Massachusetts Adult Basic Education

Curriculum Framework

For

Mathematics and Numeracy

Massachusetts Department of Education
Adult and Community Learning Services
October, 2005

TABLE OF CONTENTS

Acknowledgments

Special thanks are due to the team who have contributed to the development of the Massachusetts ABE Curriculum Framework for Mathematics and Numeracy over the past number of years:

Patricia Donovan*
Barbara Goodridge*
Robert Foreman
Roberta Froelich*
Esther D. Leonelli*
Andrea (Drey) Martone
Marilyn Moses*
Jenifer Mullen*
Mary Jane Schmitt*
Jane Schwerdtfeger
Ruth Schwendeman*
Judith Titzel

* Denotes members of the original Math Curriculum Framework Development Team

In addition, we would like to recognize the ABE practitioners, students, business representatives, and other stakeholders from across the Commonwealth who shared their valuable time and talent through developmental working groups, field trials, and revisions that were essential in bringing the ABE Curriculum Framework for Mathematics and Numeracy to the level of quality that is reflected in this edition.

Introduction

The Development of the Massachusetts ABE Curriculum Framework for Mathematics and Numeracy

Over the past number of years, several initiatives have set the stage for writing the Massachusetts ABE Curriculum Frameworks for Mathematics and Numeracy.

The First Version: Changing the Way We Teach Math

In 1989, the National Council of Teachers of Mathematics (NCTM) published the *Curriculum and Evaluation Standards for School Mathematics*, a document that served as a template for reforming and improving K-12 mathematics education across the nation. In 1994, sixteen Massachusetts ABE/GED teachers formed a team and studied the Massachusetts K-12 standards to see how some of the ideas might play out in their adult education classrooms. After a year of action research in their classes, these teachers published two documents: a set of adult education math standards and stories of what changes looked like in their classrooms. Their adult math standards were incorporated into the *Massachusetts ABE Math Standards* (1995) and were the first set of ABE frameworks to hit the press. As such, they served as an early template for the Massachusetts ABE Curriculum Frameworks in other subjects that were subsequently developed.

In 1996, in the wake of education reform and a national science and math initiative in the state (which included Adult Basic Education), the Massachusetts ABE Math Standards were subsumed into the document, *Massachusetts Curriculum Frameworks: Achieving Mathematical Power* (1996). This state curriculum framework was to be used for both grades K-12 and for Adult Basic Education. In 2000, when the Massachusetts K-12 frameworks were revised, it was decided that the adult education math framework should be rewritten and revised, and developed as a separate document. This current version of the *Massachusetts ABE Mathematics Curriculum Frameworks* is a second revision of that first framework, but it is heavily influenced by developments in the adult education field since then, both nationally and internationally.

National Influences: The Adult Numeracy Frameworks and Equipped for the Future

In March 1994, the first national Conference on Adult Mathematical Numeracy, co-sponsored by the National Council of Teachers, the National Center on Adult Literacy (NCAL), and the U.S. Department of Education/Office of Vocation and Adult Education, brought policy makers, researchers, publishers, and practitioners together to discuss the issues of adult numeracy needs and mathematical education. Out of this conference came at least two significant events: the formation of the Adult Numeracy Network (ANN), a national network of practitioners, and the development of the "honest list: what math we should be teaching adults."

In October 1995, the ANN was granted one of eight planning grants for system reform and improvement, funded by the National Institute for Literacy as part of the Equipped for

the Future (EFF) project. Over the course of a year, through teacher-led focus groups of learners, business, and other state policy stakeholders in five states (including Massachusetts), and an on-line virtual study group, the ANN expanded upon the "honest list" developed from the conference. The teacher teams studied, among other documents, the teacher-developed Massachusetts ABE math standards, the report of the Secretary's Commission on Achieving Necessary Skills (SCANS, 1991), and Equipped for the Future. Out of their research and focus groups, the teams developed seven themes which serve as the foundation for adult numeracy standards: Relevance/Connections, Problem-Solving/Reasoning/Decision-Making, Communication, Number and Number Sense, Data, Geometry: Spatial Sense and Measurement, Algebra: Patterns and Functions. In 1996, they published *A Framework for Adult Numeracy Standards: The Mathematical Skills and Abilities Adults Need to be Equipped for the Future* (1996).

