KYAE Standards for Mathematics Level 2 (2.0 – 3.9)

Beginning Adult Basic Education

KYAE Beginning ABE (NRS Level 2) Standards for Mathematics lay a foundation for mathematical understanding and skills.

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 2 **Recognize and Compare Numbers** strand is on developing an understanding of the place value system for whole numbers and decimals. The concept of "part and whole" is emphasized using simple fractions and decimals.

Standard 2.1.1 The adult student will read aloud, write, order and compare two-, three- and four-digit numbers.

	Benchmark	Applications	Instructor Notes
a.	Identify the place value for each digit and explain that the position of a digit signifies its value	Checking a receipt against purchases	Place value refers to the value of each digit and depends upon the position of the digit in the number. In the number 7,864, the eight is in the hundreds place, and the value of the 8 is eight hundred. Flexibility in thinking about numbers — or "decomposition" of numbers — is critical and supports understandings essential to multiplication and division. For example, 123 is 123 ones; or 1 hundred, 2 tens, and 3 ones; or 12 tens and 3 ones.
b.	Count forwards or backwards by 10's or 100's starting from any two-, three- or four-digit number, up to 10,000	Locating a house address	
c.	Explain the use of zero as a place holder	Discussing projected incomes of various occupations	
d.	Write statements of **inequality** for numbers up to 10,000 using the symbols for less than (<) and greater than (>)	Comparing various weights	Mathematical symbols (>, <) used to compare two unequal numbers are called *inequality symbols*.

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Standard 2.1.2 The adult student will identify, write and compare fractions including halves, thirds, fourths, fifths, eighths and tenths to describe amounts less than one whole.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Represent a given **fraction** using materials or drawings	Cutting a celery stalk into thirds	Fractions are used to name a part of one thing or a part of a collection of things. Informal, integrated experiences with fractions at this level will help students develop a foundation for deeper learning. Understanding the language of fractions (e.g., *thirds* means "three equal parts of a whole," $\frac{1}{3}$ represents one of three equal-size parts when a pizza is shared among three students, or *three-fourths* means "three of four equal parts of a whole") furthers this development. Strategies for comparing fractions having unlike denominators may include comparing fractions to familiar benchmarks (e.g., 0, $\frac{1}{2}$, 1); finding equivalent fractions, using manipulative models such as fraction strips or number lines.

Standard 2.1.3 The adult student will read aloud and write decimals to two places (tenths and hundredths).			
	Benchmark	**Applications**	**Instructor Notes**
a.	Demonstrate an understanding that decimals are another way of representing fractions	Writing .25 to stand for a quarter or ¼ of a dollar	Decimals and fractions represent the same relationships; however, they are presented in two different formats. A decimal point separates the whole number places from the places that are less than one. Place values extend infinitely in two directions from a decimal point.

DRAFT

b.	Demonstrate an understanding that **decimals** are an extension of the place value system and that each place to the right of the decimal gets ten times smaller than the previous place	Comparing pennies and dimes to a dollar bill	A number containing a decimal point is called a *decimal number* or simply a *decimal*. Models and real-life examples of decimals should be used to represent decimals as a part of a whole. Decimals may be written in a variety of forms: – Standard: 26.53 – Written: twenty-six and fifty-three hundredths

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Content Strand 2 of 10
Rounding and Estimation

The focus of instruction in the Level 2 **Rounding and Estimation** strand is on understanding place value as it relates to rounding whole numbers.

Standard 2.2.1 The adult student will apply the concept of rounding to a specified place value.

	Benchmark	Applications	Instructor Notes
a.	Round whole numbers through 4 digits to the nearest ten, hundred and thousand (e.g., is 565 closer to 500 or 600?)	Giving ballpark figures for numbers in a crowd	Students should explore reasons for estimation, using real-life experiences, and use rounding to solve real-life situations. Opportunities to explore the concept of rounding on number lines reinforce an understanding of rounding to the nearest ten or nearest hundred. Use the strategy of identifying the number on the number line and locating the multiple of ten or one hundred to which it is closest.
b.	Demonstrate an understanding of place value for units, tens, hundreds and thousands		

Standard 2.2.2 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.	Estimate to check the reasonableness of results	Eliminate unreasonable choices on a multiple choice test	Rounding is one of the estimation strategies and is often used to assess the reasonableness of a solution or to give a rough idea of an amount.

DRAFT

Content Strand 3 of 10
Number Theory and Mathematical Symbols

The focus of instruction in the Level 2 **Number Theory and Mathematical Symbols** strand is on developing an understanding of the effects of number properties as they apply to the four operations.

