

COGNITIVE TUTOR ALGEBRA

Numbers and Operations Standard: Understands and applies concepts of numbers and operations				
Power Benchmark 1: Understands numbers, ways of representing numbers, relationships among numbers, and number systems				
Course Level Benchmark	Vocabulary	Background Knowledge/Prior Skills	Skills to Assess	
a. Simplifies expressions involving exponents ITED * ACT SAT * ITED 1-3 items	<ul style="list-style-type: none"> • Simplify • Exponent • Base • Power • Expanded form • Zero exponent • Negative exponent • Squared • Cubed • Scientific notation 	<ul style="list-style-type: none"> • Knows an exponent tells how many times the base is used as a factor • Knows $a^0 = 1$ • Knows $a^{-n} = 1/a^n$ • Knows when multiplying exponents with the same base you add the exponents • Knows when dividing exponents with the same base you subtract the exponents 	<ul style="list-style-type: none"> • Simplifies and expands algebraic expressions involving exponents, including zero and negative exponents (ACT, SAT) • Evaluates expressions involving exponents - • Multiplies and divides expressions involving exponents (ITED, ACT, SAT) 	

Numbers and Operations Standard: Understands and applies concepts of numbers and operations

Power Benchmark 1: Understands numbers, ways of representing numbers, relationships among numbers, and number systems

Course Level Benchmark	Vocabulary	Background Knowledge/Prior Skills	Skills to Assess	
b. Simplifies expressions involving radicals ITED * ACT SAT ASVAB * ITED 1-3 items	<ul style="list-style-type: none"> • Simplify • Radical • Exact form • Approximate form • Perfect-square factors • Square root • Like/unlike radical • Negative square root • Rationalize denominators 	<ul style="list-style-type: none"> • Knows the distributive property can be used to combine radicals • Knows $\sqrt{ah} = \sqrt{a} \cdot \sqrt{h}$ • Knows $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ 	<ul style="list-style-type: none"> • Writes radicals in simplest form (ITED, ACT, SAT) • Performs mathematical operations with radicals (ACT, SAT, ASVAB) • Express radicals in exact form and appropriate form - • Simplifies by rationalizing denominators - 	

Numbers and Operations Standard: Understands and applies concepts of numbers and operations

Power Benchmark 2: Understands meanings of operations and how they relate to one another

Course Level Benchmark	Vocabulary	Background Knowledge/Prior Skills	Skills to Assess	
<p>a. Uses the properties of operations to simplify computations and solve problems ITED *** ACT SAT</p> <p>*** ITED more than 3 items</p>	<ul style="list-style-type: none"> • Identity property • Inverse property • Distributive property • Associative property • Commutative property • Squaring • Square root • Like terms • Order of operations • Grouping • Inverse operations 	<ul style="list-style-type: none"> • Knows the identity properties of addition and multiplication • Knows the distributive, associative, and communicative properties of addition and multiplication • Knows squaring and square root are inverse operations • Knows the inverse operations undo each other • Recognizes like terms • Understands rules for combining variables • Knows the order of operations 	<ul style="list-style-type: none"> • Explains the meaning of adding, subtracting, multiplying, and dividing integers - • Uses inverse properties and relationships to solve problems (ACT, SAT) • Uses order of operations including grouping symbols to solve problems (ITED, ACT, SAT) • Simplifies equations using properties of operations (ACT, SAT) 	

Numbers and Operations Standard: Understands and applies concepts of numbers and operations				
Power Benchmark 3: Computes fluently and makes reasonable estimates				
Course Level Benchmark	Vocabulary	Background Knowledge/Prior Skills	Skills to Assess	
a. Uses a variety of operations on expressions containing real numbers ITED *** ACT SAT *** ITED more than 3 items	<ul style="list-style-type: none"> • Simplify • Rational numbers • Irrational numbers • Real numbers 	<ul style="list-style-type: none"> • Knows the algorithms of operations for real numbers 	<ul style="list-style-type: none"> • Adds, subtracts, multiplies, divides, and simplifies expression of real numbers (ITED, ACT, SAT) 	
b. Determines reasonableness of answers	<ul style="list-style-type: none"> • Reasonableness 	<ul style="list-style-type: none"> • Knows how to judge the reasonableness of the answer 	<ul style="list-style-type: none"> • Checks answer to see if it is reasonable - • States sensible answers to a problem - 	

ITED Focus Lessons: Ratios, Proportions, Matrices (adding and subtracting), Fractions, Decimals, Percents, Absolute Value (simplify and solve problems), range of rounded numbers, write equations for specific problem but do not solve, Pythagorean Theorem

