KYAE Standards for Mathematics Level 4 (6.0 – 8.9)

High Intermediate Adult Basic Education

KYAE High Intermediate ABE (NRS Level 4) Standards for Mathematics identify mathematical concepts and skills which directly relate to assessments for the Kentucky Employability Certificate (KEC), the General Educational Development credential (GED®) and college readiness through use of the following symbols: *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 4 **Recognize and Compare Numbers** strand is on developing number sense with an emphasis on equivalent representations of fractions, decimals and percents. Integers are introduced.

Standard 4.1.1 The adult student will read aloud, write, order and compare a given set of whole numbers, fractions, decimals and integers.

	Benchmark	Applications	Instructor Notes
a.	Using the mathematical symbols **>, ≥, <, ≤, =, ≠**, compare and order whole numbers, **fractions** and **decimal** numbers of any size	Reading and comparing gas prices	
b.	Read, write, order and compare **positive** and **negative integers**	Balancing a checkbook	Comparison between integers can be made by using the mathematical symbols: < (less than), > (greater than), or = (equal to).

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Standard 4.1.2 The adult student will recognize and use equivalencies between fractions, decimals and percents, confirming results with a calculator.

	Benchmark	Applications	Notes
a.	Identify examples of **percents** in real-world situations	Using a coupon for 15% off suggested retail price	Percents are used in real life for tips, taxes, sales, data description, and data comparison.
b.	Convert between **mixed numbers** and **decimals**	Comparing interest rates on credit cards (e.g., 5.75% = 5¾%)	
c.	Identify the **decimal** and **percent** equivalents for halves, thirds, fourths, fifths and tenths	Filling out a time sheet: 3.5 = 3 ½	Flexible thinking about number representations is encouraged when students solve problems.
d.	Explain the equivalent relationship between **decimals**, **percents** and **fractions** with **denominators** that are **factors** of 100		Fractions, decimals and percents are three different representations of the same number.

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Content Strand 2 of 10
Rounding and Estimation

The focus of instruction in the Level 4 **Rounding and Estimation** strand is on problem solving and mathematical reasoning through the application of estimations skills.

Standard 4.2.1 The adult student will apply the concept of rounding and estimation to solve multi-step problems, confirming results with a calculator.

	Benchmark	Applications	Instructor Notes
a.	Solve real-world and mathematical problems with the help of estimating measurements, such as length, time, weight and mass, temperature, money, **perimeter** and **area**	Estimating the cost of gasoline needed to take a trip	Solving multistep problems in the context of real-life situations enhances interconnectedness and proficiency with estimation strategies.
b.	Use estimation strategies to predict answers and to check the reasonableness of results	Checking possible answers on a test by using estimation	Estimation and checking the reasonableness of a result enhance computational proficiency. Different strategies can be used to estimate the result of computations and judge the reasonableness of the result. For example: What is an approximate answer for 2.19 ÷ 0.8? The answer is around 2 because 2 ÷ 1 = 2.

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Content Strand 3 of 10
Number Theory and Mathematical Symbols

The focus of instruction in the Level 4 **Number Theory and Mathematical Symbols** strand is on developing an understanding of the commutative, associative and distributive properties. Square roots are introduced.

Standard 4.3.1 The adult student will summarize and apply mathematical properties.

	Benchmark	Applications	Instructor Notes
a.	Summarize and apply the **Commutative Property of Addition** and **Multiplication**: • Commutative Property of Addition-changing the ORDER of numbers that are being added does NOT change the sum: $a + b = b + a$, e.g. 1 + 3 + 4 = 3 + 1 + 4 • Commutative Property of Multiplication - changing the ORDER of numbers being multiplied does NOT change the product: $a \cdot b = b \cdot a$, 6 x 2 = 2 x 6	Adding grocery receipts for the month to meet a budget Finding the area of a space to carpet	Using the properties of operations with real numbers helps with understanding mathematical relationships. Subtraction and division are neither commutative nor associative.

