

Multiplying and Dividing Polynomials

11.10.15

Warm-up

$$x^2 + x =$$

$$x^2 + x^2 =$$

$$x^2y + x^2y =$$

$$x^2y + xy =$$

$$2x^2 + x^2 =$$

$$3x^2y + x^2y =$$

$$a \cdot a =$$

$$a^2 \cdot a =$$

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

$$3a^2 \cdot a^2 =$$

$$3a^2 \cdot a =$$

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

$$\begin{aligned} x(x^2 + 4x - 3) + 2(x^2 + 4x - 3) &= \\ x^3 + 4x^2 - 3x + 2x^2 + 8x - 6 &= \\ x^3 + 4x^2 + 2x^2 - 3x + 8x - 6 &= \\ x^3 + 6x^2 + 5x - 6 \end{aligned}$$

Don't forget to distribute the negative.

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

$$(-2x^2 + 4)^3 =$$

Division of Polynomials:

Two Types: **Long Division** and **Synthetic Division**

Type 1: Long Division

Example #1:

Divide using long division:

$$(15x^2 + 8x - 12) \div (3x + 1)$$

Steps:

Example #2: **Divide using long division.**

$$(-y^2 + 2y^3 + 25) \div (y - 3)$$

You try: **Divide using long division.**

$$(x^2 + 5x - 28) \div (x - 3)$$

Type 2: Synthetic Division

Synthetic division is a shorthand method of dividing a polynomial by a linear binomial by using only the coefficients.

- The divisor must be in the form $(x - a)$.
- For synthetic division to work, the polynomial must be written in standard form, using 0 as a coefficient for any missing terms

Example #1: Divide using synthetic division.

$$(2x^3 + 5x^2 - x + 7) \div (x - 2)$$

Example #2: Divide using synthetic division.

$$(3x^4 - x^3 + 5x - 1) \div (x + 2)$$

You try: Divide using synthetic division.

$$(3x^2 + 9x - 2) \div (x - 1)$$

Example #3:

Use synthetic substitution to evaluate the polynomial for the given value.

$$P(x) = 5x^2 + 9x + 3 \text{ for } x = \frac{1}{5}$$

You Try:

Use synthetic substitution to evaluate:

$$P(x) = x^3 + 3x^2 - 6 \text{ for } x = -1$$

Think about it: When is synthetic division more helpful than long division?

When is long division better?

Exit Slip

$$1) (x^3 - 5x^2 + 5x - 3) - (2x^3 + 3x^2 - 6x + 4)$$

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

$$3) (x^3 - 4x^2 + 2x - 4) \div (x + 2)$$

$$4) (x^2 - 9x - 10) \div (x + 1)$$

- 1) $(-x^3 - 8x^2 + 11x - 7)$
- 2) $(15x^5 + 5x^4 + 6x^3 - 2x^2)$
- 3) $(x^2 - 6x + 14 - \frac{32}{x+2})$
- 4) $x-10$