Algebra Standard: Understands and applies concepts of algebra and functions

Power Benchmark 1: Represents patterns and relationships in a variety of ways

Course Level Benchmark	Vocabulary	Background Knowledge/Prior Skills	Skills to Assess	
a. Uses patterns and relationships to analyze mathematical situations SAT ASVAB	<ul style="list-style-type: none"> • Patterns • Term • Prediction • Sequence 	<ul style="list-style-type: none"> • Knows patterns can be described in a variety of ways • Knows how to use the pattern to predict change from one term to the next 	<ul style="list-style-type: none"> • Describes patterns using words, tables, and graphs - • Finds the terms in a sequence (ASVAB) • Generates equations to describe linear patterns (SAT) 	
b. Describes functions and their properties using function notations ITED * * ITED 1-3 items	<ul style="list-style-type: none"> • Function • Domain • Independent Variable • Dependent Variable • Range • One-to-one correspondence • Function notation • Function rule • Relation • Vertical Line Test 	<ul style="list-style-type: none"> • Knows for every value in the domain of a function, there is one and only one corresponding value in the range • Understands the concept of a function as the correspondence between the elements of two sets • Understands the definition of a function: domain, range, function, relation 	<ul style="list-style-type: none"> • Identifies the domain, range, and rule of a function - • Describes functions and their properties using function notation - • Recognizes the graphs of non-linear functions - • Describes from a graph the relationship between two variables (ITED) 	

Algebra Standard: Understands and applies concepts of algebra and functions

Power Benchmark 2: **Represents and analyzes mathematical situations and structures using algebraic symbols**

Course Level Benchmark	Vocabulary	Background Knowledge/Prior Skills	Skills to Assess	
<p>a. Represents linear and quadratic functions in a variety of ways</p> <p>ITED *</p>	<ul style="list-style-type: none"> • Standard Form • Linear function • Quadratic function • Parabola 	<ul style="list-style-type: none"> • Knows a function can be represented in a variety of ways • Understands a family of functions has similar characteristics 	<ul style="list-style-type: none"> • Describes functions using words, tables, graphs and equations – • Graphs linear and quadratic functions - • Recognizes a linear and quadratic function from its graph (ITED) • Writes the equation of a linear function given the table of values, graph, two points on the line, and slope and y-intercept - 	

* ITED 1-3 items

Algebra Standard: Understands and applies concepts of algebra and functions

Power Benchmark 2: **Represents and analyzes mathematical situations and structures using algebraic symbols**

Course Level Benchmark	Vocabulary	Background Knowledge/Prior Skills	Skills to Assess	
b. Interprets graphical representations of linear functions - ACT	<ul style="list-style-type: none"> • Rate of change • Slope • Direct Variation • Slope-Intercept Form 	<ul style="list-style-type: none"> • Understands change can be described mathematically • Understands how rate of change can be described numerically and graphically • Knows a linear graph has a constant rate of change 	<ul style="list-style-type: none"> • Interprets slope as the amount of one quantity (y) per unit of another quantity (x) - • Defines slope as a rate of change - • Finds the slope, x-intercept, and y-intercept of a line given its graph, equation, or two points on the line (ACT) • Uses slope to differentiate between lines that are parallel, perpendicular, horizontal, or vertical - • Compares the rates of change of two different graphs - 	

Algebra Standard: Understands and applies concepts of algebra and functions

Power Benchmark 3: Uses mathematical models to represent and understand quantitative relationships.

Course Level Benchmark	Vocabulary	Background Knowledge/Prior Skills	Skills to Assess	
<p>a. Rewrites algebraic expressions in equivalent forms ITED *** ACT SAT ASVAB</p> <p>*** ITED more than 3 items</p>	<ul style="list-style-type: none"> • Variable • Algebraic expression • Like terms • Coefficient • Terms • Equivalent forms • Unit analysis/ Dimensional analysis 	<ul style="list-style-type: none"> • Recognizes like terms - • Knows rules to simplify expressions - • Knows the order of operations - • Understands the concept of equivalent forms of expressions - 	<ul style="list-style-type: none"> • Simplifies algebraic expressions by combining like terms and applying appropriate properties (ITED) • Evaluates simple algebraic expressions (ACT, SAT, ASVAB) • Translates words into algebraic expressions (ITED, ACT, ASVAB) • Uses unit analysis/dimensional analysis to organize conversions and computations (ITED, ACT) 	

Algebra Standard: Understands and applies concepts of algebra and functions

Power Benchmark 3: Uses expressions and symbols to represent mathematical relationships (con't)

Course Level Benchmark	Vocabulary	Background Knowledge/Prior Skills	Skills to Assess	
b. Simplifies polynomial expressions ACT SAT ASVAB	<ul style="list-style-type: none"> • Degree • Standard form • Monomial • Binomial • Trinomial • Polynomial • Constant • Linear • Quadratic • Cubic • Greatest monomial factor • Difference of squares • Perfect square trinomial 	<ul style="list-style-type: none"> • Knows the meaning of like terms • Knows how to a factor number (ex: $8 = 1*8, 2*4$) • Knows how to find the GCF of numbers 	<ul style="list-style-type: none"> • Names polynomials by degree and number of terms - • Writes polynomials in standard form - • Adds, subtracts, and multiplies polynomials (ACT, SAT, ASVAB) • Applies basic factoring techniques to second and simple third degree polynomials (ACT, SAT) 	

Algebra Standard: Understands and applies concepts of algebra and functions

Power Benchmark 3: Uses expressions and symbols to represent mathematical relationships (con't)

