ALGEBRA 1
INTERACTIVE NOTEBOOK
CHAPTER 7:
POLYNOMIALS
Today we will:
- Define monomials.
- Multiply monomials.
- Simplify expressions involving monomials.

**What is a monomial?**

**What is a constant?**

**Examples of Monomials**

---

**The product of powers!**

For any number $a$ and all integers $m$ and $n$,

$$a^m \cdot a^n = a^{m+n}$$

When multiplying two powers with the same base, add the exponents.

Example:
Simplify $(3x^6)(5x^2)$.

---

**The power of a power**

For any number $a$ and all integers $m$ and $n$,

$$(a^m)^n = a^{mn}$$

When taking the power of another power, multiply the exponents.

Example:
Simplify $(-2ab^2)^3$.

---

**The power of a product**

For any number $a$ and all integers $m$ and $n$,

$$(ab)^m = a^m \cdot b^m$$

When finding the power of a product, find the power of each factor and multiply.

Example:
Simplify $(3x)^2$.

---

**How to simplify expressions:**

1. $$(2x^2y^3z^4)^3(x^2z)^4$$
2. $$-3(2x)^4(4x^5y)^2$$
Today we will:
• Find the QUOTIENT of two monomials.
• Simplify expressions containing negative and zero exponents.

Quotients of Monomials

We can use the principles for reducing fraction to find the quotients of monomials like ...

The quotient of powers!

For any \( a \neq 0 \) and any integers \( m \) and \( p \),
\[
\frac{a^m}{a^p} = a^{m-p}
\]

When dividing two powers with the same base, subtract the exponents.

Example:
Simplify \( \frac{x^3y^4}{x^2y} \).

The power of a quotient

For any number \( a \) and \( b \neq 0 \), and any integer \( m \),
\[
\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}
\]

When taking the power of another exponent, multiply the exponents together and keep the base.

Example:
Simplify \( \left(\frac{5x^2y}{6}\right)^2 \).

The zero exponent

A zero exponent is a non-zero number raised to the zero power. For any \( a \neq 0 \), \( a^0 = 1 \).

Example:
Simplify \( \frac{3^5}{3^5} \).

Negative Exponents

A non-zero number raised to a negative power is a negative exponent. For any \( a \neq 0 \) and any integer \( n \), \( a^{-n} = \frac{1}{a^n} \).

Investigate:

Example: \( \frac{n^{-5}p^4}{r^{-2}} \)

Calculator Bloopers

\(-6^3 = (-6)^2 = \)
Sometimes with numbers this small or this large, it can be helpful to rewrite without the extra zeroes.

So, we ___ the 1st non-zero digit, place a ____ ___ before the next, and use powers of ____ to correctly represent how we moved the decimal point.

The rewritten format is called **Scientific Notation**.

When converting a number into scientific notation,

If you moved a decimal to the **left**, the power of ten represents...

If you moved a decimal to the **right**, the power of ten represents....

Careful!

When writing scientific notation, if you moved a decimal to the **right**, the power of ten is **negative**.

Try it:

Write 0.0337 in scientific notation...
### Powers of Ten

<table>
<thead>
<tr>
<th>Standard Form</th>
<th>Scientific Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>56,790</td>
<td>2.4 \times 10^{-2}</td>
</tr>
<tr>
<td>7,000</td>
<td>1.65 \times 10</td>
</tr>
<tr>
<td>0.93806</td>
<td>1.469 \times 10^8</td>
</tr>
</tbody>
</table>

When we UN-DO an operation, we do the **OPPOSITE** (Inverse operations)!

Working Backwards:

- When converting **FROM** scientific notation **INTO** standard form, remember that the decimal is moving in the opposite direction. So if the power is **NEGATIVE**, you will move it to the **POSITIVE**, and if the power is **POSITIVE**, you will move it to the **NEGATIVE**.

Dividing by 100 is the same as multiplying by ten to the what power? ______

SCIENTIFIC NOTATION PRACTICE
Today we will:
- Define polynomial.
- Determine the degree of a polynomial.
- Write polynomials in standard form.

