MATH RESOURCE TOOL FOR CCR STANDARDS

Arkansas Adult Ed

Arkansas Division of
Workforce Services
Adult Education

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ARKANSAS ADULT EDUCATION
SUMMARY OF MATH STANDARDS

Standards for Mathematical Practice (Practices mathematically proficient students should do across Strands of Mathematics Content Standards)	
Mathematical Practice 1	**Make sense of problems and persevere in solving them.**
Mathematical Practice 2	**Reason abstractly and quantitatively.**
Mathematical Practice 3	**Construct viable arguments and critique the reasoning of others.**
Mathematical Practice 4	**Model with mathematics.**
Mathematical Practice 5	**Use appropriate tools strategically.**
Mathematical Practice 6	**Attend to precision.**
Mathematical Practice 7	**Look for and make use of structure.**
Mathematical Practice 8	**Look for and express regularity in repeated reasoning.**

Shift 1	**Focus: Focusing strongly where the standards focus**
Shift 2	**Coherence: Designing learning around coherent progressions level to level**
Shift 3	**Rigor: Pursuing conceptual understanding, procedural skill and fluency, and application—all with equal intensity**

ARKANSAS ADULT EDUCATION
SUMMARY OF MATH STANDARDS

Numbers, Operations, Fractions, and Systems

Digit	**Thousands**	**Hundreds**	**Tens**	**Ones**
Less	**More**	**Place Value**	**Addition**	**Subtraction**
Skip-count	**Greater Than**	**Less Than**	**Equal To**	**Whole Numbers**
Algorithm	**Fraction**	**Quantity**	**Number Line**	**Equivalent**
Equal	**Numerator**	**Denominator**	**Decompose**	**Multiplication**
Division	**Decimal**	**Tenth**	**Hundredth**	**Thousandth**
Array	**Model**	**Diagram**	**Dividend**	**Divisor**
Common Factor	**Quotient**	**Distributive Property**	**Commutative Property**	**Associative Property**
Identity Property	**Inverse Property**	**Positive**	**Negative**	**Rational**
Irrational	**Real**	**Sign**	**Integers**	**Absolute Value**
Compare	**Solve**	**Locate**	**Estimate**	**Rate**
Ratio				

Algebra

Compute	**Proportion**	**Equation**	**Exponent**	**Expression**
Unit	**Sums**	**Rounding**	**Factor**	**Pattern**
Calculation	**Numerical**	**Polynomial**	**Inequalities**	**Formula**
Linear Equation	**Quadratic Equation**			

Geometry

Two-dimensional Shapes	**Three-dimensional Figures**	**Rectangle**	**Square**	**Trapezoid**
Triangle	**Half-Circle**	**Quarter-Circle**	**Cube**	**Right Rectangular Prism**
Right Circular Cone	**Right Circular Cylinder**	**Attribute**	**Angle**	**Face**
Quadrilaterals	**Pentagon**	**Hexagon**	**Rhombus**	**Point**
Line	**Line Segment**	**Ray**	**Right Angle**	**Acute Angle**
Obtuse Angle	**Perpendicular Line**	**Parallel Line**	**Axes/Axis**	**Coordinate**
Graph	**Polygon**	**Coordinate Plane**	**Scale**	**Similar**
Circumference	**Supplementary Angle**	**Complementary Angle**	**Vertical Angle**	**Adjacent Angle**
Congruent	**Rotation**	**Reflection**	**Translation**	**Area**
Transversal	**Pythagorean Theorem**	**Volume**	**Surface Area**	**Base**
Edge	**Vertex/Vertices**			

Measurement and Data

Length	**Inch**	**Foot**	**Centimeter**	**Meter**
Minute	**Hour**	**Picture Graph**	**Bar Graph**	**Half/halves**
Quarter	**Plane Figure**	**Square Unit**	**Tiling**	**Perimeter**
Distance	**Degree**	**Line Plot**		

