Welcome to Precalculus Key Concepts

Introduction to Precalculus Lesson

No key concepts are included in this lesson.

Algebraic Expressions and Equations Lesson

Properties of Real Numbers

Commutative Properties	Changing the order of the terms in addition or multiplication does not affect the sum or product. The Commutative Property of Addition states: $a + b = b + a$. The Commutative Property of Multiplication states: $ab = ba$.
Associative Properties	Changing the grouping of real numbers in addition and multiplication expressions does not affect the outcome. The Associative Property of Addition states: $(a+b)+c=a+(b+c)$. The Associative Property of Multiplication states: $(ab)c=a(bc)$.
Distributive Property	Multiply the factor outside a set of parentheses by every term inside the parentheses when simplifying. The Distributive Property states: $a(b+c)=ab+ac$.
Identity Properties	The identity for an operation is the value that does not change the value of an expression for that operation. Zero is the additive identity; adding zero to a number does not change its value. One is the multiplicative identity; multiplying a number by one does not change its value. The Identity Property of Addition states: $n + 0 = n$. The Identity Property of Multiplication states: $n \cdot 1 = n$.
Inverse Properties	The inverse of a number related to an operation is the value that combines with the number to give the identity of that operation as a result. The Inverse Property of Addition states: $n+(-n)=0$, with $-n$ being the additive inverse and zero being the additive identity. The Inverse Property of Multiplication states: $n \cdot \frac{1}{n}=1, n \neq 0$, where $\frac{1}{n}$ is the multiplicative inverse and one is the multiplicative identity.

Operations of Real Numbers

Parentheses	Simplify inside parentheses first. If there is more than one set of parentheses, start with the innermost set and work outward. When fractions are involved, expressions in the numerator and denominator should be treated as if they are in parentheses.
Exponents	Simplify power expressions second.
Multiplication and Division	Simplify multiplication and division in order from left to right third.
Addition and Subtraction	Simplify addition and subtraction in order from left to right fourth.

Properties of Exponents and Square Roots

The following are the properties of exponents and square roots where *a* and *b* are real numbers or algebraic expressions and *m* and *n* are real numbers.

Zero Exponent Property	$a^0 = 1$, where $a \neq 0$
Negative Exponent Property	$a^{-n} = \frac{1}{a^n}$, where $a \neq 0$
Power Rule for Products	$(ab)^n = a^n b^n$
Power Rule for Quotients	$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$, where $b \neq 0$
Power Rule for Powers	$(a^n)^m = a^{nm}$
Product Rule for Powers	$a^n \cdot a^m = a^{n+m}$
Quotient Rule for Powers	$\frac{a^n}{a^m} = a^{n-m}$, where $a \neq 0$
Square Root Rule for Products	$\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$, where $a \geq 0$ and $b \geq 0$
Square Root Rule for Quotients	$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$, where $a \geq 0$ and $b > 0$

Zero-Product Property
If *ab* = 0, then *a* = 0 or *b* = 0.

The Quadratic Formula
The solutions to any quadratic equation in the form $ax^2 + bx + c = 0$ can be found using the quadratic formula, $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

Relations and Functions Lesson

Representing Relations and Functions
Relations and functions can be represented as ordered pairs, in tables, and in graphs.

Vertical Line Test
A vertical line will pass through the graph of a function at only one point. If any vertical line passes through a graph at more than one point, the relation is not a function.

The Complex Number System Lesson

The Complex Number System
The complex number system consists of all real numbers, $a+bi$ where *b*=0, all imaginary numbers, $a+bi$ where *a*=0, and complex numbers, $a+bi$ where $a \neq 0$ and $b \neq 0$.

Complex Number Graphs
Complex numbers can be graphed on a complex plane, where the horizontal axis is the real axis, and the vertical axis is the imaginary axis.

Conjugate of a Complex Number
The conjugate of the complex number $a+bi$ is $a-bi$.

Absolute Value of a Complex Number
The absolute value of the complex number $a+bi$ has the value $\sqrt{a^2+b^2}$.

Operations with Complex Numbers Lesson

Performing Operations with Complex Numbers

Complex numbers can be added, subtracted, multiplied, and divided using the properties of real numbers and the definition of the imaginary unit *i.* The set of complex numbers is closed for the operations of addition, subtraction, multiplication, or division.