As a result of this work, mathematics was included in the *Equipped for the Future Content Standards: What Adults Need to Know for the 21st Century* (Stein, 2000), a framework for adult instruction that is grounded in data gathered from adults on their roles as workers, parents, and community members. Of the sixteen EFF standards, one specifically addresses numeracy or mathematics: listed under Decision-Making Skills, it is *Use Math to Solve Problems and Communicate*.

International Influences: Looking at Adult Numeracy

In addition to studying state and national mathematics curriculum frameworks, the ABE Math Frameworks 2001 Development Team considered several numeracy frameworks from other countries, including Australia, the United Kingdom, and the Netherlands, as well as the numeracy framework developed for the Adult Literacy and Lifeskills Survey (ALL), an international, large-scale comparative survey of basic skills in the adult populations of participating countries.

The term *numeracy* is a word that was first used in 1959 in Great Britain and is used more often internationally than in this country. Numeracy has been described as the mirror image of *literacy* (Crowther Report, 1959) and is often thought to deal just with "numbers." But since the 1980's, work by adult educators in Australia, the UK, and other countries, has expanded the notion that *numeracy* refers just to the ability to perform basic calculations. For example, in the Australian curriculum frameworks, *numeracy* denotes the ability to perform a wider range of math skills, such as measuring and designing, interpreting statistical information, and giving and following directions, as well as using formulas and other advanced topics to pursue further knowledge. Moreover, numeracy and literacy are presented as interconnected and on an equal footing. The frameworks are written so as to address the *purposes* for learning mathematics and do not proceed from a school-based mathematics curriculum model so much as looking at the mathematics that is used in the context of adult lives. The Massachusetts ABE Curriculum Frameworks for Mathematics and Numeracy incorporate some of these ideas in the current revision.

What is Numeracy? A Definition of Numerate Behavior

For purposes of this framework, the following definition is incorporated for describing *numeracy* and what it means to be a *numerate* adult:

Numerate behavior involves:

Managing a situation or solving a problem in a real context
everyday life
work
societal
further learning

by responding
identifying or locating
acting upon
interpreting
communicating about

to information about mathematical ideas
quantity and number
dimension and shape
pattern and relationships
data and chance
change

that is represented in a range of ways
objects and pictures
numbers and symbols
formulae
diagrams and maps
graphs
tables
texts

and requires activation of a range of enabling knowledge, behaviors, and processes.
mathematical knowledge and understanding
mathematical problem-solving skills
literacy skills
beliefs and attitudes.

Source: Gal, I., van Groenestijn, M., Manly, M., Schmitt, M.J., and Tout, D. (1999). *Adult Literacy and Lifeskills Survey Numeracy Framework Working Draft*. Ottawa: Statistics Canada.

How to use This Document (Teacher's Guide)

The Mathematics Frameworks presents four learning strands: *Number Sense; Patterns, Functions, and Algebra; Statistics and Probability; Geometry and Measurement* which are described beginning on page 16 (in the Section on Content Strands and Learning Standards.) In order to present a document that makes sense practically, as well as theoretically, the Outline of Learning Levels on page 21 presents each of the strands and their standards at six performance levels:

- Level 1: Beginning Adult Numeracy
- Level 2: Beginning ABE Mathematics
- Level 3: Intermediate ABE Mathematics
- Level 4: Pre-GED/ABE Mathematics
- Level 5: ASE/GED Mathematics
- Level 6: ASE/Bridge to College Mathematics

At each level the strands are given in a chart, as shown below.

Level ⇒**Level 1: Beginning Adult Numeracy**

Strand ⇒ **Number Sense**

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to:

Standard ⇒

Benchmark ⇒

Assessment (See page 10) ⇒

Standard 2P-3. Recognize and use algebraic symbols to model mathematical and contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
2P-3.4 Read and understand positive and negative numbers as showing direction and change. *Assessed by 3P-3.7*	2P-3.4.1 Know that *positive* refers to values greater than zero 2P-3.4.2 Know that *negative* refers to values less than zero 2P-3.4.3 Use a horizontal or vertical number line to show positive and negative values	Reading thermometers Riding an elevator below ground level Staying "in the black" or going "into the red" on bill paying
2P-3.5 Use a number line to represent the counting numbers.	2P-3.5.1 Demonstrate an understanding that a horizontal number line moves from left to right using lesser to greater values	Reading and interpreting scales

⇑ **Enabling skill** ⇑ **Application**

Benchmark Column (e.g. At this level an adult will be expected to:)

Benchmarks describe the set of skills learners need to develop and achieve in order to meet the more broadly stated standards. By providing more detailed information on the specific skills and contexts for learners to meet the standard, benchmarks show teachers and learners what a standard "looks like" at each of the six levels.