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b.	Summarize and apply the **Associative Property of Addition** and **Multiplication**:		
	• Associative Property of Addition - changing the GROUPING of numbers being added does NOT change the sum: *(a + b) + c = a + (b + c)*, 2+ (3 + 4) = (2 + 3) + 4	Placing orders for supplies	
	• Associative Property of Multiplication – changing the GROUPING of numbers being multiplied does NOT change the product: *(a · b) · c = a · (b · c)*, (6 x 2) x 3 = 6 x (2 x 3)	Ordering team uniforms	
c.	Summarize and apply the **Distributive Property of Multiplication** – the product of a number and the sum (or difference) of two other numbers equals the sum (or difference) of the products of the number and each other number : *a(b + c) = ab + ac* and *(b + c)a = ba + bc*; or *a(b – c) = ab – ac and (b – c)a = ba – ca,* e.g., 5 · (3 + 7) = (5 · 3) + (5 · 7), or 5 · (3 – 7) = (5 · 3) – (5 · 7)]	Rearrange expressions for quick mental computation such as 5 x 43 = 5(40+3) = 5 x 40 + 5 x 3 = 200 + 15 = 215	

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d.	Demonstrate an understanding that **squaring** and finding the **square root** $\sqrt{\ }$ are **inverse operations,** e.g. $5(5) = 5^2 = 25$; $\sqrt{25} = 5$	Determining the length to cut rafters for a roof	A square root of a number is a number which, when multiplied by itself, produces the given number (e.g., the square root of 49 is 7 since $7 \times 7 = 49$). Thus, the inverse of squaring a number is determining the square root.

Standard 4.3.2 The student will identify and use a variety of mathematical symbols and words that represent the symbols.

	Benchmark	Applications	Notes
a.	Demonstrate an understanding that **≤** (less than or equal to), **≥** (greater than or equal to) and **≈** (is approximately equal to) are symbols of comparison	Understanding nutrition labels or tables in medical reports	
b.	Demonstrate the ability to use division symbols appropriately: **–** (fraction bar), **)**‾‾ and **÷**	Using a calculator; helping children with homework	
c.	Demonstrate the ability to use the $\sqrt{\ }$ (**radical**) in computation		

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d.	Demonstrate the ability to use the following geometric symbols: ° - **degree** ∠- **angle** ⊥ - **perpendicular** to ‖ - **parallel** to ∟ -**right angle** π - **pi** (pi ≈ 3.14 or 22/7)	Reading blueprints	

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Content Strand 4 of 10
Mathematical Operations

The focus of instruction in the Level 4 **Mathematical Operations** strand is on developing fluency in fraction and decimal computation for the purpose of solving real-world problems.

Standard 4.4.1 The adult student will add, subtract, multiply and divide whole numbers, confirming results with a calculator.

	Benchmark	Applications	Notes
a.	Demonstrate the ability to apply the four operations to whole numbers of any size, with and without the use of a calculator		

Standard 4.4.2 The adult student will add, subtract, multiply and divide fractions and mixed numbers with like and unlike denominators, confirming results with a calculator.

	Benchmark	Applications	Instructor Notes
a.	Add and subtract **mixed numbers** with and without regrouping, expressing answers in **simplest form**	Doubling or reducing amounts in a recipe	There is implied addition of the whole number part and the fractional part in mixed numerals. 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.
b.	Rename whole numbers and **mixed numbers** as **improper fractions** for the purpose of multiplication and division	Calculating measurements in construction	It is helpful for students to simplify before they multiply fractions, using the commutative property of multiplication to reduce fractions to simplest form before multiplying.

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Standard 4.4.3 The adult student will add, subtract, multiply and divide decimals of any size, confirming results with a calculator.

	Benchmark	Applications	Instructor Notes
a.	Align numbers for column addition and subtraction	Working with metric measurements	Division of decimals is performed the same way as division of whole numbers. The only difference is the placement of the decimal point in the quotient. Understanding this placement 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, by 0.06, and by 0.006.
b.	Demonstrate and explain the impact on place value as the position of the **decimal point** changes in multiplication and division problems	Averaging metric measurements	

Standard 4.4.4 The adult student will apply algebraic notation to number operations.

	Benchmark	Applications	Instructor Notes
a.	Use **algebraic notation** for multiplication and division including **exponents** and **square roots** (e.g., 4(12) and 4 · 12 for multiplication of 4 times 12; $\frac{12}{3}$ for 12 ÷ 3)	Preparing for further study	
b.	Calculate **squares** and **cubes** of whole numbers one through ten using a calculator to confirm results	Working with area and volume	

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Standard 4.4.5 The adult student will use strategies to solve word problems.

