KYAE Standards for Mathematics Level 3 (4.0 – 5.9)

Low Intermediate Adult Basic Education

KYAE Low Intermediate ABE (NRS Level 3) Standards for Mathematics build upon the foundational concepts and skills presented in Levels 1 and 2. For the benefit of the instructor, concepts which directly relate to the *eventual* attainment of a Kentucky Employment Certificate (KEC) or the General Educational Development (GED®) credential and preparation for postsecondary education are indicated by symbols which represent these goals: *KEC (KY Employability Certificate),* *GED Test Preparation* and *College Readiness. Where a symbol precedes a standard, the symbol applies to all the benchmarks for that standard.*

Guiding Principle: Use Math to Solve Problems and Communicate

Content Strand 1 of 10
Recognize and Compare Numbers

The focus of instruction in the Level 3 **Recognize and Compare Numbers** strand is on developing number sense with an emphasis on fractions and decimals.

Standard 3.1.1 The adult student will read aloud, write and compare a given set of whole numbers through 7-digits.

	Benchmark	Applications	Instructor Notes
a.	Identify the place value for each digit and explain that the position of a digit signifies its value	Budgeting	The structure of the base-10 number system is based upon a simple pattern of tens in which each place is ten times the value of the place to its right. This is known as a ten-to-ten place-value relationship.
b.	Write statements of **inequality** for numbers up to 10,000,000 using the symbols for less than (<) and greater than (>)	Using the Dewey Decimal System to find a library book on the shelf	

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Standard 3.1.2 The adult student will read aloud, write and compare a given set of common fractions and/or mixed numbers using like and unlike denominators (e.g., halves, thirds, fourths, fifths, eighths, tenths).

	Benchmark	Applications	Instructor Notes
a.	Demonstrate an understanding that the **denominator** indicates the number of equal parts in the whole and that the **numerator** identifies how many of these equal parts are being described	Filling a ¼ cup measure 3 times to add flour when a recipe calls for ¾ of a cup of flour	Comparing unit fractions (a fraction in which the numerator is on) builds a mental image of fractions and the understanding that as the number of pieced of a whole increases, the size of one single piece decreases (e.g., $^{1}/_{5}$ of a bar is smaller than ¼ of a bar). Simplifying fractions to their simplest form assists with uniformity of answers and concepts. Rewriting an improper fraction as a mixed numeral assists with uniformity of answers and concepts. There is implies addition of the whole number part and the fractional part in mixed numerals.
b.	Identify, give examples and define **proper** and **improper fractions** and **mixed numbers**		Equivalent fractions name the same amount. To find the equivalent fractions, multiply or divide the numerator and denominator by the same non-zero number.
c.	Change **fractions** to **equivalent fractions** for the purpose of comparison, explaining that equivalent fractions *look* different but have the same value	Comparing interest rates Recognizing relationships in the context of measures (e.g., $^{2}/_{8}$ inch = ¼ inch	To compare fractions and mixed numbers, it often helps to find the least common denominator. The least common denominator (LCD) of two or more fractions is the least common multiple (LCM) of the denominators.
d.	Demonstrate an understanding that when the top and bottom number of a **fraction** are the same, the fraction is equivalent to 1	Dividing a whole pizza into the number needed to serve	

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Standard 3.1.3 The adult student will read aloud, write, order and compare a given set of decimals up to four places.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Demonstrate an understanding of place value for decimals up to four places	Reading extremely precise metric measurements	A decimal point separates the whole number places from the places less than one. Place values extend infinitely in two directions from a decimal point. A number containing a decimal point is called a decimal number or simply a decimal.
b.	Write statements of inequality for **decimals** up to four places using the symbols for less than (<) and greater than (>)	Comparing car prices	A procedure for comparing two decimals by examining place value may include the following: • Line up the decimal numbers at their decimal points. • Beginning at the left, find the first place value where the digits are different. • Compare the digits in this place value to determine which number is greater (or which is less). • Use the appropriate symbol > or < or the words greater than or less than to compare the numbers in the order in which they are presented. • If both numbers are the same, use the symbol = or words equal to. Two numbers can be compared by examining place value and/or using a number line.