Expressions and Equations

Rate	**Ratio**	**Expression**	**Sum**	**Term**
Product	**Factor**	**Quotient**	**Co-efficient**	**Variable**
Parentheses	**Square Root**	**Cube Root**	**Slope**	**Order of Operations**
Proportional	**Non-Proportional**			

Statistics and Probability

Data	**Dot Plot**	**Histogram**	**Box Plot**	**Median**
Mean	**Range**	**Probability**	**Scatter Plot**	**Outliers**
Frequency	**Intercept**	**Correlation**	**Causation**	

Functions

Function	Input	Ordered Pair	Domain	Range
Output				

Content Strand	Level	Content Thread	Content Standard
Number and Operations: Base Ten			
Strand 1	Level A Beginning ABE	Understand place Value. Thread 1	a. Understand that the two digits of a two-digit number represent amounts of tens and ones. (1.1.a) b. Understand the following as special cases: 1. 10 can be thought of as a bundle of ten ones- called a "ten" (1.1.b.1) 2. The numbers 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones. (1.1.b.2) 3. The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones). (1.1.b.3) c. Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of the comparisons with the symbols >, =, and <. (1.1.c)
		Use place value understanding	a. Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit

		and the properties of operations to add and subtract. **Thread 2**	**number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten. (1.2.a)** **b. Given a two-digit number, mentally find 10 more or 10 less than the number without having to count; explain the reasoning used. (1.2.b)** **c. Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 (limited to positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. (1.2.c)**
	Level B ABE I	**Understand place value.** **Thread 3**	**a. Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. (1.3.a)** **b. Understand the following as special cases:** **1. 100 can be thought of as a bundle of ten tens — called a "hundred." (1.3.b.1)** **2. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones). (1.3.b.2)** **c. Count within 1000; skip-count by 5s, 10s, and 100s. (1.3.c)** **d. Read and write numbers to 1000 using base-ten numerals, number names, and expanded form. (1.3.d)** **e. Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons. (1.3.e)**
		Use place value understanding and properties of operations to add and subtract. **Thread 4**	**a. Add up to four two-digit numbers using strategies based on place value and properties of operations. (1.4.a)** **b. Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds. (1.4.b)** **c. Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900. (1.4.c)** **d. Explain why addition and subtraction strategies work, using place value and the properties of operations.**

			(1.4.d)
		Use place value understanding and properties of operations to perform multi-digit arithmetic. Thread 5	a. Use place value understanding to round whole numbers to the nearest 10 or 100. (1.5.a) b. Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction. (1.5.b) c. Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9 times 80, 5 Times 60) using strategies based on place value and properties of operations. (1.5.c)
	Level C ABE II	N/A	N/A
	Level D ABE III	N/A	N/A
	Level E ASE I and II	N/A	N/A
Number and Operations: Fractions			
Strand 2	Level A Beginning ABE	N/A	N/A
	Level B ABE I	Develop understanding of fractions as numbers. Thread 1	a. Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size 1/b. (2.1.a) b. Understand a fraction as a number on the number line; represent fractions on a number line diagram. (2.1.b) 1. Represent a fraction 1/b on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into b equal parts. Recognize that each part has size 1/b and that the endpoint of the part based at 0 locates the number 1/b on the number line. (2.1.b.1) 2. Represent a fraction a/b on a number line diagram by marking off a lengths 1/b from 0. Recognize that the resulting interval has size a/b and that its endpoint locates the number a/b on the number line.