Standard 2.3.1 The adult student will summarize and apply basic number theory concepts.

	Benchmark	Applications	Instructor Notes
a.	**Property of zero** for addition, subtraction, multiplication and division - the sum or difference of any number and zero is that number (5 + 0 = 5, 5 – 0 = 5); the product of any number and zero equals zero (5 x 0 = 0); zero divided by any number is zero (0 ÷ 5 = 0)		Number theory is a part of mathematics in which characteristics of numbers and relationships between numbers are examined. Identity elements are numbers that combine with other numbers without changing the other numbers.
b.	**Property of one** for multiplication and division – the product of a number and one is that number, e.g. 4 x 1 = 4; any number divided by one will equal that number (e.g., 4 ÷ 1 = 4)		

DRAFT

Standard 2.3.2 The adult student will model meanings of addition and subtraction of two- , three- and four- digit whole numbers.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Demonstrate that when combining amounts, the total will be the same regardless of the order of the numbers (**commutative property**: 2 + 4 + 3 gives the same total as 3 + 4 + 2)		The commutative property for addition states that changing the order of the addends does not affect the sum (e.g., 4 + 3 = 3 + 4). Similarly, the commutative property for multiplication states that changing the order of the factors does not affect the product (e.g., 2 × 3 = 3 × 2).
b.	Explain that subtraction is not **commutative**: having 4 and giving away 2 is not the same as having 2 and giving away 4		In building thinking strategies for subtraction, an emphasis is placed on connecting the subtraction fact to the related addition fact. The same is true for division, where the division fact is tied to the related multiplication fact. Building fact sentences helps strengthen this relationship, (e.g. given 3 × 2 = 6, write __ × 3 = 6, 6 ÷ 3 = __, and 6 ÷ __ = 3).
c.	Explain that subtraction can be used to answer questions of comparison: How much more or less?		
d.	Demonstrate that addition and subtraction relate to each other as opposites (e.g., check subtraction answers by using addition: 10 – 6 = 4 because 6 + 4 = 10)		

DRAFT

Standard 2.3.3 The adult student will model meanings of multiplication and division for one- and two-digit whole numbers.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Demonstrate that multiplication is a shorter way to do repeated addition (e.g., 3 x 4 = 3 + 3 + 3 + 3)		Multiplication is a shortcut for adding same-size groups. To extend the understanding of multiplication, three models may be used: ➢ The equal-sets or equal-groups model lends itself to sorting a variety of concrete objects into equal groups and reinforces repeated addition or skip counting. ➢ The array model, consisting of rows and columns (e.g., 3 rows of 4 columns for a 3-by-4 array) helps build the commutative property. ➢ The length model (e.g., a number line) also reinforces repeated addition or skip counting.
b.	Explain that multiplication is **commutative**: 3 x 4 x 2 gives the same product as 2 x 3 x 4	Calculating the total number of hours worked	
c.	Demonstrate that division is a shorter way to do repeated subtraction (e.g., 12 ÷ 4 = 3 because 12 - 4 - 4 - 4 = 0)		
d.	Explain that division is not **commutative**: 12 ÷ 4 does not equal 4 ÷ 12	Working out how many cars are needed to transport a group of people	
e.	Demonstrate that multiplication and division relate to each other as opposites	Check division answers by using multiplication: 12 ÷ 4 = 3 because 3 x 4 = 12	Addition and subtraction are inverse operations, as are multiplication and division; that is, one undoes the other.

DRAFT

Standard 2.3.4 The adult student will identify and use mathematical symbols and words that represent those symbols.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Explain that **x** represents multiplication	Using a calculator, or helping children with homework.	Comparison between whole numbers can be made by using the symbols of inequality: < (less than), > (greater than), ≠ (is not equal to), or = (equal to).
b.	Explain that ÷ and **)‾‾‾** are used to represent division		
c.	Explain that **≠** represents non-equal amounts		
d.	Explain that > and < represent amounts of **inequality**		

DRAFT

Content Strand 4 of 10
Mathematical Operations

The focus of instruction in the Level 2 **Mathematical Operations** strand is on developing an understanding of the effects of the four operations and their related symbols on whole numbers as well as the addition and subtraction of simple fractions and decimals.

Standard 2.4.1 The adult student will demonstrate the ability to use addition and subtraction flexibly, efficiently and accurately.