Standard 3.1.4 The adult student will recognize and write fraction, decimal and percent equivalents.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Write **decimal** and **percent** equivalents for the **fractions** one-half, one-tenth, one-quarter and three-quarters	Understanding sale reductions	A fraction can be rewritten as an equivalent fraction with a denominator of 100, and, thus, as a decimal or percent (e.g. $^{3}/_{5} = {}^{60}/_{100} = 0.60 = 60\%$). Decimals and fractions represent the same relationships; however, they are presented in two different formats. Decimal numbers are another way or writing fractions.

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Standard 3.1.5 The adult student will read aloud, write and identify positive and negative numbers in practical contexts.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Explain the meaning of the words **positive** and **negative** as they relate to numbers	Reading a thermometer with temperatures ranging above and below zero	

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Content Strand 2 of 10
Rounding and Estimation

The focus of instruction in the Level 3 **Rounding and Estimation** strand is on understanding place value for whole numbers and decimals as well as using estimation as a tool in problem solving.

Standard 3.2.1 The adult student will apply the concept of rounding to a specified place value.

	Benchmark	Applications	Instructor Notes
a.	Round whole numbers through 7 digits to the nearest thousand, ten thousand and hundred thousand	Placing orders at a warehouse	A strategy for rounding decimal numbers to the nearest tenth and hundredth is as follows: • Look one place to the right of the digit to which you wish to round. • If the digit is less than 5, leave the digit in the rounding place as it is, and change the digits to the right of the rounding place to zero. • If the digit is 5 or greater, add 1 to the digit in the rounding place and change the digits to the right of the rounding place to zero.
b.	Round **decimals** to the nearest whole number, tenths, hundredths or thousandths place	Determining amount of money needed to buy lunch for a group	

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Standard 3.2.2 The adult student will use rounding techniques to estimate the solution to real-world problems and determine the reasonableness of results.

	Benchmark	Applications	Instructor Notes
a.	Demonstrate an understanding of when the context requires rounding off to a whole number	Finding how many buses are needed to transport three classes of children for a field trip	
b.	Compose and decompose numbers to aid addition and subtraction (e.g., 1,240 + 2,040 = 1,000 + 2,000 + 200 + 40 + 40) and estimate answers to problems	Using mental math	Examples of problems to be solved by using estimation strategies are encountered in shopping for groceries, buying school supplies, budgeting allowance, and sharing the cost of a pizza or the prize money from a contest.
c.	Compose and decompose numbers, applying the **distributive property** to mentally compute products in multiplication problems (e.g., 5 x 43 can be written as (5 x 40) + (5 x 3) which is 200 + 15 or 215)		

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Content Strand 3 of 10
Number Theory and Mathematical Symbols

The focus of instruction in the Level 3 **Number Theory and Mathematical Symbols** strand is on developing an understanding of the concepts of prime and composite numbers, multiples and factors of numbers, and various symbols used to indicate multiplication.

Standard 3.3.1 The adult student will summarize and apply basic number theory concepts.

	Benchmark	Applications	Instructor Notes
a.	Explain the concept of **prime numbers** and recall orally the first 5 in order (e.g., primes include 2, 3, 5, 7, 11, 13, 17, 19, 23, etc.)	Determining the factors of any number	Number theory is a part of mathematics in which characteristics of numbers and relationships between numbers are examined. A prime number is a natural number that has exactly two different factors, one and the number itself.
b.	Explain the concept of **composite numbers** (e.g., composites include 4, 6, 8, 9, 10, 12, 14, 15, 16, etc.)	Canceling when multiplying fractions	A composite number is a natural number that has more than two different factors.
c.	Explain and demonstrate the concept of **factors**, including **GCF** (**greatest common factor**)	Reducing fractions	A factor of a number is an integer that divides evenly into that number. A factor of a number is a divisor of the number. A common factor of two or more numbers is a divisor that all of the numbers share. The greatest common factor of two or more numbers is the largest of the common factors that all of the numbers share.
d.	Explain and demonstrate the concept of **multiples**, including **LCM** (**least common multiple** or **least common denominator**)	Finding common denominators	A multiple of a number is the product of the number and any natural number. The least common multiple of two or more numbers is the smallest common multiple of the given numbers. The number 1 is neither prime nor composite because it has only one factor, itself. Zero is not a natural number. Although it has an infinite number of factors, it is neither prime nor composite.