	Benchmark	Applications	Instructor Notes
a.	Analyze real-world problems to identify the essential information and select the appropriate operation(s) needed to solve multi-step problems involving whole numbers, **fractions**, **decimals** and **percents**	Determining weekly pay based on a consistent, predictable pattern, such as $5.85 per hour	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. *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?
b.	Explore multiple strategies for arriving at the solution to a word problem		

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Content Strand 5 of 10
Measurements

The focus of instruction in the Level 4 **Measurements** strand is on conversions within the U.S. customary system and exploration of the metric system. Angle measurement is introduced.

Standard 4.5.1 The adult student will select and use appropriate instruments, technology and techniques to solve problems of metric and customary measurement systems.

	Benchmark	Applications	Instructor Notes
a.	Measure length, weight and **volume** in fractional units using appropriate tools	Determining a person's height	Experience using a variety of measuring devices and making real measurements promotes an understanding of measurements and the formulas associated with measurements.
b.	Measure time and temperature in fractional units to solve real-world problems	Determining how many hours someone has worked	
c.	Identify the **customary measures** most appropriate for a given situation	Describing the size of a room vs. the size of a picture frame	
d.	Convert common equivalent measurements within the **customary system**	Changing pints to cups in a recipe	
e.	Identify the **metric measures** most appropriate for a given situation	Dispensing medicine to a baby or insulin to a diabetic	
f.	Associate prefixes used in the **metric system** with the **decimal** equivalents (kilo, deci, centi, milli)	Discussing the distance to run in a race	

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Standard 4.5.2 The adult student will measure angles of less than 360° to the nearest degree, using the appropriate tools.

	Benchmark	Applications	Instructor Notes
a.	Using a protractor, determine and record the measurement of a variety of **angles**	Studying construction blueprints	Angles are measured in degrees. A degree is $^{1}/_{360}$ of a complete rotation. To measure the number of degrees in an angle, use a protractor or an angle ruler. A right angle measures exactly 90°. An acute angle measures less than 90°. An obtuse angle measures greater than 90° but less than 180°. Before measuring an angle, students should first compare it to a right angle to determine whether the measure of the angle is less than or greater than 90°.
b.	Make visual estimates of angle measurement using 45°, 90° and 180° as reference points and label angles as **right, obtuse, acute** or **straight**, confirming estimates with a **protractor**		

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Geometry

The focus of instruction in the Level 4 **Geometry** strand is on the use of geometric terminology to identify and describe a variety of shapes. The application of geometric formulas is also emphasized.

Standard 4.6.1 The adult student will recognize and describe a variety of two- and three-dimensional shapes.

	Benchmark	Applications	Instructor Notes
a.	Identify, label and use geometric terminology associated with **lines**: **points**, **segments**, **rays**, **parallel**, **perpendicular**, **intersecting**, and **transversal**	Explaining the route or drawing a map to a specific location	**a.** A point is an exact location in space. It has no length or width. A point is usually named with a capital letter. A line is a collection of points going on and on infinitely in both directions. It has no endpoints. When a line is drawn, at least two points on it can be marked and given capital letter names. The line can also be named with a single, lower-case letter. Arrowheads must be drawn to show that the line goes on in both directions infinitely. A line segment is part of a line. It has two endpoints and includes all the points between those endpoints. To name a line segment, name the endpoints. A ray is part of a line. It has one endpoint and continues on and on in one direction. To name a ray, say the name of its endpoint first and then say the name of one other point on the ray. Parallel lines are lines that lie on the same flat surface (plane) and never cross. Parallel lines are always the same distance apart and do not share any points. Perpendicular lines are special intersecting lines that form right angles (square corners) where they intersect. Intersecting lines are lines that cross and have one point in common.

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b.