## What is a polynomial?

## How do I determine the degree of a polynomial?

<table>
<thead>
<tr>
<th>Expression</th>
<th>Is it a polynomial?</th>
<th>Monomial, binomial, or trinomial?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. $4y - 5xz$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. $-6.5$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. $7a^{-3} + 9b$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. $5x^2 + 7x - 2x + 9$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NAME:

Today we will:
- Add polynomials.
- Subtract polynomials.

**Learn it by Doing it**

Cut and paste each expression into your interactive notebook. Simplify each them, showing your work underneath the paper strip. Then cut each piece from the right side of the page and match the answers to the expressions below.

1. \((6x^3-4)+(-2x^3+9)\) → \(-xy^2+6xy-10\)
2. \((x^3-x^2+5x+6)-(x^2+2x)\) → \(9x+4y-17z\)
3. \((-4x^3-2x+8)-(4x^3+3x^2-5)\) → \(9x-6\)
4. \((8y-4y^3)+(3y-9y^3)\) → \(-3y^2+3y-12\)
5. \((4y^2+2y-8)-(7y^2+4-y)\) → \(-13y^2+11y\)
6. \((x^3-3x+1)-(x^3+7-12x)\) → \(-8x^3-3x^2-2x+13\)
7. \((xy^2+2xy-4)+(-6+4xy-2xy^2)\) → \(4x^3+5\)
8. \((4x+2y-62)+(5y-22+7x)-(9x+2x+3y)\) → \(x^3-2x^2+3x+6\)
Today we will:
• Multiply a polynomial by a monomial.
• Solve equations involving the products of monomials and polynomials.

### Polynomials Multiplied by a Monomial

1. Find \(-3x^2(7x^2-x+4)\).

2. Find \(-6d^3(3d^4-2d^2-d+9)\).

3. Simplify \(5a^2(-4a^2+2a-7)-2a(a^2+a-3)\).

### Solve Equations with Polynomial Expressions

Solve for \(x\).

4. \(-6(11-2c)=7(-2-2c)\)

5. \(2x(x+4)+7 = (x+3) + 2x(x+1)+12\)

Marlene is buying a new plasma television. The height of the screen of the television is one half the width plus 5 inches. The width is 30 inches. Find the height of the screen in inches.
Today we will:
• Multiply binomials using the FOIL method.
• Multiply polynomials by using the Distributive Property.

**FOIL**

(2x - 7)(3x + 5)

\[
\begin{align*}
\text{First} & : 2x \cdot 3x = 6x^2 \\
\text{Outer} & : 2x \cdot 5 = 10x \\
\text{Inner} & : (-7) \cdot 3x = -21x \\
\text{Last} & : (-7) \cdot 5 = -35
\end{align*}
\]

\[6x^2 + 10x - 21x - 35 = 6x^2 - 11x - 35\]

**Distributive Property**

(2x^2 + 3x - 1)(3x^2 - 5x + 2)

\[
\begin{align*}
\text{First} & : 2x^2 \cdot 3x^2 = 6x^4 \\
\text{Outer} & : 2x^2 \cdot (-5x) = -10x^3 \\
\text{Inner} & : 3x \cdot 3x^2 = 9x^3 \\
\text{Last} & : 3x \cdot 2 = 6x \\
\text{Outer} & : (-1) \cdot 3x^2 = -3x^2 \\
\text{Inner} & : (-1) \cdot (-5x) = 5x \\
\text{Last} & : (-1) \cdot 2 = -2
\end{align*}
\]

\[6x^4 - 10x^3 + 9x^3 + 6x - 3x^2 + 5x - 2 = 6x^4 - x^3 + 11x - 2\]

**Try it**

1. \((x+5)(x+2)\)
2. \((2a+9)(5a-6)\)
3. \((y-2)(2y^2+y+4)\)
4. Find an expression to represent the area of the shaded region of the figure shown.
\[(a+b)^2\]

\[(a-b)^2\]

\[(a+b)(a-b)\]
Give an example of each of the following vocab words (or use the ones on pg. 459):

- Binomial
- Constant
- Degree of a monomial
- Degree of a polynomial
- FOIL Method
- Leading coefficient
- Monomial
- Order of magnitude
- Polynomial
- Quadratic expression
- Scientific notation
- Standard form of a polynomial
- Trinomial