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e.	Use **inverse operations** to check solutions (e.g. , if 342 ÷ 6 = 57, then 57 X 6 = 342)		Inverses are numbers that combine with other numbers and result in identity elements. Subtraction is the inverse of addition; therefore, addition and subtraction are inverse operations. The multiplicative inverse property states that the product of a number and its multiplicative inverse (or reciprocal) always equals one (e.g., $^{1}/_{5} \bullet 5 = 1$. Division is the inverse of multiplication; therefore, multiplication and division are inverse operations. Zero has no multiplicative inverse. Division by zero is not a possible arithmetic operation.

Standard 3.3.2 The adult student will identify and use mathematical symbols and words that represent the symbols.

	Benchmark	Applications	Instructor Notes
a.	Demonstrate an understanding that the **percent** symbol **%** represents hundredths	Determining an affordable loan amount	A number followed by a percent symbol (%) is equivalent to that number with a denominator of 100 (e.g., 30% = $\frac{30}{100} = \frac{3}{10} = 0.3$). Percents can be expressed as decimals (e.g.,38% = $\frac{38}{100} = 0.38$).
b.	Write multiplication statements for whole numbers using **algebraic notation** (e.g., 3 x 3 = 3(3) = 3•3 = 3^2)	Preparing for further study	At this level, discuss how the symbol × used to represent multiplication can often be confused with the variable x. Students can minimize this confusion by using parentheses, e.g. 4(x) = 20 or a small dot raised off the line to represent multiplication, e.g. 4•x = 20.

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c.	Use **exponents** (**powers**) to represent repeated multiplication: $4 \cdot 4 \cdot 4 = 4^3$	Calculating interest on a car loan for a set length of time	Repeated multiplication can be represented with exponents. A power of a number represents repeated multiplication of the number by itself, e.g. 83 = 8 × 8 × 8 and is read "8 to the third power". In exponential notation, the base is the number that is multiplied, and the exponent represents the number of times the base is used as a factor. Perfect squares are the numbers that result from multiplying any whole number by itself, e.g. 36 = 6 × 6.

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Content Strand 4 of 10
Mathematical Operations

The focus of instruction in the Level 3 **Mathematical Operations** strand is on developing proficiency in addition and subtraction with fractions and fluency in multiplication and division with whole numbers and decimals for the purpose of problem solving.

Standard 3.4.1 The adult student will calculate using addition and subtraction with whole numbers through 7 digits, using efficient written methods to check answers.

	Benchmark	Applications	Instructor Notes
a.	Align whole numbers of different place values in column addition and subtraction	Balancing a checking account	
b.	Demonstrate strategies or methods for subtraction such as borrowing or counting up	Determining amount of change to give for a purchase	
c.	Demonstrate various methods of checking answers	Adding in a different order, using inverse operations, collecting 10's and using a calculator	Estimation gives a rough idea of an amount. Strategies such as front-end, rounding, and mental computation may be used to estimate addition, subtraction, multiplication, and division of whole numbers. Estimation can be used to check the reasonableness of the results.

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Standard 3.4.2 The adult student will add and subtract with fractions and mixed numbers having like and unlike denominators.

	Benchmark	Applications	Instructor Notes
a.	Demonstrate the ability to find the **greatest common factor** and **least common multiple** of two or more **fractions**	Adding hours on a time sheet that includes fractions	Equivalent forms are needed to perform the operations of addition and subtraction with fractions. To add or subtract with fractions having the same or like denominators, add or subtract the numerators and write in simplest form.
b.	Change **fractions** to **equivalent fractions** for the purpose of addition and subtraction	Increasing or decreasing measurements in a recipe to adjust the number of servings	To add or subtract with fractions that *do not* have the same denominator, first find equivalent fractions with the least common denominator. Then add or subtract and write the answer in simplest form.
c.	Demonstrate the ability to bring a **fraction** to its **simplest form** (e.g., by using factors to "reduce")	Helping children with homework	Simplifying fractions assists with uniformity of answers and concepts. A fraction can be expressed in simplest form (simplest equivalent fraction) by dividing the numerator and denominator by their greatest common factor. A fraction is in simplest form when its numerator and denominator have no common factors other than 1.
d.	Add and subtract **mixed numbers** with and without regrouping, expressing answers in **simplest form**		A mixed number has two parts: a whole number and a fraction. To add or subtract with mixed numbers, students may use a number line, draw a picture, rewrite fractions with like denominators, or rewrite mixed numbers as fractions.