d.	Identify and describe characteristics of **quadrilaterals** including a **parallelogram**, **rectangle**, **square**, **rhombus** and **trapezoid**		**d.** A quadrilateral is a polygon with four sides. Quadrilaterals can be classified by the number of parallel sides: ➢ a parallelogram, rectangle, rhombus, and square each have two pairs of parallel sides ➢ a trapezoid has only one pair of parallel sides ➢ other quadrilaterals have no parallel sides. A parallelogram is a quadrilateral in which both pairs of opposite sides are parallel. A rectangle is a parallelogram with four right angles. Since a rectangle is a parallelogram, a rectangle has the same properties as those of a parallelogram. A square is a rectangle with four congruent sides. Since a square is a rectangle, a square has all the properties of a rectangle and of a parallelogram. A rhombus is a parallelogram with four congruent sides. Opposite angles of a rhombus are congruent. Since a rhombus is a parallelogram, the rhombus has all the properties of a parallelogram. A trapezoid is a quadrilateral with exactly one pair of parallel sides. The parallel sides are called *bases,* and the non-parallel sides are called *legs*. If the legs have the same length, then the trapezoid is an isosceles trapezoid.
e.	Identify by the number of sides a variety of **polygons**: **pentagon**, **hexagon**, **heptagon**, **octagon**, **nonagon** and **decagon**		**e.** Prefixes in the names of polygons tell the number of sides: penta = 5, hexa = 6, hepta = 7, octa = 8, nona = 9, and deca = 10.
f.	Identify, label, and use geometric terminology associated with **circles**: **circumference, chord, radius, diameter, pi**		**f.** A circle is a set of points on a flat surface (plane) with every point equidistant from a given point called the *center*. A chord is a line segment connecting any two points on a circle. A diameter is a chord that goes through the center of a circle. A radius is a segment from the center of a circle to any point on the circle. Two radii end-to-end form a diameter of a circle. Circumference is the distance around or perimeter of a circle.

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Standard 4.6.2 The adult student will recognize and apply a variety of formulas for two- and three-dimensional shapes to solve real-world and mathematical problems.

	Benchmark	Applications	Instructor Notes
a.	Apply **substitution** to **formulas** to calculate the **circumference** and/or **area** of a **circle** when given the **diameter** or **radius**	Determining the amount of edging needed to border a circular flower bed	A formula is a statement based on logical mathematical conclusions or observation and experimental evidence. The area of a circle is computed by squaring the radius and multiplying that product by π: ($A = \pi r^2$, where $\pi = 3.14$ or $\frac{22}{7}$).
b.	Apply **substitution** to **formulas** to calculate the **perimeter** and **area** of **rectangles**, **squares** and **triangles**	Determining the amount of paint needed to cover a room	Perimeter is the distance around an object; it is a measure of length. The perimeter of any polygon is the distance around the figure. Area is the number of square units needed to cover a surface. The area of a rectangle is computed by multiplying the lengths of two adjacent sides. The area of a triangle is computed by multiplying the measure of its base by the measure of its height and dividing that product by 2.
c.	Apply **substitution** to **formulas** to calculate **volume** and **surface area** of **rectangular solids** and **cylinders**	Determining if a container is large enough to hold a given amount	Volume is a measure of capacity. The volume of a cylinder is computed by multiplying the area of the base, B, (πr^2) by the height of the cylinder ($V = \pi r^2 h = Bh$). The surface area of a three-dimensional object is the sum of the areas of all its faces.

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Standard 4.6.3 The adult student will apply transformations to geometric figures represented on graph paper.

	Benchmark	Applications	Instructor Notes
a.	Identify the geometric **transformations** of **rotation** (rotate or turn), **reflection** (reflect or flip) and **translation** (translate or slide) in real-life examples	Hanging patterned wall paper	Transformations and combinations of transformations can be used to describe movement of objects in a plane. A translation of a geometric figure is a slide of the figure in which all the points on the figure move the same distance in the same direction.
b.	Differentiate between **rotations**, **reflections** and **translations** of simple figures on a **coordinate grid**	Designing a quilt pattern	A reflection (flip) is a transformation in which a figure is flipped over a line, called the *line of reflection*. All corresponding points in the image and pre-image are equidistant from the line of reflection. A rotation of a geometric figure is a turn of the figure around a fixed point. The point may or may not be on the figure. The fixed point is called the *center of rotation*.

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Using Ratios, Proportions and Percents

The focus of instruction in the Level 4 **Using Ratios, Proportions and Percents** strand is on developing the ability to solve problems of percentage and use proportional reasoning skills to solve a variety of real-world problems.

Standard 4.7.1 The adult student will identify and write ratios and proportions within word problems.