	Benchmark	Applications	Instructor Notes
a.	Add and subtract two-, three- and four-digit whole numbers	Adding deposits to a bank account	A certain amount of practice is necessary to develop fluency with computational strategies for multi-digit numbers; however, the practice must be motivating and systematic if students are to develop fluency in computation, whether mental, with manipulative materials or with paper and pencil.
b.	Correctly align numbers in column addition		Regrouping is used in addition and subtraction algorithms. When adding, if the sum in a place is 10 or more, place value is used to regroup the sums so that there is just one digit in each place. When subtracting, if the number in a place is not enough to subtract from, regrouping is required.
c.	Add and subtract with **proper fractions**, having like **denominators**		The concepts of addition and subtraction applied to fractions are the same as these concepts applied to whole numbers. A proper fraction is a fraction whose numerator is smaller than its denominator.
d.	Add and subtract with **decimals** to two places (tenths and hundredths)	Determining change from a purchase	For decimal computation, the same ideas developed for whole-number computation may be used, and these ideas may be applied to decimal place values, giving careful attention to the placement of the decimal point in the solution.
e.	Correctly align **decimals** points in column addition and subtraction		

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Standard 2.4.2 The adult student will demonstrate the ability to use the operation of multiplication and related vocabulary (e.g., *multiplied by*, *times*, etc.).

	Benchmark	Applications	Instructor Notes
a.	Perform multiplication facts through 10 x 10	Calculating the total number of items packaged in batches	The development of computational fluency relies on quick access to basic number facts such as multiplication facts. Multiplication is a shortcut for repeated addition. The terms associated with multiplication are listed below: factor → 54 factor → × 3 product → 162
b.	Recall two- and three-digit **multiples** of 2, 5, or 10 and three- and four-digit multiples of 50 and 100	Performing mental computations	
c.	Double one- and two-digit numbers up to 50	Doubling a wager	

Standard 2.4.3 The adult student will demonstrate the ability to use the operation of division and related vocabulary (e.g., *divided by*, *goes into*, etc.)

	Benchmark	Applications	Instructor Notes
a.	Perform division on two-digit numbers by one-digit numbers with no remainders	Dividing amounts into equal parts	Division is the operation of making equal groups or equal shares. When the original amount and the number of shares are known, divide to find the size of each share. When the original amount and the size of each share are known, divide to find the number of shares. Terms used in division are dividend, divisor, and quotient. Ex: dividend ÷ divisor = quotient or quotient divisor)dividend
b.	Recall halves of even numbers up to 100		

DRAFT

Standard 2.4.4 The adult student will use a calculator to check calculations using whole numbers and decimals.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Demonstrate the ability to: • identify the signs for addition, subtraction, multiplication, division and equals • key in numbers, decimal points and operators in the correct order • clear the display before starting a new calculation	Checking calculations for accuracy	Calculators should be used to solve problems that require tedious calculations. Calculators are an appropriate tool for computing sums and differences of large numbers, particularly when mastery of the algorithm has been demonstrated.

Standard 2.4.5 The adult student will demonstrate the ability to select the appropriate operation to solve real-world problems involving whole numbers.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Demonstrate an understanding that **+** represents combining and **–** represents separation or comparison	Including sales tax with a purchase	Problem solving means engaging in a task for which a solution or a method of solution is not known in advance. An example of an approach to solving problems is Polya's four-step plan: 1. *Understand*: Retell the problem; read it twice; take notes; study the charts or diagrams; look up words and symbols that are new. 2. *Plan*: Decide what operation(s) and sequence of steps to use to solve the problem.

DRAFT

b.	Demonstrate an understanding that **x** represents combining multiples and ÷ or $\overline{)}$ means separating into equal groups or discovering the number of equal groups contained within	Calculating total hours worked in a month or the average time on task	3. *Solve*: Follow the plan and work accurately. If the first attempt does not work, try another plan. 4. *Look back*: Does the answer make sense?
c.	Demonstrate an understanding that **=** represents vocabulary such as *is equal to*, *is the same as*, and *gives you*, and that **≠** represents vocabulary such as *is not equal to*, is *not the same as*, *does not give you*	Helping a child with math homework	

DRAFT

Content Strand 5 of 10
Measurements

The focus of instruction in the Level 2 **Measurements** strand is on developing an understanding of customary and metric measurement systems.

Standard 2.5.1 The adult student will demonstrate the ability to use common measurement systems.