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Standard 3.4.3 The adult student will calculate using addition and subtraction with decimals to 4 places, using efficient written methods to check answers.

	Benchmark	Applications	Instructor Notes
a.	Align **decimals** of different place values in column addition and subtraction	Keeping a current balance in a checkbook	Decimal computation uses similar procedures as those developed for whole-number computation and applies them to decimal place values, giving careful attention to the placement of the decimal point in the solution.
b.	Count and make change using all U.S. coins and currency	How much change should you receive if you pay for a $29.95 money order with a $50 bill	

Standard 3.4.4 The adult student will calculate using multiplication and division with whole numbers up to 3 digits.

	Benchmark	Applications	Instructor Notes
a.	Calculate with multiplication and division using facts through 12 x 12	Calculating the amount of carpet needed for a room	There are a variety of algorithms for division such as repeated multiplication and subtraction. Experience with these algorithms may enhance understanding of the traditional long-division algorithm. Division can be shown in a variety of representations: • dividend ÷ divisor = quotient • quotient / divisor)dividend • $\frac{\text{dividend}}{\text{divisor}}$ = quotient
b.	Divide whole numbers by 2- or 3-digit numbers and interpret remainders, including ways to check answers	Calculating miles per gallon	
c.	Contrast the change in place value when multiplying and dividing whole numbers by 10 and 100	Converting within the metric system	

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Standard 3.4.5 The adult student will multiply and divide with decimals up to 2 places.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Determine the placement of **decimal** points in the multiplication of **decimal** numbers of up to two places	Calculating wages earned	Multiplication of decimals follows the same procedure as multiplication of whole numbers. The only difference is that a decimal point must be correctly placed in the product.
b.	Demonstrate the procedure for dividing numbers by **decimals** up to two places	Determining the number of gallons of gas that can be bought with $20	Understanding the placement of the decimal point is very important when finding quotients of decimals. Examining patterns with successive decimals provides meaning, such as dividing the dividend by 6, by 0.6, and by 0.06.

Standard 3.4.6 The adult student will use strategies to solve word problems.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Identify the information and operation (addition, subtraction, multiplication or division) necessary to solve one-step problems	Preparing for real-life situations requiring mathematical solutions	An example of an approach to solving problems is Polya's four-step plan: *Understand*: Retell the problem; read it twice; take notes; study the charts or diagrams; look up words and symbols that are new.
b.	Explore multiple strategies for arriving at the solution to a word problem		*Plan*: Decide what operation(s) to use and what sequence of steps to use to solve the problem. *Solve*: Follow the plan and work accurately. If the first attempt doesn't work, try another plan. *Look back*: Does the answer make sense?

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Content Strand 5 of 10
Measurements

The focus of instruction in the Level 3 **Measurements** strand is on active exploration of the learner's environment in order to apply concepts from the metric as well as the U.S. customary systems of measurement through the use of appropriate tools.

Standard 3.5.1 The adult student will demonstrate the ability to use common measurement systems.

	Benchmark	Applications	Instructor Notes
a.	Use the appropriate tools to measure length, weight, time and temperature in whole and fractional units of ½ and ¼	Record a child's height on a growth chart	U.S. Customary units for measurement of length include inches, feet, yards, and miles. Appropriate measuring devices include rulers, yardsticks and tape measures. Metric units for measurement of length include millimeters, centimeters, meters and kilometers. Appropriate measuring devices include rulers, meter sticks and tape measures.
b.	Write abbreviations for measurements of length and weight in both the customary and metric systems (including ' for ft. and " for in.)	Sharing recipes	When measuring with the U.S. Customary units, students should be able to measure to the nearest part of an inch (½, ¼, $^{1}/_{8}$), foot , yard or mile.
c.	Use and interpret the 24 hour clock	Serving in the military	Elapsed time is the amount of time that has passed between two given times.
d.	Identify and convert equivalencies for hours, seconds, minutes, days, weeks, months, years, decades, and centuries	Making out a schedule	Elapsed time can be found by counting on from the beginning time to the finishing time. ➢ Count the number of whole hours between the beginning and finishing times. ➢ Count the remaining minutes. ➢ Add the hours and minutes. For example, to find the elapsed time between 10:15 a.m. and 1:25 p.m. count as follows: • from 10:15 a.m. to 1:15 p.m., count 3 hours; • from 1:15 p.m. to 1:25 p.m., count 10 minutes; • then add 3 hours and 10 minutes to find the total elapsed time of 3 hours and 10 minutes.