	Benchmark	Applications	Instructor Notes
a.	Identify concrete and symbolic representations of **ratios** in real-world situations	Comparing any two groups in the results of a study	
b.	Represent **ratios** in equivalent forms (e.g., 2:1 = 2/1 = 2 to 1)	Expressing the odds of a horse winning a race	A ratio can be written using a fraction form ($\frac{2}{3}$), a colon (2:3), or the word *to* (2 to 3).
c.	Interpret **ratio** as comparison based on division	Understanding miles per gallon	A ratio is a comparison of two numbers, measures, or quantities. All fractions are ratios.
d.	Demonstrate an understanding that two equal **ratios** form a **proportion** (e.g., 4/5 = 12/15)	Building a scale model of a large object	A proportion is a statement of equality between two ratios. A proportion can be written as $\frac{a}{b} = \frac{c}{d}$, $a{:}b = c{:}d$, or a is to b as c is to d.
e.	Select when to solve specific problems by using **ratios** or **proportions**	Converting a recipe that serves 4 to serve 12	Proportional situations are based on multiplicative relationships. Equal ratios result from multiplication or division, not from addition or subtraction.

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Standard 4.7.2 The adult student will use proportion to solve practical problems.

	Benchmark	Applications	Instructor Notes
a.	Calculate for the missing term in a **proportion**	Determining how many correct answers are needed to score 80% on a test with 35 questions	Proportions are useful in solving many types of problems. When two quantities are proportional, a change in one quantity corresponds to a predictable change in the other; both quantities increase or decrease together. A proportion can be solved by finding equivalent fractions. Thus, a proportion can be solved by finding the product of the means and the product of the extremes. For example, in the proportion $a:b = c:d$, a and d are the extremes and b and c are the means. If values are substituted for a, b, c, and d such as 5:12 = 10:24, then the product of extremes (5×24) is equal to the product of the means (12×10).
b.	Apply **proportions** to solve problems, including problems involving **percents**	Determining the amount of a discount on an item that is marked down 40%	A percent is a special ratio in which the denominator is 100.

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Standard 4.7.3 The adult student will use percents to solve practical problems, confirming results with a calculator.

	Benchmark	Applications	Instructor Notes
a.	Find the *part* or *partial amount* of a whole amount when a **percent** is given (e.g., 20**%** $45 is how much?)	Determining the amount of savings at a 20% off sale	Percents are used in real life for tips, taxes, sales, data description, and data comparison. Students benefit from practice using paper and pencil, calculators and mental strategies to solve real life problems requiring percentage computations, i.e. figuring the tip and total for a meal, a discount and the resulting (sale) price, the sales tax for purchased items.
b.	Find what ***percent*** *or* ***rate*** one number is of another (e.g., 25 is what **%** of 40?)	Determining the % of students who completed their goals	
c.	Find the *whole* or *base* when a **percent** is given (e.g., 15 is 25% of what number?)	Determining one's monthly income if 25% or $400/month is spent for rent	

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Data Interpretation and Probability

The focus of instruction in the Level 4 **Data Interpretation** strand is on developing an awareness of the power of data analysis and probability to predict trends and inform decisions.

Standard 4.8.1 The adult student will read aloud, interpret and compare data from graphs, charts, schedules, tables, maps and diagrams.

	Benchmark	Applications	Instructor Notes
a.	Identify and interpret **graphs**, **charts** and **tables** in real-world materials and classroom resources	Interpreting information presented in graphical form in newspapers and magazines	Different types of graphs are used to display different types of data. Bar graphs use categorical (discrete) data (e.g., months or eye color). ➢A bar graph uses either horizontal or vertical parallel 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. The values should represent equal increments. ➢Each axis should be labeled, and the graph should have a title. ➢Statements representing an analysis and interpretation of the characteristics of the data in the graph (e.g., similarities and differences, mode, least and greatest) should be included.
b.	Relate the significance of titles, labels and other information to the understanding of the **data**	Examining conclusions drawn from studies	
c.	Create various types of lists, **graphs**, schedules and **tables** from collected **data**	Making a child's homework schedule or list of chores	

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d.	Make comparisons and predictions from **pictographs**, **circle graphs**, **bar graphs** and **line graphs**	Comparing reports for accuracy	Line graphs use continuous data (e.g., temperature and time). ➢Line graphs should be utilized 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 with the passage of 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. ➢The values along the vertical axis 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. ➢Each axis should be labeled, and the graph should have a title. ➢Statements representing an analysis and interpretation of the characteristics of the data in the graph (e.g., trends of increase and/or decrease, least and greatest) should be included. Circle graphs show a relationship of the parts to a whole. All graphs include a title, and data categories should have labels. A key is essential to explain how to read the graph. A title is essential to explain what the graph represents.
e.	Use a scale to determine distance on a map	Planning a road trip	
f.	Use a map showing time zones to determine the time in one location given the specified time in another	Planning when to call someone far away, such as Hawaii or Mexico	

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Standard 4.8.2 The adult student will demonstrate the ability to calculate and apply measures of central tendency in real-life situations.

