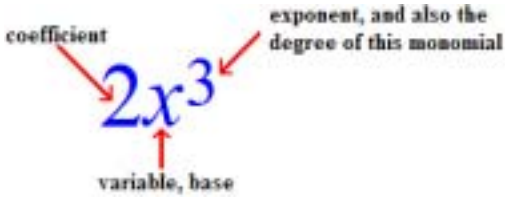
Chapter 3: Algebraic Expressions
Lesson Index & Summary

Section 1: Monomials

Index

Key Topics & Formulas

- Definitions: *(Screen 2)*
  - A **variable** is a letter or symbol used to represent a quantity that is unknown or can change. The letters x and y are the symbols most commonly used as variables but any letter can be used. Variables are also sometimes referred to as "unknowns."
  - A **constant** is a quantity that does not change in value.
  - A **monomial** is a constant, a variable, or the product of constants and variables. A monomial never involves addition, subtraction, radicals of variables, or variables in a denominator.
- The **degree** of a monomial with only one variable is simply the degree of that variable. *(Screen 7)*
  - The degree of x is 1 since $x = x^1$.
  - The degree of a constant is 0.



(Screen 7)

Chapter 3: Algebraic Expressions
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Section 2: Basic Rules for Exponents

Index

Key Topics & Formulas

- Definition of Exponents: $x^n = \overbrace{x \cdot x \cdot x \cdots \cdot x}^{n \text{ of these}}$ *(Screen 2)*
- Rules of Exponents:

  Rule 1: $x^1 = x$, for any real number x. *(Screen 2)*

  Rule 2: $x^m \cdot x^n = x^{m+n}$, for any real number x and any integers m and n. *(Screen 2)*

  Rule 3 $(xy)^n = x^n \cdot y^n$, for any real numbers x and y and any positive integer n. *(Screen 3)*

  Rule 4: $\left(x^m\right)^n = x^{m \cdot n}$, for any real number x and any integers m and n. *(Screen 3)*

  Rule 5: $\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}$, for any x and y, $y \neq 0$, and any integer n. *(Screen 7)*

- The order of operations is as follows: *(Screen 11)*
  2. Simplify within parentheses.
  3. Simplify any exponents.
  4. Perform multiplication and division <u>from left to right.</u>
  5. Perform addition and subtraction <u>from left to right</u>.
- Some find it helpful to keep in mind that negatives are equivalent to multiplication by -1: $-A = (-1) \cdot A$. *(Screen 13)*
- A negative number raised to an even exponent is positive, but a negative number raised to an odd exponent is negative. *(Screen 13)*
- The negative sign is not part of the base unless it is included in parentheses. *(Screen 13)*

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Section 3: Additional Rules for Exponents

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Key Topics & Formulas

- More Rules of Exponents:

  Rule 6 (Cancellation): $\frac{x^m}{x^n} = x^{m-n}$, for any real number x, $x \neq 0$, and any integers m and n. *(Screen 2)*

  Rule 7: $x^0 = 1$ for any real number $x \neq 0$. *(Screen 3)*

  Rule 8 (Definition of Negative Exponent): $x^{-n} = \frac{1}{x^n}$, for any real number x, $x \neq 0$, and for any integer n. *(Screen 4)*

  (Screen 5)

Properties of Exponents	
1	$a^1 = a$
2	$a^m \cdot a^n = a^{m+n}$
3	$(ab)^n = a^n \cdot b^n$
4	$(a^m)^n = a^{m \cdot n}$
5	$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$
6	$\frac{a^m}{a^n} = a^{m-n}$
7	$a^0 = 1$
8	$a^{-n} = \frac{1}{a^n}$

- Remember that the **elevator rule** only works when the numerator and the denominator are both completely factored as products; **if there is any addition or subtraction in the fraction, do NOT use this technique.** *(Screen 11)*

Section 4: From Words to Algebraic Expressions

Index

Key Topics & Formulas

- Common word expressions that indicate algebraic relationships:

is equal to	$=$	
is not equal to	$\neq$	
is less than	$<$	
is less than or equal to	$\leq$	
is greater than	$>$	
is greater than or equal to	$\geq$	*(Screen 5)*

- Common word phrases and their algebraic equivalents: *(Screens 9-10)*

x plus 8 8 added to x x increased by 8 8 more than x the sum of x and 8 the total of x and 8 x and 8 together } $x + 8$	8 times x the product of 8 and x x multiplied by 8 8 multiplied by x 8 xs } $8x$
x minus 8 8 subtracted from x x decreased by 8 8 less than x 8 fewer than x the difference of x and 8 } $x - 8$	x divided by 8 one-eighth of x an eighth part of x the quotient of x and 8 the ratio of x and 8 } $\frac{x}{8}$ or $x \div 8$ or $\frac{1}{8}x$

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is less than 8 is smaller than 8 $\}<8$	equals 8 is 8 is equal to 8 $\}=8$
is greater than 8 is more than 8 $\}>8$	
is greater than or equal to $8\}\geq 8$	does not equal 8 is not 8 is not equal to 8 $\}\neq 8$
is less than or equal to $8\}\leq 8$	

Section 5: Evaluating Expressions

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Key Topics & Formulas

- **Evaluate** means to substitute the given number for the variable and then simplify the expression.

  Example A: Evaluate the monomial $3x^2$ when $x = 5$. *(Screen 2)*

  If $x = 5$, then $3x^2 = 3(5)^2 = 3 \cdot 25 = 75$.

  Example D: Evaluate $a - b + 7$ when $a = 14$ and $b = 3$. *(Screen 3)*

  Replace a with 14 and b with 3: $a - b + 7 = 14 - 3 + 7 = 18$.

- When you substitute a negative number for a variable, use parentheses. *(Screen 4)*

Section 6: Polynomials

Index

Key Topics & Formulas

- A **polynomial** is a monomial or the sum or difference of any number of monomials. *(Screen 2)*
- Like terms can be added. This is called **combining like terms**. When you combine like terms, you add the coefficients of each term and leave the variable parts unchanged. Thus,
  $5x^2y - 9xy + 7x^2y - 4 = 12x^2y - 9xy - 4$. *(Screen 4)*
- We saw earlier that the **degree of a monomial** with only one variable is simply the degree of that variable. When a monomial has more than one variable, the degree of the monomial is the sum of the exponents of all the variables of the monomial. *(Screen 6)*
- The **degree of a polynomial** in standard form is the highest degree of any of its terms (assuming its like terms have all been combined). *(Screen 6)*

(Screen 7)

A Word to the Wise

Always combine like terms before deciding the degree of a polynomial.