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Standard 3.5.2 The adult student will make informal comparisons between inches and centimeters.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Create physical (bodily) benchmarks for units (e.g., little fingernail = 1 cm; thumb joint = 1 inch; a person's foot = 12 inches)	Estimating the width of a button or the dimensions of a room	Benchmarks by which to estimate or judge the size of objects allow students to make "ballpark" comparisons rather than memorize conversion factors between U.S. Customary and metric units.
b.	Make visual estimates of the number of **centimeters** per inch	Reading sewing patterns	Practical experience measuring familiar objects helps students establish benchmarks and facilitates students' ability to use the units of measure to make estimates.

Standard 3.5.3 The adult student will apply geometric concepts to calculate measurements.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Measure **perimeter** in **linear** units (in., ft., yd., m., cm.)	Determining amount of fencing needed for a garden	Perimeter is the distance around a figure. To find the perimeter of any polygon, add the lengths of the sides.
b.	Measure **area** in square units (sq., in., sq. ft., sq. cm.)	Determining amount of flooring needed for a room	Area is the number of square units needed to cover a surface or figure. Students should investigate the area of a square, rectangle, and triangle by using manipulatives (e.g., tiles, geoboards, graph paper). Students should label the perimeter or area with the appropriate unit of linear or square measure.

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Content Strand 6 of 10
Geometry

The focus of instruction in the Level 3 **Geometry** strand is on understanding the classification of two- and three-dimensional figures, geometric terminology and the application of simple formulas. Transformations and angles are introduced.

Standard 3.6.1 The adult student will apply geometric concepts to identify and describe two- and three- dimensional figures.

	Benchmark	Applications	Instructor Notes
a.	Identify and classify **plane figures** (**two-dimensional**): **circles** and types of **polygons** (**triangles** and **quadrilaterals**)	Planning landscaping projects	The identification of two- and three-dimensional figures is accomplished by working with and handling objects. Plane figures are two-dimensional figures formed by lines that are curved, straight, or a combination of both.
b.	Identify and classify **solid figures** (**three-dimensional**): **cubes**, **rectangular containers**, **cylinders**, **square pyramids**, **cones** and **spheres**	Welding	Three-dimensional figures are called solid figures or simply solids. Solids enclose a region of space. Solids are classified by the types of surfaces they have. These surfaces may be flat, curved, or both. • A cylinder is a three-dimensional object formed by two congruent parallel circles joined by a curved surface (usually a solid or hollow object shaped like a can). • A cone is a solid bounded by a circular base and a curved surface with one vertex. • A cube is a solid with six congruent square faces and every edge the same length. A cube has 6 faces and 12 edges. • A square pyramid is a solid whose base is a square and whose other faces are triangles that share a common vertex. • A sphere is a three-dimensional object with all of its points the same distance from the center.
c.	Use informal visual methods to describe and compare **shape**, **dimension**, **perimeter**, **area**, **volume**, **angles** and sides of figures	Packing the trunk of a car or the bed of a pickup	The relationship between plane and solid geometric figures, such as the square and the cube or the rectangle and the rectangular solid, helps build the foundation for future geometric study of faces, edges and vertices.

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d.	Estimate and identify where a **line** of **symmetry** falls in a basic **shape**, describing the concepts of 'sameness' or 'half-ness'	Cutting a pie in half or folding objects	A line of symmetry is a line that divides a figure into congruent halves, each of which is the reflected image of the other.
e.	Identify properties, locations and functions of **right angles** (e.g., a **right angle** is 90 degrees or a quarter turn, that two **right angles** make a straight line, etc.)	Explaining the movement of the hands of a clock to tell time	A right angle is an angle that forms a square corner. A right angle measures exactly 90°.

Standard 3.6.2 The adult student will apply geometric formulas to solve problems involving simple polygons (four or fewer sides).