	Benchmark	Applications	Instructor Notes
a.	Apply the concept of **mean** to solve problems	Tracking temperatures annually to determine spring planting dates	Mean, median, and mode are measures of central tendency that are useful for describing the average for different situations. ➢ Mean works well for sets of data with no very high or low numbers. The mean of a set of numbers is the sum of the set of numbers divided by the number of numbers in the set. ➢ Median is a good choice when data sets have a couple of values much higher or lower than most of the others. The median is the middle number of a set of data when the numbers are arranged from least to greatest or the mean of the two middle numbers when the set has two middle numbers. ➢ Mode is a good descriptor to use when the set of data has some identical values. The mode is the number that appears most frequently in a set of data. There may be one, more than one, or no mode. ➢ Range indicates how data is spread out or dispersed. The range is the difference between the greatest and least values in a set of data and shows the spread in a set of data.
b.	Apply the concept of **median** to solve problems		
c.	Apply the concept of **mode** to solve problems		
d.	Apply the concepts of **range** to solve problems		

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Standard 4.8.3 The adult student will demonstrate the ability to calculate probability in real-life situations.

	Benchmark	Applications	Instructor Notes
a.	Determine simple **probabilities**, demonstrating that **probability** depends on the total number of possibilities	Rolling dice	The probability of an event occurring is equal to 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 = $\frac{\text{number of favorable outcomes}}{\text{total number of possible outcomes}}$. Activities should include real-life examples: a simple event is one event (e.g., pulling one sock out of a drawer and examining the probability of getting one color).

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Number Line and Grids

The focus of instruction in the Level 4 **Number Line and Grids** strand is on developing fluency in the use of the coordinate grid. Addition of positive and negative integers is introduced.

Standard 4.9.1 The adult student will use a number line to represent mathematical operations with integers.

	Benchmark	Applications	Instructor Notes
a.	Add and subtract both **positive** and **negative integers** on a **number line**	Calculating a bank account balance	Integers are used in real-life situations, such as temperature changes (above/below zero), balance in a checking account (deposits/withdrawals), and changes in altitude (above/below sea level)
b.	Explain the words ***positive*** and ***negative*** as showing direction on both horizontal and vertical **number lines**	Staying "in the black" or going "into the red" in a bank account	Concrete experiences in formulating rules for adding and subtracting integers should be explored by examining patterns along a number line and using manipulatives, such as two-color counters or by using algeblocks.

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Standard 4.9.2 The adult student will demonstrate an understanding of the coordinate grid.

	Benchmark	Applications	Instructor Notes
a.	Identify **x- and y-axes**, **point of origin**, **quadrants, coordinates** and **ordered pairs** (e.g., (3,2) or (-2,2))	Following stock market fluctuations	A coordinate plane is a way to locate points in a plane. To draw a coordinate plane, draw a horizontal number line and a vertical number line with the two lines intersecting in a right angle at 0 on each line. The horizontal number line is called the *x-axis* or the *horizontal axis*. The vertical number line is called the *y-axis* or the *vertical axis*. Any point on a coordinate plane may be named with two numbers. These two numbers are called *coordinates*. The pair is always named in order — i.e., first *x* (the location along the *x*-axis), then *y* (the location along the *y*-axis) — and the pair is represented (*x*, *y*). When plotting a point, start at the origin (0, 0) and let the *x*-coordinate indicate how far to move horizontally. Then let the *y*-coordinate indicate how far to move vertically. The quadrants of a coordinate plane are the four regions created by the two intersecting perpendicular number lines. Quadrants are named in counterclockwise order. The signs on the ordered pairs for quadrant I are (+,+); for quadrant II, (–,+); for quadrant III, (–, –); and for quadrant IV, (+,–).
b.	Read and interpret **points** in any of the **quadrants**	Discussing charted rainfall amounts	
c.	Plot **points** in all four **quadrants**	Plotting trends	

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Algebra

The focus of instruction in the Level 4 **Algebra** strand is on developing the ability to use algebraic concepts and terms appropriately to solve one-step equations.

