + 2x - 1$
5. $y = x^2 - x + 3$
6. $y = 2x^2 + 3x + 1$

Cumulative Warm Up

Axis of symmetry:

$x = -b/2a$

Vertex: use the x value of axis of symmetry and plug into quadratic and solve for y.

Essential Question

How can you factor a polynomial?

· Find the greatest common factor (GCF)

· Use the ac method

· Factor by grouping (4 terms)

Essential Question

· remember that a polynomial is only fully factored when the remaining terms have nothing more in common.

What you will learn:

· Factor polynomials

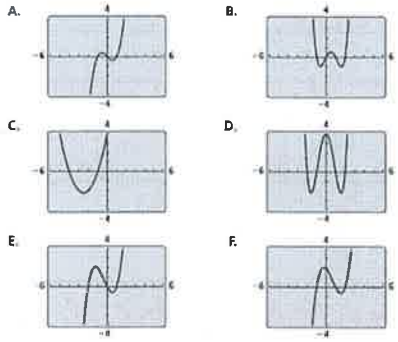
· Use factor theorem.

Work with a partner. Match each polynomial equation with the graph of its related polynomial function. Use the x-intercepts of the graph to write each polynomial in factored form. Explain your reasoning.

a. $x^2 + 5x + 4 = 0$ **b.** $x^3 - 2x^2 - x + 2 = 0$

c. $x^3 + x^2 - 2x = 0$ **d.** $x^3 - x = 0$

e. $x^4 - 5x^2 + 4 = 0$ **f.** $x^4 - 2x^3 - x^2 + 2x = 0$



Exploration 1

* Work in pairs matching with a graphing calculator.

Work with a partner. Use the x-intercepts of the graph of the polynomial function to write each polynomial in factored form. Explain your reasoning. Check your answers by multiplying.

a. $f(x) = x^2 - x - 2$ **b.** $f(x) = x^3 - x^2 - 2x$

c. $f(x) = x^3 - 2x^2 - 3x$ **d.** $f(x) = x^3 - 3x^2 - x + 3$

e. $f(x) = x^4 + 2x^3 - x^2 - 2x$ **f.** $f(x) = x^4 - 10x^2 + 9$

Exploration 2

* additions student practice

factors

$ax^2 + bx + c = (\ \ +\ \ )(\ \ +\ \ )$

$ax^2 - bx + c = (\ \ -\ \ )(\ \ -\ \ )$

$ax^2 - bx - c = (\ \ -\ \ )(\ \ +\ \ )$ largest factor

$ax^2 + bx - c = (\ \ -\ \ )(\ \ +\ \ )$ largest factor

Factor each polynomial completely.

a. $x^3 - 4x^2 - 5x$ **b.** $3y^5 - 48y^3$ **c.** $5z^4 + 30z^3 + 45z^2$

GCF = x

$5 \cdot 1 = 5$

$1 \quad 5$

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

$x[(x^2 - 5x) + (1x - 5)]$

$x[x(x-5) + 1(x-5)]$

$x(x-5)(x+1)$

Example 1

- begin by finding a GCF
- divide out of each term
- use ac method - multiply c term by a term
- find all factors of the product
- rewrite polynomial in 4 terms
- factor by grouping
- factor common binomial
- write what is left over

Factor the polynomial completely.

$10 \cdot 1 = 10$ / $-1 \cdot -10$ / $-2 \cdot -5$

1. $x^3 - 7x^2 + 10x$ GCF = $x \to x(x^2 - 7x + 10)$

$x[(x^2 - 2x)(-5x + 10)] = x[x(x-2) - 5(x-2)]$

$x(x-2)(x-5)$

$25 \cdot 1 = 25$ / $+1 \cdot -25$ / $+5 \cdot -5$

2. $3n^7 - 75n^5$ GCF $3n^5 \to 3n^5(n^2 - 25)$

$n^2 + 0n - 25 \to (n^2 + 5n)(-5n - 25)$

$n(n+5) - 5(n+5) = 3n^5(n+5)(n-5)$

$1 \cdot 1 = 1$ / $-1 \cdot -1$

3. $8m^5 - 16m^4 + 8m^3$ GCF = $8m^3$

$m^2 - 2m + 1$ $8m^3[m(m-1) - 1(m-1)]$

$(m^2 - 1m)(-1m + 1)$ $8m^3(m-1)(m-1)$

Monitoring Progress 1-3

- If a term is missing you can use a place holder (0x or whatever variable) to help w/ factoring

Special case → difference of two squares

Perfect square trinomial

a

Core Concept

Special Factoring Patterns

Sum of Two Cubes	Example
$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$	$64x^3 + 1 = (4x)^3 + 1^3$
	$= (4x + 1)(16x^2 - 4x + 1)$

Difference of Two Cubes	Example
$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$	$27x^3 - 8 = (3x)^3 - 2^3$
	$= (3x - 2)(9x^2 + 6x + 4)$

Core Concept

Cubes:

Remember SOAP

Same Opposite Always Positive

Factor (a) $x^3 - 125$ and (b) $16s^5 + 54s^2$ completely.

Example 2

Factor $z^3 + 5z^2 - 4z - 20$ completely.

Example 3

Factor (a) $16x^4 - 81$ and (b) $3p^8 + 15p^5 + 18p^2$ completely.

Example 4

Factor the polynomial completely.

4. $a^3 + 27$

5. $6z^5 - 750z^2$

6. $x^3 + 4x^2 - x - 4$

7. $3y^3 + y^2 + 9y + 3$

8. $-16n^4 + 625$

9. $5w^6 - 25w^4 + 30w^2$

Monitoring Progress 4-9