			(2.1.b.2) c. Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size. (2.1.c) 1. Understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line. (2.1.c.1) 2. Recognize and generate simple equivalent fractions, e.g., 1 half equals 2 fourths, 4 sixths equals 2 thirds. Explain why the fractions are equivalent, e.g., by using a visual fraction model. (2.1.c.2) 3. Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. (2.1.c.3) 4. Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model. (2.1.c.4)
	Level C ABE II	Extend understanding of fraction equivalence and ordering. Thread 2	a. Explain why a fraction a/b is equivalent to a fraction (n x a)/(n x b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions. (2.2.a) b. Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1 half. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model. (2.2.b)
		Build fractions from unit fractions by applying and extending previous understanding of operations on whole numbers.	a. Understand a fraction a/b with a > 1 as a sum of fractions 1/b. (2.3.a) 1. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole. (2.3.a.1) 2. Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. (2.3.a.2) 3. Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction. (2.3.a.3)

		Thread 3	4. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem. (2.3.a.4) b. Apply and extend previous understandings of multiplication to multiply a fraction by a whole number. (2.3.b) 1. Understand a fraction a/b as a multiple of 1/b. (2.3.b.1) 2. Understand a multiple of a/b as a multiple of 1/b, and use this understanding to multiply a fraction by a whole number. (2.3.b.2) 3. Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem. (2.3.b.3)
		Understand decimal notation for fractions, and compare decimal fractions. Thread 4	a. Use decimal notation for fractions with denominators 10 or 100. For example, rewrite 0.62 as 62 one hundredths ; describe a length as 0.62 meters; locate 0.62 on a number line diagram. (2.4.a) b. Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual model. (2.4.b)
		Use equivalent fractions as strategy to add and subtract fractions. Thread 5	a. Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. (2.5.a) b. Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. (2.5.b)
		Apply and extend previous understanding of multiplication and division to multiply and divide fractions.	a. Interpret a fraction as division of the numerator by the denominator Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem. (2.6.a) b. Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. (2.6.b) c. Interpret multiplication as scaling (resizing), by:

		Thread 6	1. Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication. (2.6.c.1) 2. Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence a/b = (nxa)/(nxb) to the effect of multiplying a/b by 1. (2.6.c.2) d. Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem. (2.6.d) e. Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (2.6.e) 1. Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. (2.6.e.1) 2. Interpret division of a whole number by a unit fraction, and compute such quotients. (2.6.e.2) 3. Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. (2.6.e.3)
	Level D ABE III	N/A	N/A
	Level E ASE I and II	N/A	N/A
Number and Operations: Base Ten (+ The Number System)			
Strand 3	Level A Beginning ABE	N/A	N/A
	Level B ABE I	N/A	N/A
	Level C ABE II	Generalize place value	a. Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. For example, recognize that 700 ÷ 70 = 10 by applying concepts of place value and

		understanding for multi-digit whole numbers. Thread 1	division. (3.1.a) b. Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < Symbols to record the results of comparisons. (3.1.b) c. Use place value understanding to round multi-digit whole numbers to any place. (3.1.c)
		Use place value understanding and properties of operations to perform multi-digit arithmetic. Thread 2	a. Fluently add and subtract multi-digit whole numbers using the standard algorithm. (3.2.a) b. Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. (3.2.b) c. Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. (3.2.c)
		Understand the place value system. Thread 3	a. Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1 tenth of what it represents in the place to its left. (3.3.a) b. Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. (3.3.b) c. Read, write, and compare decimals to thousandths. (3.3.c) 1. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form. (3.3.c.1) 2. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons. (3.3.c.2) d. Use place value understanding to round decimals to any place. (3.3.d)
		Perform operations with multi-digit whole numbers and with decimals to hundredths.	a. Fluently multiply multi-digit whole numbers using the standard algorithm. (3.4.a) b. Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. (3.4.b)

		Thread 4	c. Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. [NOTE: Applications involving financial literacy should be used.] (3.4.c)
	Level D ABE III	N/A	N/A
	Level E ASE I and II	N/A	N/A
The Number System			
Strand 4	Level A Beginning ABE	N/A	N/A
	Level B ABE I	N/A	N/A
	Level C ABE II	Compute fluently with multi-digit numbers and find common factors and multiples. Thread 1	a. Fluently divide multi-digit numbers using the standard algorithm. (4.1.a) b. Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. (4.1.b) c. Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express 36 plus 8 as 4 times the quantity 9 plus 2. (4.1.c) .
		Apply and extend previous understandings of multiplication and division to	a. Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. (4.2.a)