Standard 4.10.1 The adult student will analyze the structure of numerical and geometric patterns (how they repeat or grow) and express the relationship.

	Benchmark	Applications	Instructor Notes
a.	Compare and contrast repeating and growing **patterns**	5, 10, 15, 20 … (repeating) 1, 2, 4, 7, 11, 16 … (growing)	The simplest types of patterns are repeating patterns. In such patterns, students need to identify the basic unit of the pattern and repeat it. 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 both in numerical and geometric formats. Strategies to recognize and describe the differences between terms in numerical patterns include, but are not limited to, examining the change between consecutive terms, looking for prime numbers, and finding common factors. An example is the pattern 1, 2, 4, 7, 11, 16, …. In geometric patterns, students must often recognize transformations of a figure. Strategies to recognize and describe geometric patterns include, but are not limited to, examining flips, slides, turns, growth, and symmetry. Rotation (turn) is the result of turning a figure around a point or a vertex. Translation (slide) is the result of sliding a figure in any direction within a plane. Dilatation (scale increase or decrease) is the result of enlarging or shrinking a figure by a scale amount. Reflection (flip) is the result of flipping a figure over a line.
b.	Discover and continue **patterns** in an **in-out table**	Predicting outcomes	
c.	Use words, **tables**, **graphs** or a mathematical sentence to express relationships found in **patterns** and **sequences**		

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Standard 4.10.2 The adult student will read aloud, write and solve simple algebraic expressions and numerical sentences (equations) using addition, subtraction, multiplication or division with problems that represent verbal situations.

	Benchmark	Applications	Instructor Notes
a.	Identify examples of **expressions**, **equations**, **variables**, **terms** and **coefficients**	Helping a child with algebra homework	*Expression* is a word used to designate any symbolic mathematical phrase that may contain numbers and/or variables. Expressions do not contain an equal sign An *equation* is a mathematical sentence stating that two expressions are equal. A one-step linear equation is an equation that requires one operation to solve. A *variable* is a symbol (placeholder) used to represent an unspecified member of a set. A *term* is a number, variable, product, or quotient in an expression of sums and/or differences. In $7x^2 + 5x - 3$, there are three terms, $7x^2$, $5x$, and 3. A *coefficient* is the numerical factor in a term. For example, in the term $3xy^2$, 3 is the coefficient; in the term x, 1 is the coefficient.
b.	**Evaluate expressions** and solve one-step **linear equations** in one **variable** using **order of operations**, <u>excluding</u> **parentheses** and **exponents**		
c.	Demonstrate the steps for using **inverse operations** to solve simple **equations**	Preparing for further study in algebra or higher math	The inverse operation for addition is subtraction, and the inverse operation for multiplication is division. In an equation, the equal sign indicates that the value on the left is the same as the value on the right. To maintain equality, an operation that is performed on one side of an equation must be performed on the other side.
d.	Use **substitution** to check solutions of **equations**, including **formulas**	Taking a multiple-choice test when seeking employment	

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Standard 4.10.3 The adult student will demonstrate an understanding of squares and square roots.

	Benchmark	Applications	Instructor Notes
a.	Identify **perfect squares** between 0 -144	Determining the length of a square space given its area	Perfect squares are the numbers that result from multiplying any whole number by itself (e.g., $36 = 6 \times 6$). A square root of a number is a number which, when multiplied by itself, produces the given number (e.g., the square root of 49 is 7 since $7 \times 7 = 49$).
b.	Identify the two consecutive whole numbers between which the **square root** of any whole number from 0 -144 lies	$\sqrt{30}$ lies between 5 and 6 since $5^2 = 25$ and $6^2 = 36$	The square root of a perfect square is an integer. The square root of a non-perfect square lies between two consecutive integers.
c.	Analyze and describe **patterns** for powers of 10 (e.g., $10^1 = 10$, $10^2 = 100$, $10^3 = 1{,}000$, $10^4 = 10{,}000$, etc.)	Understanding scientific notation	When multiplying tens together, the product is called a "power of 10." The numbers 1, 10, 100, 1000, and 10,000 are powers of 10. A power of 10 can be expressed with an exponent. The exponent gives the number of times that 10 is a factor, i.e., $10 \times 10 \times 10 = 10^3$. Patterns in place-value charts provide visual meaning of exponents: $10^3 = 1000$, $10^2 = 100$, $10^1 = 10$.

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