	Benchmark	Applications	Instructor Notes
a.	Determine if a problem situation involving simple **polygons** represents the application of **perimeter** or **area**		A formula is a statement based on logical mathematical conclusions or observation and experimental evidence. Perimeter is the distance around a figure. To find the perimeter of any polygon, add the lengths of the sides.
b.	Compute the **perimeter** of simple **polygons** and the **area** of any **rectangular shape**	Determining the amount of fencing needed to enclose a yard	Area is the number of square units needed to cover a surface or figure. Students should investigate, using manipulatives, to discover the formulas for the area of a square and a rectangle: Area of a rectangle = Length × Width Area of a square = Side × Side Students should label the perimeter or area with the appropriate unit of linear or square measure.

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Standard 3.6.3 The adult student will use manipulatives to demonstrate transformations of 2-dimensional shapes.

	Benchmark	Applications	Instructor Notes
a.	Change the orientation of a **shape** by rotating, flipping or sliding the shape to another location	Determining how to arrange furniture in a room	In geometric patterns, students must often recognize transformations of a figure, particularly rotation or reflection. Rotation (turn) is the result of turning a figure around a point or a vertex, and reflection (flip) is the result of flipping a figure over a line. Recognizing shapes once transformations (slides, flips, turns) have been applied is a skill that students should begin at an early level.

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Content Strand 7 of 10
Using Ratios, Proportions and Percents

The focus of instruction in the Level 3 **Using Ratios, Proportions and Percents** strand is on developing an understanding of ratio as a comparison and percentage as it relates to part and whole.

Standard 3.7.1 The adult student will identify and write simple ratios.

	Benchmark	Applications	Instructor Notes
a.	Demonstrate an understanding of the importance of order when writing **ratios**	Determining the ratio of males to females in the classroom	A ratio is a comparison of any two quantities and conveys an idea that cannot be expressed as a single number. A ratio is used to represent a variety of relationships within a set and between two sets. A ratio can compare part of a set to the entire set (part-whole comparison). A ratio can compare part of a set to another part of the same set (part-part comparison). A ratio can compare part of a set to a corresponding part of another set (part-part comparison). A ratio can compare all of a set to all of another set (whole-whole comparison).

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Standard 3.7.2 The adult student will explain the part-whole relationship inherent in fractions and percents.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Compute **percentages** using friendly numbers (e.g., 10%, 25%, 50%, and 75%) when part and whole are given	Calculating tips	Percents are used in real life for tips, taxes, sales, data description, and data comparison.

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Content Strand 8 of 10
Data Interpretation and Probability

The focus of instruction in the Level 3 **Data Interpretation** strand is on developing the ability to interpret data from a variety of displays. Measures of central tendency are introduced.

Standard 3.8.1 The adult student will classify graphs by type (line, bar and circle or pie) according to their distinguishing features.

	Benchmark	Applications	Instructor Notes
a.	Demonstrate an understanding that **line graphs** use lines to connect data points	Determining trends in mortgage rates	**a.** Line graphs are used to show how one variable changes over time. By looking at a single-line graph, it can be determined whether the variable is increasing, decreasing, or staying the same over time. The values along the horizontal axis represent continuous data on a given variable, usually some measure of time (e.g., time in years, months, or days). The data presented on a line graph is referred to as "continuous data" because it represents data collected over a continuous period of time. Each axis should be labeled and the graph should have a title. A line graph tells whether something has increased, decreased, or stayed the same with the passage of time. Statements representing an analysis and interpretation of the characteristics of the data in the graph should be included (e.g., trends of increase and/or decrease, and least and greatest). The values along the vertical axis are the scale and represent the frequency with which those values occur in the data set. The values should represent equal increments of multiples of whole numbers, fractions, or decimals depending upon the data being collected. The scale should extend one increment above the greatest recorded piece of data.
b.	Demonstrate an understanding that bar heights on a bar graph show quantity and that comparative statements, such as greater than or less than, twice or half, can be made based on the height of the bars	Understanding economic comparisons	
c.	Demonstrate an understanding that a **circle graph** or **pie chart** represents the whole	Reading census data	

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d.	Demonstrate an understanding that a **table** can display the same datum as a **graph** but arranged in rows and columns	Comparing costs of modes of transportation	**b.** Bar graphs are used to compare counts of different categories (categorical data). A bar graph uses either horizontal or vertical bars to represent counts for several categories. One bar is used for each category, with the length of the bar representing the count for that category. There is space before, between, and after the bars. The axis displaying the scale representing the count for the categories should extend one increment above the greatest recorded piece of data. Each axis should be labeled, and the graph should have a title. Statements representing an analysis and interpretation of the characteristics of the data (e.g., similarities and differences, mode, and least and greatest) in the graph should be included.