	divide fractions by fractions. **Thread 2**	
Level D ABE III	**Apply and extend previous understandings of numbers to the system of rational numbers.** **Thread 3**	**a. Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (4.3.a)** **b. Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. (4.3.b)** **1. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., The opposite of negative 3 equals 3, and that 0 is its own opposite. (4.3.b.1)** **2. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. (4.3.b.2)** **3. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane. (4.3.b.3)** **c. Understand ordering and absolute value of rational numbers. (4.3.c)** **1. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. (4.3.c.1)** **2. Write, interpret, and explain statements of order for rational numbers in real-world contexts. (4.3.c.2)** **3. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. (4.3.c.3)** **4. Distinguish comparisons of absolute value from statements about order. (4.3.c.4)** **5. Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate. (4.3.c.5)**

		Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. **Thread 4**	**a. 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. (4.4.a)** **1. Describe situations in which opposite quantities combine to make 0. (4.4.a.1)** **2. Understand p + q as the number located a distance |q| from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real world contexts. (4.4.a.2)** **3. Apply properties of operations as strategies to add and subtract rational numbers. (4.4.a.3)** **b. Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. (4.4.b)** **1. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (-1)(-1)=1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real world contexts. (4.4.b.1)** **2. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then -(p/q) = (-p)/q = p/(-q). (4.4.b.2)** **3. Apply properties of operations as strategies to multiply and divide rational numbers. (4.4.b.3)** **4. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats. (4.4.b.4)** **c. Solve real-world and mathematical problems involving the four operations with rational numbers. (4.4.c)** **d. Understand subtraction of rational numbers as adding the additive inverse, p-q = p+ (-q). Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply the principle in real world contexts. (4.4.d)**
		Know that there are numbers that are not rational, and approximate them by rational numbers. **Thread 5**	**a. 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., pi squared pi squared). (4.5.a)**

		Understand ratio concepts and use ratio reasoning to solve problems. Thread 6	a. Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. (4.6.a) 1. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. (4.6.a.1) 2. Solve unit rate problems including those involving unit pricing and constant speed. (4.6.a.2) 3. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30 one hundredths times the quantity); solve problems involving finding the whole, given a part and the percent. (4.6.a.3) 4. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities. (4.6.a.4)
		Analyze proportional relationships and use them to solve real-world and mathematical problems. Thread 7	a. Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. (4.7.a) b. Recognize and represent proportional relationships between quantities. (4.7.b) 1. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. (4.7.b.1) 2. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. (4.7.b.2) 3. Represent proportional relationships by equations. (4.7.b.3) 4. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate. (4.7.b.4) c. Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error. (4.7.c)
	Level E ASE I and II	N/A	N/A
Number and Quantity: The Real Number; Systems and Quantities			

Strand 5	**Level A Beginning ABE**	**N/A**	**N/A**
	Level B ABE I	**N/A**	**N/A**
	Level C ABE II	**N/A**	**N/A**
	Level D ABE III	**N/A**	**N/A**
	Level E ASE I and II	**Extend the properties of exponents to rational exponents.** **Thread 1**	**a. Rewrite expressions involving radicals and rational exponents using the properties of exponents. (5.1.a)**
		Reason quantitatively and use units to solve problems. **Thread 2**	**a. 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. (5.2.a)** **b. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (5.2.b)**
Algebra			
Strand 6	**Level A Beginning ABE**	**Represent and solve problems involving addition and subtraction.** **Thread 1**	**a. Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem. (6.1.a)**

