

Standard 7: Number/Quantity						
	6	Pre-Algebra Plus	Algebra	Geometry	Algebra II	Fourth Course
Benchmark 1 (Part 1)		Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.				
		Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.				
		Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.				
		Solve real-world and mathematical problems involving the four operations with rational numbers. ¹				
Benchmark 1 (Part 2)		Know that there are numbers that are not rational, and approximate them by rational numbers.	Use properties of rational and irrational numbers.			
		Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.	Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.			

		Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2).				
Benchmark 1 (Part 3)		Work with radicals and integer exponents.	Extend the properties of exponents to rational exponents.			
		Know and apply the properties of integer exponents to generate equivalent numerical expressions.	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.			
		Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.	Rewrite expressions involving radicals and rational exponents using the properties of exponents.			
		Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.				

		Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.				
Benchmark 2		Analyze proportional relationships and use them to solve real-world and mathematical problems.	Reason quantitatively and use units to solve problems.			
		Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. For example, if a person walks $\frac{1}{2}$ mile in each $\frac{1}{4}$ hour, compute the unit rate as the complex fraction $\frac{1/2}{1/4}$ miles per hour, equivalently 2 miles per hour.	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.			
		Recognize and represent proportional relationships between quantities.	Define appropriate quantities for the purpose of descriptive modeling.			
		Use proportional relationships to solve multistep ratio and percent problems.	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.			
Benchmark 3 (Part 1)					Perform arithmetic operations with complex numbers.	Perform arithmetic operations with complex numbers.

					Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real.	(+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.
					Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	
Benchmark 3 (Part 2)					Use complex numbers in polynomial identities and equations. (Polynomials with real coefficients)	Represent complex numbers and their operations on the complex-plane.
					Solve quadratic equations with real coefficients that have complex solutions.	(+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.
					(+) Extend polynomial identities to the complex numbers. For example, rewrite $x^2 + 4$ as $(x + 2i)(x - 2i)$.	(+) Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. For example, $(-1 + \sqrt{3}i)^3 = 8$ because $(-1 + \sqrt{3}i)$ has modulus 2 and argument 120° .
					(+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.	(+) Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.
Benchmark 4 (Part 1)						Represent and model with vector quantities.

						(+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., v , $ v $, $\ v\ $, v).
						(+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.
						(+) Solve problems involving velocity and other quantities that can be represented by vectors.
Benchmark 4 (Part 2)						Perform operations on vectors.
						(+) Add and subtract vectors.
						(+) Multiply a vector by a scalar.
Benchmark 4 (Part 3)						Perform operations on matrices and use matrices in applications.
						(+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.
						(+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.

						(+) Add, subtract, and multiply matrices of appropriate dimensions.
						(+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.
						(+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.
						(+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.
						(+) Work with 2×2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.