

4.1 - Graphing Polynomial Functions

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Warm-up - Identify graphs with functions

a. $x^2 + 5x + 4 = 0$ **C**

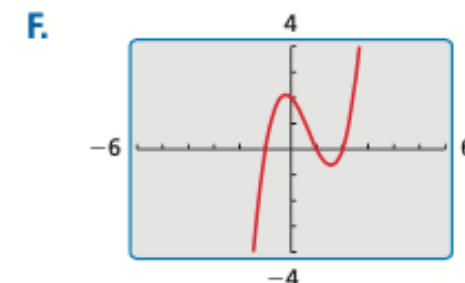
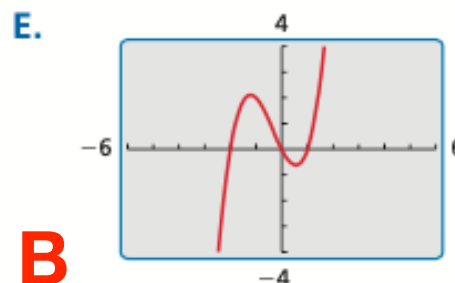
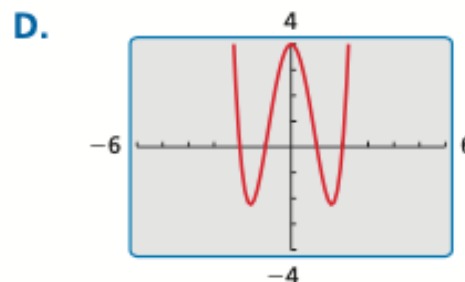
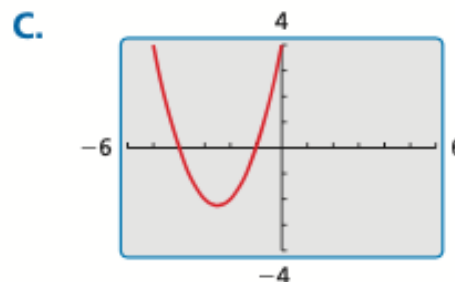
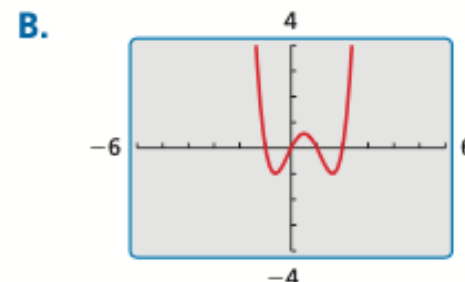
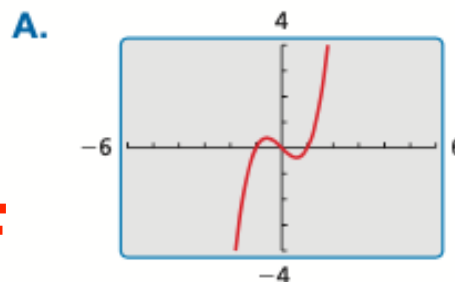
b. $x^3 - 2x^2 - x + 2 = 0$ **F**

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

d. $x^3 - x = 0$ **A**

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

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



4.4 - Factoring Polynomials

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Completely Factored Polynomial

When it is written as a product of unfactorable polynomials with integer coefficients.

$$3y^5 - 48y^3 = 3y^3(y^2 - 16) = 3y^3(y - 4)(y + 4)$$

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Factor Completely

$$5y^6 - 125y^4$$

$$5y^4(y + 5)(y - 5)$$

$$6z^2 - 24z + 24$$

$$6(z - 2)^2$$

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Practice - Factor Completely

1. $x^3 - 7x^2 + 10x$

2. $3y^5 - 75y^3$

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Special Factoring Patterns

Sum of Two Cubes

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

Example

$$\begin{aligned} 64x^3 + 1 &= (4x)^3 + 1^3 \\ &= (4x + 1)(16x^2 - 4x + 1) \end{aligned}$$

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Factor Completely

$$a^3 + 27$$

$$(a + 3)(a^2 - 3a + 9)$$

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

$$6z^2(z - 5)(z^2 + 5z + 25)$$

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Practice - Factor Completely

3. $16b^5 + 686b^2$

4. $w^3 - 27$

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Factor By Grouping

$$z^3 + 5z^2 - 4z - 20$$

$$z^2(z + 5) - 4(z + 5)$$

Factor by grouping

$$(z^2 - 4)(z + 5)$$

Distributive Property

$$(z - 2)(z + 2)(z + 5)$$

Difference of Two Squares

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Factor By Grouping

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

$$(x - 1)(x + 1)(x + 4)$$

$$3y^3 + y^2 + 9y + 3$$

$$(y^2 + 3)(3y + 1)$$

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Practice - Factor By Grouping

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

54. $x^5 + 5x^3 - 3x^2 - 15$

57. $3xy - 5rx - 10rs + 6sy$

58. $6x^2 - 10x + 3x - 5$

53. $(x^2 + 2)(x - 3)$

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

57. $3xy + 6sy - 5rx - 10rs$
 $(3y - 5r)(x + 2s)$

58. $(2x + 1)(3x - 5)$

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Factor In Quadratic Form

$$3p^8 + 15p^5 + 18p^2$$

$$3p^2(p^6 + 5p^3 + 6)$$

Factor common monomial

$$3p^2(p^3 + 3)(p^3 + 2)$$

Factor in quadratic form

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Factor In Quadratic Form

$$-16n^4 + 625 \quad -(2n + 5)(2n - 5)(4n^2 + 25)$$

$$5w^6 - 25w^4 + 30w^2 \quad 5w^2(w^2 - 3)(w^2 - 2)$$

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The Factor Theorem

A polynomial $f(x)$ has a factor $x-k$ if and only if $f(k) = 0$.

$$\frac{f(x)}{x-k} = q(x) + \frac{0}{d(x)} = q(x)$$

$$f(x) = (x-k)q(x)$$

4.4 - Factoring Polynomials

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Determine if $x + 5$ is a factor of:

$$f(x) = 3x^4 + 15x^3 - x^2 + 25$$

If yes, then factor the polynomial.

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