		Understand and apply properties of operations and the relationship between addition and subtraction. **Thread 2**	**a. Apply properties of operations as strategies to add and subtract. Examples: If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known. (Commutative property of addition.) To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12. (Associative property of addition.) (6.2.a)** **b. Understand subtraction as an unknown-addend problem. For example, subtract 10 minus 8 by finding the number that makes 10 when added to 8. (6.2.b)**
		Add and subtract with 20. **Thread 3**	**a. Relate counting to addition and subtraction (e.g., by counting on 2 to add 2). (6.3.a)** **b. Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g., 8 + 6 = 8 + 2 + 4 = 10 + 4 = 14); decomposing a number leading to a ten (e.g., 13 minus 4 equals 13 minus 3 minus 1 equals 10 minus 1 equals 9); using the relationship between addition and subtraction (e.g., knowing that 8 + 4 = 12, one knows 12 minus 8 equals 4); and creating equivalent but easier or known sums (e.g., adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13). (6.3.b)**
		Work with addition and subtraction. **Thread 4**	**a. Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. (6.4.a)** **b. Determine the unknown whole number in an addition or subtraction equation relating three whole numbers. (6.4.b)**
	Level B ABE I	**Represent and solve problems involving addition and subtraction.** **Thread 5**	**a. Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem. (6.5.a)**
		Add and subtract with 20. **Thread 6**	**a. Fluently add and subtract within 20 using mental strategies. Know from memory all sums of two one-digit numbers. (6.6.a)**

		Represent and solve problems involving multiplication and division. Thread 7	a. Interpret products of whole numbers, e.g., interpret 5 times 7 as the total number of objects in 5 groups of 7 objects each. (6.7.a) b. Interpret whole-number quotients of whole numbers, e.g., interpret 56 ÷ 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. (6.7.b) c. Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem. (6.7.c) d. Determine the unknown whole number in a multiplication or division equation relating three whole numbers. (6.7.d)
		Understand properties of multiplication and the relationship between multiplication and division. Thread 8	a. Apply properties of operations as strategies to multiply and divide. (Associative property of multiplication.) (Distributive property.) (6.8.a) b. Understand division as an unknown-factor problem. For example, find 32 ÷ 8 by finding the number that makes 32 when multiplied by 8. (6.8.b)
		Multiply and divide within 100. Thread 9	a. Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that 8 times 5 = 40, one knows 40 ÷ 5 = 8) or properties of operations. Know from memory all products of two one-digit numbers. (6.9.a)
		Solve problems involving the four operations, and identify and explain patterns in arithmetic. Thread 10	a. Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. (6.10.a) b. Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations. (6.10.b)

	Level C ABE II	Use the four operations with whole numbers to solve problems. Thread 11	a. Interpret a multiplication equation as a comparison. Represent verbal statements of multiplicative comparisons as multiplication equations. (6.11.a) b. Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison. (6.11.b) c. Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. (6.11.c)
		Gain familiarity with factors and multiples. Thread 12	a. Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite. (6.12.a)
		Generate and analyze patterns. Thread 13	a. Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. For example, given the rule "Add 3" and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way. (6.13.a)
		Write and interpret numerical expressions. Thread 14	a. Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols. (6.14.a) b. Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. (6.14.b)
	Level D ABE III	N/A	N/A
	Level E ASE I and II	Interpret the structure of expressions. Thread 15	a. Interpret expressions that represent a quantity in terms of its context. (6.15.a) 1. Interpret parts of an expression, such as terms, factors, and coefficients. (6.15.a.1) b. Use the structure of an expression to identify ways to rewrite it. (6.15.b)

		Write expressions in equivalent forms to solve problems. Thread 16	a. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. (6.16.a) 1. Factor a quadratic expression to reveal the zeros of the function it defines. (6.16.a.1)
		Perform arithmetic operations on polynomials. Thread 17	a. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. (6.17.a)
		Create equations that describe numbers or relationships. Thread 18	a. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. (6.18.a) b. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (6.18.b) c. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non- viable options in a modeling context. (6.18.c) d. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (6.18.d)
		Understand solving equations as a process of reasoning and explain the reasoning. Thread 19	a. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. (6.19.a) b. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. (6.19.b)
		Solve equations and inequalities in one variable.	a. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. (6.20.a) b. Solve quadratic equations in one variable. (6.20.b)