	Benchmark	Applications	Instructor Notes
a.	Contrast common uses of the U.S. **Customary measurement system** with the **metric system**	Describing distances in the U.S. and those in other countries	The concept of a standard measurement unit is one of the major ideas in understanding measurement. Familiarity with standard units is developed through hands-on experiences of comparing, estimating, measuring, and constructing.
b.	Describe the relationships of familiar units of customary measurements (e.g., 12 inches in a foot, 3 feet in a yard, 4 cups in a quart)	Expressing a person's height in feet and inches	
c.	Read, write, and explain the time formats of quarter and half hours using a 12 hour analog clock	Reporting to work on time	Telling time is applying reading skills to a clock face. While digital clocks make reading time easy, it is necessary to ensure that students understand that there are sixty minutes in an hour.

DRAFT

Standard 2.5.2 The adult student will demonstrate the ability to use U.S. currency and coins.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Count and make change using U.S. coins and currency up to $10.00	Making change: sort coins into like piles, and then determine the value of each pile	A variety of skills can be used to determine the change after a purchase, including: • counting on, i.e., starting with the amount to be paid (purchase price), counting forward to the next dollar, and then counting forward by dollar bills to reach the amount from which to make change; • mentally calculating the difference

DRAFT

Content Strand 6 of 10
Geometry

The focus of instruction in the Level 2 **Geometry** strand is on developing an understanding of the prevalence of geometric shapes in the environment. The relationship of geometry to measurement is also emphasized.

Standard 2.6.1 The adult student will investigate and explain common uses of shapes in the environment.

	Benchmark	Applications	Instructor Notes
a.	Identify, describe and draw basic **two-dimensional (plane) figures**: **square**, **circle**, **rectangle**, **triangle**		The study of geometric figures must be active, using visual images and concrete materials. Opportunity should be provided for building and using geometric vocabulary to describe geometric shapes.
b.	Identify and describe **three-dimensional (solid) figures**, including **cube**, **cone**, **cylinder** and **sphere**, in the real world	Comparing use of shapes in house construction or room design	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 solid bounded by two congruent, parallel circular bases joined by a curved surface whose cross-section perpendicular to the axis is always a circle congruent to the bases. 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 rectangular prism is a solid in which all six faces are rectangles with three pairs of parallel, congruent, opposite faces.

DRAFT

Standard 2.6.2 The adult student will apply geometric formulas to solve problems involving rectangular figures.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Find the **perimeter** of rectangular figures not to exceed 10,000 units	Determining the amount of fencing needed for a garden	Perimeter is the distance around a closed figure. The perimeter of any shape can be found by adding the lengths of the sides. Students need to describe situations from their environment that represent perimeter (e.g., the distance around the edge of a picture frame). Students should practice associating the word perimeter with examples of the concept of perimeter.
b.	Find the **area** of rectangular figures up to 100 square units, demonstrating that area measures the space within a figure in square units	Determining the amount of flooring needed for a room	Area is the number of square units needed to cover a surface or figure. Students need to describe situations from their environment that represent area.

DRAFT

Content Strand 7 of 10
Using Ratios, Proportions and Percents

The focus of instruction in the Level 2 **Using Ratios, Proportions and Percents** strand is on developing an understanding of percent.

Standard 2.7.1 The adult student will demonstrate an understanding of percent as meaning "out of 100" or "hundredths".

	Benchmark	Applications	Instructor Notes
a.	Explain that 100 **percent** is the same as one whole	Answering all questions correctly on a test earns the grade of 100 percent	Percent means "per 100" or how many "out of 100"; percent is another name for hundredths. Percents can be expressed as fractions with a denominator of 100 (e.g., 75% = $\frac{75}{100} = \frac{3}{4}$). Percents can be expressed as decimals (e.g.,38% = $\frac{38}{100}$ = 0.38). Percents are used in real life for taxes, sales, data description, and data comparison.
b.	Explain that 50 **percent** is equivalent to one-half	Buying something at a 50 percent discount means getting the item for half its original price	

DRAFT

Content Strand 8 of 10
Data Interpretation and Probability

The focus of instruction in the Level 2 **Data Interpretation** strand is on developing the ability to interpret data from a variety of displays. The concept of probability is introduced.

Standard 2.8.1 The adult student will identify and interpret information displayed in various forms of data collection.