Standard 3.8.2 The adult student will collect and represent data.

	Benchmark	Applications	Instructor Notes
a.	Gather **data** by observing and asking relevant questions	Planning a birthday party	Statistical investigations should be active, with students formulating questions about something in their environment and finding quantitative ways to answer the questions. Investigations can be brief class surveys or more extended projects taking many days. Through experiences displaying data in a variety of graphical representations, students learn to select an appropriate representation.
b.	Compile **data** by counting responses and grouping them using a single criterion such as **shape**, size, color or yes/no responses	Keeping track of who will or will not attend a party	
c.	Construct simple **graphs**, lists, schedules, **tables** or diagrams to represent compiled **data** so that it makes sense to others	Developing and writing a schedule for how and when to take medication according to a doctor's order	

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Standard 3.8.3 The student will find simple mean, median, mode and range for a data set.

	Benchmark	Applications	Instructor Notes
a.	Demonstrate that **mean** can be found by adding all values in the **data set** and dividing by the number of values in the set	Determining average miles per gallon	The mean, median, and mode are three of the various ways that data can be analyzed. **a.** The mean is the numerical average of the data set and is found by adding all the values in the set and dividing the sum by the number of values.
b.	Demonstrate that when there is an even number of values in the **data set**, the **median** is found by calculating the mean of the two middle values	Understanding income reports	**b.** The median is the piece of data that lies in the middle of the set of data arranged in order. If there are an odd number of pieces of data, the median is the middle value in ranked order. If there is an even number of pieces of data, the median is the numerical average of the two middle values.
c.	Demonstrate that **mode** is the item that occurs most often in a **data set**	Understanding medical studies	**c.** The mode is the piece of data that occurs most frequently in the data set. If no value occurs more often than any other, there is no mode. If there is more than one value that occurs most often, all these most-frequently-occurring values are modes. When there are exactly two modes, the data set is bimodal. • For 2, 3, 4, 5, 5, 6, 7, 8, 8, 8, 9, 11, the mode is 8. • For 2, 3, 4, 5, 5, 5, 7, 8, 8, 8, 9, 11, the modes are 5 and 8 (bimodal). • or 2, 3, 4, 5, 6, 7, 8, 9, 11, 13, 17, there is no mode.
d.	Explain that **range** can be found by subtracting the lowest number in a set from the greatest number in the set	Understanding a report on test scores	**d.** The range is the spread of a set of data. It is determined by subtracting the smallest number in the data from the largest number in the data. Students need to learn more than how to identify the mean, median, mode and range of a set of data. They need to build an understanding of what the number tells them about the data, and they need to see those values in the context of other characteristics of the data.

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Standard 3.8.4 The adult student will express the concept of probability as a ratio.

	Benchmark	Applications	Instructor Notes
a.	State **probability** as the **ratio** of the potential successful outcomes to total possibilities: $\frac{\text{number of favorable outcomes}}{\text{total number of possible outcomes}}$	Understanding one's chances of winning the lottery	Probability is the chance of an event occurring. The probability of an event occurring is the ratio of desired outcomes to the total number of possible outcomes. If all the outcomes of an event are equally likely to occur, the probability of the event $= \frac{\text{number of favorable outcomes}}{\text{total number of possible outcomes}}$. Students should have opportunities to describe in informal terms (i.e., impossible, unlikely, as likely as unlikely, equally likely, likely, and certain) the degree of likelihood of an event occurring. Activities should include real-life examples.

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Content Strand 9 of 10
Number Line and Grids

The focus of instruction in the Level 3 **Number Line and Grids** strand is on the use of the number line to develop an understanding of positive and negative numbers and use of the compass rose as a precursor to the coordinate grid.

Standard 3.9.1 The adult student will use a number line to demonstrate the relationship of positive and negative numbers to zero.