		Thread 20	
		Solve systems of equations. Thread 21	a. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. (6.21.a)
		Represent and solve equations and inequalities graphically. Thread 22	a. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). (6.22.a)
Geometry			
Strand 7	Level A Beginning ABE	Analyze, compare, create, compose shapes. Thread 1	a. Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/ "corners") and other attributes (e.g., having sides of equal length). (7.1.a)
		Reason with shapes and their attributes. Thread 2	a. Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape. (7.2.a)
	Level B ABE I	Reason with shapes and their attributes. Thread 3	a. Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes. (7.3.a) b. Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape. (7.3.b) c. Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share

			attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories. (7.3.c) d. Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. (7.3.d)
	Level C ABE II	Draw and identify lines and angles, and classify shapes by properties of their lines and angles. Thread 4	a. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. (7.4.a)
		Graph points on the coordinate plane to solve real-world and mathematical problems. Thread 5	a. Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate). (7.5.a) b. Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. (7.5.b)
		Classify two-dimensional figures into categories based on their properties. Thread 6	a. Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. (7.6.a)

		Solve real-world and mathematical problems involving area, surface area, and volume. Thread 7	a. Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems. (7.7.a) b. Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems. (7.7.b) c. Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems. (7.7.c)
	Level D ABE III	Draw, construct, and describe geometrical figures and describe the relationships between them. Thread 8	a. Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. (7.8.a)
		Solve real-life and mathematical problems involving angle, measure, area, surface area, and volume. Thread 9	a. Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. (7.9.a) b. Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure. (7.9.b) c. Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. (7.9.c)
		Understand congruence and similarity using physical models, transparencies,	a. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. (7.10.a) b. Understand that a two-dimensional figure is similar to another if the second can be obtained from the

		or geometry software. Thread 10	first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them. (7.10.b) c. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. (7.10.c)
		Understand and apply the Pythagorean Theorem. Thread 11	a. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. (7.11.a) b. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system. (7.11.b)
	Level E ASE I and II	Experiment with transformations in the plane. Thread 12	a. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. (7.12.a)
		Prove theorems involving similarity. Thread 13	a. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. (7.13.a)
		Explain volume formulas and use them to solve problems. Thread 14	a. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. (7.14.a)
		Apply geometric concepts in modeling situations.	a. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). (7.15.a)

		Thread 15	
Measurement and Data			
Strand 8	Level A Beginning ABE	**Measure lengths indirectly and by iterating length units.** **Thread 1**	**a. Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps. (8.1.a)**
		Represent and interpret data. **Thread 2**	**a. Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another. (8.2.a)**
	Level B ABE I	**Measure and estimate lengths in standard units.** **Thread 3**	**a. Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen. (8.3.a)** **b. Estimate lengths using units of inches, feet, centimeters, and meters. (8.3.b)** **c. Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit. (8.3.c)**
		Relate addition and subtraction to length. **Thread 4**	**a. Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram. (8.4.a)**
		Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.	**a. Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram. (8.5.a)** **b. Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).18 Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a**

	Thread 5	**measurement scale) to represent the problem. (8.5.b)**
	Represent and interpret data. **Thread 6**	**a. Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a graph. (8.6.a)** **b. Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. (8.6.b)** **c. Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. (8.6.c)**
	Geometric measurement: understand concepts of area and relate to area of multiplication and addition. **Thread 7**	**a. Recognize area as an attribute of plane figures and understand concepts of area measurement. (8.7.a)** **1. A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area. (8.7.a.1)** **2. A plane figure which can be covered without gaps or overlaps by n unit squares is said to have an area of n square units. (8.7.a.2)** **b. Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).** **c. Relate area to the operations of multiplication and addition. (8.7.c)** **1. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths. (8.7.c.1)** **2. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular area mathematical reasoning. (8.7.c.2)** **3. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths a and b + c is the sum of a times b and a times c. Use area models to represent the distributive property in mathematical reasoning. (8.7.c.3)** **4. Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems. (8.7.c.4)**

		Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures. Thread 8	a. Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters. (8.8.a)
	Level C ABE II	Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit. Thread 9	a. Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale. (8.9.a) b. Apply the area and perimeter formulas for rectangles in real world and mathematical problems. For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor. (8.9.b)
		Geometric measurement: understand concepts of angle and measure angles. Thread 10	a. Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement: (8.10.a) 1. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1 three sixtieth of a circle is called a "one-degree angle," and can be used to measure angles. (8.10.a.1) 2. An angle that turns through n one-degree angles is said to have an angle measure of n degrees. (8.10.a.2 b. Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure. (8.10.b) c. Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g., by using

			an equation with a symbol for the unknown angle measure. (8.10.c)
		Convert like measurement units within a given measurement system. Thread 11	a. Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems. (8.11.a)
		Represent and interpret data. Thread 12	a. Make a line plot to display a data set of measurements in fractions of a unit (1 half, 1 fourth, 1 eighth). Use operations on fractions for this grade to solve problems involving information presented in line plots. (8.12.a)
		Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition. Thread 13	a. Recognize volume as an attribute of solid figures and understand concepts of volume measurement. (8.13.a) 1. A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume. (8.13.a.1) 2. A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units. (8.13.a.2) b. Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units. (8.13.b) c. Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume. (8.13.c) 1. Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication. (8.13.c.1) 2. Apply the formulas V = l times w times h and V = b times h for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems. (8.13.c.2) 3. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right

			rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems. (8.13.c.3)
	Level D ABE III	N/A	N/A
	Level E ASE I and II	N/A	N/A
Ratios and Proportional Relationships			
Strand 9	Level A Beginning ABE	N/A	N/A
	Level B ABE I	N/A	N/A
	Level C ABE II	Understand ratio concepts and use ratio reasoning to solve problems. Thread 1	a. Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, “The ratio of wings to beaks in the bird house at the zoo was 2 to 1 , because for every 2 wings there was 1 beak.” “For every vote candidate A received, candidate C received nearly three votes.” (9.1.a) b. Understand the concept of a unit rate a/b associated with a ratio a:b with n not equal 0, and use rate language in the context of a ratio relationship. (9.1.b)
	Level D ABE III	N/A	N/A
	Level E ASE I and II	N/A	N/A
Statistics and Probability			

Strand 10	**Level A Beginning ABE**	**N/A**	**N/A**
	Level B ABE I	**N/A**	**N/A**
	Level C ABE II	**Apply and extend previous understandings of arithmetic to algebraic expressions.** **Thread 1**	**a. Write and evaluate numerical expressions involving whole-number exponents. (10.1.a)** **b. Write, read, and evaluate expressions in which letters stand for numbers. (10.1.b)** **1. Write expressions that record operations with numbers and with letters standing for numbers. (10.1.b.1)** **2. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. (10.1.b.2)** **3. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). (10.1.b.3)** **c. Apply the properties of operations to generate equivalent expressions. (10.1.c)** **d. Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). (10.1.d)**
		Reason about and solve one-variable equations and inequalities. **Thread 2**	**a. Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true. (10.2.a)** **b. Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (10.2.b)** **c. Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers. (10.2.c)** **d. Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams. (10.2.d)**

		Represent and analyze quantitative relationships between dependent and independent variables. Thread 3	a. Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. (10.3.a)
	Level D ABE III	Use properties of operations to generate equivalent expressions. Thread 4	a. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. (10.4.a) b. Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. (10.4.b)
		Solve real-life and mathematical problems using numerical and algebraic expressions and equations. Thread 5	a. Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (10.5.a) b. Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (10.5.b) 1. Solve word problems leading to equations of the form $px + q = r$ and $p(x+q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. (10.5.b.1) 2. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. (10.5.b.2)
		Work with radicals and integer	a. Know and apply the properties of integer exponents to generate equivalent numerical expressions. (10.6.a) b. 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

		exponents. Thread 6	and cube roots of small perfect cubes. Know that the square root of 2 is irrational. (10.6.b) c. 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. (10.6.c) d. 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. (10.6.d)
		Understand the connections between proportional relationships, lines, and linear equations. Graph proportional relationships Thread 7	a. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. (10.7.a)
		Analyze and solve linear equations and pairs of simultaneous linear equations. Thread 8	a. Solve linear equations in one variable. (10.8.a) 1. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers). (10.8.a.1) 2. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. (10.8.a.2) b. Analyze and solve pairs of simultaneous linear equations. (10.8.b) 1. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. (10.8.b.1) 2. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6. (10.8.b.2)