	Benchmark	Applications	Instructor Notes
a.	Extract information from a list, explaining the order of the **data** (e.g., alphabetical, numerical or random)	Using the yellow pages	
b.	Read values on a **bar graph** up to 1,000, explaining that the height of the bar is equal to the amount on the axis across from it	Reading newspapers and magazines	The purpose of a graph is to represent data gathered to answer a question. Bar graphs are used to compare counts of different categories (categorical data). A bar graph uses parallel horizontal or vertical bars to represent counts for several categories.
c.	Extract information from a **table**, explaining the arrangement of the data in rows and columns	Checking items against a stock list	
d.	Explain the importance of titles and labels in extracting information	Keeping records for a club or organization	

DRAFT

Standard 2.8.2 The adult student will demonstrate an understanding of the concept of probability.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Investigate and describe the concept of **probability** as chance		Probability is the chance of an event occurring. A spirit of investigation and experimentation should permeate probability instruction, where learners are actively engaged in explorations and have opportunities to use manipulatives.
b.	Discuss events as *likely* or *unlikely*, explaining that while some events are *impossible*, some are *certain* to happen, and in other events some are more *likely* to occur than others	Deciding whether or not to carry an umbrella	Learners should have opportunities to describe in informal terms (i.e., impossible, unlikely, equally likely, likely, and certain) the degree of likelihood of an event occurring. Activities should include real-life examples.

DRAFT

Content Strand 9 of 10
Number Line and Grids

The focus of instruction in the Level 2 **Number Line and Grids** strand is on developing an understanding of the concept of fractional distances (halfway points).

Standard 2.9.1 The adult student will use a number line to represent mathematical operations with whole numbers.

	Benchmark	Applications	Instructor Notes
a.	Connect groups of spaces to represent multiplication as repeated addition (e.g., 3 x 4 = 12 as moving to the right by 3-space groups 4 times, thereby ending at 12)	Helping children with homework	Using the number line as a tool for multiplication and division increases the learner's understanding of the relationships between the four operations used for computation.
b.	Connect groups of spaces to represent division as repeated subtraction (e.g., 15 ÷ 3 = 5 as starting at 15 and moving to the left by 3-space groups 5 times to reach zero)		
c.	Locate points on a horizontal or vertical number line that fall halfway between whole numbers (e.g., 3 ½ or 3.5)	Recording an individual's height	As a visual and spatial representation of the relationships between numbers, the number line can aid in the learner's understanding of amounts less than one whole. Locating halfway points lays the foundation for applying fractions or decimals in measurement.

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Standard 2.9.2 The adult student will use directions and keys to read maps.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Use the compass rose on a map to locate secondary directions as lying halfway between cardinal directions (e.g., northeast is halfway, the diagonal direction, between north and east)	Understanding wind directions stated in a weather forecast	Familiarity with the directions which lie between the cardinal directions serves as a precursor to the learner's perception of points within a quadrant on the coordinate grid.

DRAFT

Content Strand 10 of 10
Algebra

The focus of instruction in the Level 2 **Algebra** strand is on developing an understanding of mathematical and geometric patterns and the interpretation of word problems as number sentences.

Standard 2.10.1 The adult student will identify and continue simple patterns and sequences.

	Benchmark	Applications	Instructor Notes
a.	Identify the smallest repeated unit to continue or complete **patterns** and **sequences** using shapes or objects	Continuing a needlepoint pattern	Exploring patterns requires active physical and mental involvement. Reproduction of a given pattern in a different representation, using symbols and objects, lays the foundation for writing numbers symbolically or algebraically.
b.	Identify the smallest repeated unit to continue or complete **sequences** using numbers (e.g., 5, 10, 15, 20 25, 30, ___, ___, ___, 50)	Locating a house by its number	In numeric patterns, learners must determine the difference, called the common difference, between each succeeding number in order to determine what is added to each previous number to obtain the next number.
c.	Create simple repetitive **patterns** using numbers, shapes, colors, objects, etc.	Designing a quilt pattern	Students should have opportunities to make up their own repeating patterns and sequences using a variety of materials and concepts within the context of their daily lives, (e.g. rhythm patterns, speech patterns, designing a garden, laying tile, etc.)

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Standard 2.10.2 The adult student will read and write simple equations for problems representing verbal situations.			
	Benchmark	**Applications**	**Instructor Notes**
a.	Translate simply worded problems into simple **equations**	Writing a number sentence for "the sum of four and five is nine" as 4 + 5 = 9.	Key words in translating verbal expressions/sentences to algebraic expressions/equations may include words and their translations such as: *is* to =, *more than* to +, *less than* to –, *increased by* to +, and *decreased by* to –.
b.	Read and write simple **number sentences** where a blank __ represents a missing value	Writing a number sentence for the sum of four and what number is nine as 4 + __= 9	A number sentence is an equation with numbers (e.g., 6 + 3 = 9; or 6 + 3 = 4 + 5).
c.	Use **substitution** to determine solutions of **equations**	Using each possible answer in the blank __(e.g., a.4, b.5, c.6, d.7, in the equation 4 + __= 9)	

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