	Benchmark	Applications	Instructor Notes
a.	Compare the value of **positive numbers** as they relate to **zero**	Charting rainfall amounts	Positive numbers are greater than zero. Negative numbers are less than zero. Zero is neither positive nor negative. A negative integer is always less than a positive integer. When comparing two negative numbers, the negative number that is closer to zero is greater. An integer and its opposite are the same distance from zero on a number line. On a conventional number line, a smaller number is always located to the left of a larger number (e.g., –7 lies to the left of –3; thus –7 < –3).
b.	Compare the value of **negative numbers** as they relate to **zero**	Charting wind chill temperatures	

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Standard 3.9.2 The adult student will use direction, distance, coordinates and keys to read maps and plans.

	Benchmark	Applications	Instructor Notes
a.	Use the compass rose on a map with **primary** (N, S, E, W) and **secondary** (SW, NE, etc.) **directions**	Planning a route to a destination	Familiarity with the primary and secondary directions serves as a precursor to the learner's perception of points within a quadrant on the coordinate grid.
b.	Demonstrate an understanding of **latitude** and **longitude** as horizontal and vertical indexes on a map to find and identify locations	Using coordinates to find a city on a map	Familiarity with map coordinates lays the foundation for identifying point coordinates on a coordinate grid.

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Content Strand 10 of 10
Algebra

The focus of instruction in the Level 3 **Algebra** strand is on developing an understanding of patterns as a problem-solving tools and the use of symbols and variables to represent unknown quantities.

Standard 3.10.1 The adult student will analyze the structure of simple numerical and geometric patterns (how they repeat or grow) to describe and continue the relationship.

	Benchmark	Applications	Instructor Notes
a.	Identify the smallest unit of repetition to complete **patterns** and **numeric sequences** (e.g., 3, 6, 12, _____, 48, ……)	Using mental math strategies	There are an infinite number of patterns. The simplest types of patterns are repeating patterns. In such patterns, students need to identify the basic unit of the pattern and repeat it.
b.	Verbalize a rule for finding values in an **"in-out" table** .	Reading and explaining temperature conversion tables	Growing patterns are more difficult for students to understand than repeating patterns because not only must they determine what comes next, they must also begin the process of generalization. Students need experiences with growing patterns in both numerical and geometric formats.

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Standard 3.10.2 The adult student will read, write and solve simple algebraic expressions and numerical sentences (equations) that represent verbal situations.

	Benchmark	Applications	Instructor Notes
a.	Describe the concept of **variable** (blanks, boxes, letters or other symbols) as a representation of an unknown quantity	Preparing for further study	A variable is a quantity that can have different values. Any letter can be used as a variable. Numbers are used when they are known; variables are used when the numbers are unknown. For example, "a full box of cookies and four extra" can be represented by b + 4; "three full boxes of cookies" by 3b; "a full box of cookies shared among four" by $^{b}/_{4}$.
b.	Translate simple verbal phrases into **algebraic expressions** and sentences into **equations** (e.g., "3 more than a number" can be written as n + 3)	6 is 4 less than what number 6 = n - 4	A verbal sentence is a complete word statement (e.g., "The sum of two consecutive integers is five."). An open sentence is a mathematical sentence containing a variable and an equals sign (=). For example, b + 3 = 23 represents the answer to the word problem, "How many cookies are in a box if the box plus three more equals 23 cookies?", where b stands for the number of cookies in the box. ➢ A verbal expression is a word phrase (e.g., "the sum of two consecutive integers"). ➢ A verbal quantitative expression involving one operation can be represented by a variable expression that describes what is going on. ➢ A variable expression is like a phrase: as a phrase does not have a verb, so an expression does not have an equals sign (=). ➢ An algebraic expression is a variable expression that contains at least one variable (e.g., 2x – 5). ➢ A numerical expression is an expression that contains only numbers.
c.	Use **substitution** to verify solutions of equations	Taking a multiple choice test: Given the following choices as possible solutions for 6 = n – 4, determine which number makes the equation true: a.8, b.10, c.12 Using substitution 6 ≠ 8 – 4, 6 = 10 – 4, 6≠ 12 - 4	An algebraic equation is a mathematical statement that says that two expressions are equal (e.g., 2x + 1 = 5).

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