			3. Solve real-world and mathematical problems leading to two linear equations in two variables. (10.8.b.3)
	Level E ASE I and II	N/A	N/A
Statistics and Probability			
Strand 11	Level A Beginning ABE	N/A	N/A
	Level B ABE I	N/A	N/A
	Level C ABE II	Develop understanding of statistical variability. Thread 1	a. Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. (11.1.a) b. Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. (11.1.b) c. Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number. (11.1.c)
		Summarize and describe distributions. Thread 2	a. Display numerical data in plots on a number line, including dot plots, histograms, and box plots. (11.2.a)
	Level D ABE III	Summarize and describe distributions. Thread 3	Summarize numerical data sets in relation to their context, such as by: a. Reporting the number of observations. (11.3.a) b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. (11.3.b) c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. (11.3.c)

			d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered. (11.3.d)
		Use random sampling to draw inferences about a population. **Thread 4**	**a. Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences. (11.4.a)** **b. Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. (11.4.b)**
		Draw informal comparative inferences about two populations. **Thread 5**	**a. Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. (11.5.a)** **b. Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. (11.5.b)**
		Investigate chance processes and develop, use, and evaluate probability models. **Thread 6**	
		Investigate patterns of association in bivariate data. **Thread 7**	**a. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. (11.7.a)** **b. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. (11.7.b)**

			c. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. (11.7.c) d. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. (11.7.d)
	Level E ASE I and II	Summarize, represent, and interpret data on a single count or measurable variable. Thread 8	a. Represent data with plots on the real number line (dot plots, histograms, and box plots). (11.8.a) b. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). (11.8.b)
		Summarize, represent, and interpret data on two categorical and quantitative variables. Thread 9	a. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. (11.9.a)
		Interpret linear models. Thread 10	a. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. (11.10.a) b. Distinguish between correlation and causation. (11.10.b)
Functions/ Linear, Quadratic, and Exponential Models			
Strand 12	Level A Beginning ABE	N/A	N/A

	Level B ABE I	**N/A**	**N/A**
	Level C ABE II	**N/A**	**N/A**
	Level D ABE III	**Define, evaluate, and compare functions.** **Thread 1**	**a. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (12.1.a)** **b. Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. (12.1.b)**
		Use functions to model relationships between quantities. **Thread 2**	**a. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. (12.2.a)** **b. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally. (12.2.b)**
	Level E ASE I and II	**Understand the concept of a function and use function notation.** **Thread 3**	**a. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x). (12.3.a)** **b. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. (12.3.b)**
		Interpret functions that arise in applications in terms of the context. **Thread 4**	**a. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. (12.4.a)** **b. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. (12.4.b)** **c. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. (12.4.c)**

		Analyze functions using different representations. Thread 5	a. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. (12.5.a) b. Use properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in an exponential function and then classify it as representing exponential growth or decay. (12.5.b) c. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). (12.5.c)
		Build a function that models a relationship between two quantities. Thread 6	a. Write a function that describes a relationship between two quantities. (12.6.a)
		Construct and compare linear, quadratic, and exponential models and solve problems. Thread 7	a. Distinguish between situations that can be modeled with linear functions and with exponential functions. (12.7.a) 1. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. (12.7.a.1) 2. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. (12.7.a.2)
		Interpret expressions for functions in terms of the situation they model. Thread 8	a. Interpret the parameters in a linear or exponential function in terms of a context. (12.8.a)