Course Level Benchmark	Vocabulary	Background Knowledge/Prior Skills	Skills to Assess	
<p>c. Solves multi-step equations ITED *** ACT SAT ASVAB</p> <p>*** ITED more than 3 items</p>	<ul style="list-style-type: none"> • Multi-step problems • Literal equations • Inverse Operations 	<ul style="list-style-type: none"> • Recognizes like terms • Understands rules for combining variables • Knows the order of operations • Knows the inverse relationship between addition and subtraction and multiplication and division • Understands the process of working backwards to solve equations (strategy of undoing) 	<ul style="list-style-type: none"> • Solves equations for a specified variable (ITED, ACT, SAT, ASVAB) • Solves multi-step equations involving like variables on the same side of the equal sign, like variables on both sides of the equal sign, and the distributive property (ITED, ACT, SAT, ASVAB) • Writes an equation for a specific problem (ITED, SAT, ASVAB) 	
<p>d. Solves single variable inequalities ACT SAT ASVAB</p>	<ul style="list-style-type: none"> • Inequality • Compound inequality • Solution of an inequality • Open dot • Closed dot 	<ul style="list-style-type: none"> • Understands the process of working backwards to solve equalities (strategy of undoing) • Knows the meaning of the inequality symbols 	<ul style="list-style-type: none"> • Solves multi-step single variable inequalities involving like variables on the same side of the equal sign, like variables on both sides of the equal sign, and distributive property (ACT, SAT, ASVAB) • Graphs solutions of inequalities on a number line 	

Algebra Standard: Understands and applies concepts of algebra and functions

Power Benchmark 4: Analyze change in a variety of situations

Course Level Benchmark	Vocabulary	Background Knowledge/Prior Skills	Skills to Assess	
<p>a. Solves systems of equations by graphing, substitution, and elimination</p> <p>ACT SAT ASVAB</p>	<ul style="list-style-type: none"> • Systems of equations • Graphing method • Substitution method • Elimination method • No solution • Infinitely many solutions • One solution • Perpendicular Lines • Parallel Lines 	<ul style="list-style-type: none"> • Knows how to graph a linear equation • Knows how to solve a literal equation 	<ul style="list-style-type: none"> • Uses graphing to solve a systems of equations (ACT, SAT, ASVAB) • Uses substitution to solve a systems of equations (ACT, SAT, ASVAB) • Uses elimination to solve a systems of equations (ACT, SAT, ASVAB) • Knows whether a systems of equations has one solution, no solution, or infinitely many solutions - 	
<p>b. Solves quadratic equations by quadratic formula, factoring, and square roots</p> <p>ACT SAT ASVAB</p>	<ul style="list-style-type: none"> • Quadratic equation • Standard form • Quadratic formula • Factoring • Square roots • Zero-product property • Parabola 	<ul style="list-style-type: none"> • Knows order of operations • Knows how to find the square root of a number • Knows how to write the Standard Form of any polynomial 	<ul style="list-style-type: none"> • Solves quadratic equations by quadratic formula, factoring, and square roots (ACT, SAT, ASVAB) • Analyzes quadratic equations to decide which method of solving is appropriate - • Analyzes quadratic equations through graphing - 	

Data Analysis and Probability: Understands and applies concepts of data analysis and probability				
Power Benchmark 4: Understands and applies concepts of probability				
Grade Level Benchmark	Vocabulary	Background Knowledge/Prior Skills	Skills to Assess	
a. Experiment and analyze simple probabilities	<ul style="list-style-type: none"> • Outcomes • Sample space • Event • Probability • Theoretical Probability • Experimental Probability • Independent Events • Dependent Events 	<ul style="list-style-type: none"> • Knows the difference between Theoretical and Experimental probability 	<ul style="list-style-type: none"> • Demonstrates finding probability of an event, both independent and dependent - • Defines a sample space - 	

Problem Solving Standard: Understands and applies problem solving strategies				
Power Benchmark 1: Uses a variety of strategies to solve problems				
Grade Level Benchmark	Vocabulary	Background Knowledge/Prior Skills	Skills to Assess	
a. Applies and adapts a variety of appropriate strategies to solve problems	<ul style="list-style-type: none"> • Try, test, revise • Make a model • pertinent information • irrelevant information • insufficient information • act it out • make or use a model • find or use a pattern • draw a picture • guess and check • make a chart, table, graph, or organized list • • use logical reasoning 	<ul style="list-style-type: none"> • Knows the general problem solving strategies • Knows the same situation can often be represented in more than one way • Knows different problems may be solved using the same method 	<ul style="list-style-type: none"> • Chooses appropriate strategies to solve problems in the context of the problem situation (ITED) • Uses previous learned strategies, skills, knowledge, and concepts to solve problems (ITED) • Translates words to numbers to symbolic expressions (ITED) <ul style="list-style-type: none"> <input type="checkbox"/> Identifies pertinent and irrelevant information (ITED) <input type="checkbox"/> Generalizes solutions to new problem situations (ITED) 	