The strands and standards are arranged by performance levels so that each level can build on the previous ones. At each level, the four strands and their standards are outlined with the skills appropriate for that level. **The skills defined at each level are ones to be achieved while working through the level.** The teacher can use the frameworks as a curriculum guide. Each level builds on the previous levels, so it is recommended that teachers familiarize themselves not only with the level of their own class, but with the preceding levels as well.

Enabling Knowledge and Skills Column

The study of mathematics is developmental, but many adult learners have gaps in their learning of math. At times a learner may struggle with a skill because he or she has not grasped an enabling skill on which it is based. To present problems and practice with a skill, we must first lay the proper groundwork. Since not all adult education teachers have experience teaching math at an elementary level, the skills needed for the development of each performance skill are outlined.

Examples of Where Adults Use It Column

Teaching mathematics to adults is different than teaching it to children. As stated in the Common Chapters for the Massachusetts Adult Basic Education Curriculum Frameworks, "Adult learners value education and the power it has, but they rarely see it as an end in and of itself. Rather, education is seen as a means to other kinds of opportunities and achievements."[1] Adult learners need to know that what they are learning in the classroom is relevant to the lives and goals outside of the classroom. For this reason, we have included an application for each skill by giving an example of using the skill in an adult context.

It is our expectation that this format will be a useful tool for:

- Lesson planning
- Curriculum development
- Presenting practical applications for adult use of the math skills
- Assessing student math levels for placement, informal classroom instruction, and for pre- and post-test assessment
- Connecting pre- and post-test assessment to curriculum and instruction

The standards and benchmarks for each level are ambitious. They set the bar to be reached by learners, not the expectation of what is covered in a given class in a given year.

[1] Common Chapters for the Massachusetts Adult Basic Education Curriculum Frameworks, page 10 (*Who are Adult Education Students?*)

However, the Framework does assume that the teaching of numeracy and mathematics be given a significant amount of time and attention in a program's class offerings and curriculum.

Mathematical understanding progresses from the concrete (counting two groups of blocks) to the representative (adding numbers presented in pictorial or verbal problems) to the abstract (using symbols and graphs). Presenting adults with problems or situations that allow them to develop their own approach to an inquiry model gives learners opportunities to talk about, write about, and represent math situations. During such inquiry, a learner can experience this progression in his or her own thinking. This affords an opportunity to see interconnections within math and between math and other disciplines.

The numbering system used with the Standards and benchmarks was developed so the specific benchmarks or enabling skills can be referred to (e.g. in a lesson plan, curriculum, or scope and sequence). In the number 2P-3.4.1, for example, the system is as follows:

- **2** refers to the Proficiency Level 2
- **P-** refers to the Strand, Patterns, Functions and Algebra (N for Number Sense, and so on)
- **3** refers to the Standard *(Recognize and use algebraic symbols to model mathematical and contextual situations)*
- **4** refers to the Benchmark *(Read and understand positive and negative numbers as showing direction and change)*
- **1** refers to the Enabling Knowledge and Skills **(***Know that* positive *refers to values greater than zero)*

How to use This Document in Connecting Curriculum, Instruction, and Assessment

The University of Massachusetts Center for Educational Assessment, working with the Adult and Community Learning Services of the Massachusetts Department of Education, has developed an assessment to measure adult learners' skills as outlined in the Massachusetts ABE Curriculum Framework for Math and Numeracy.

The ABE Curriculum Framework for Math and Numeracy is not an end in itself but a part of the broader goal of aligning curriculum, instruction and assessment. To this end, Adult and Community Learning Services and ABE practitioners have worked closely with the University of Massachusetts' Center of Educational Assessment to develop a math and numeracy assessment that is designed to measure the skills outlined in the Framework. This assessment will be capable of measuring more accurately and capturing more comprehensively, the skills that adult learners have acquired or need to acquire through the instruction provided in adult basic education classes. Both the ABE Curriculum Framework

for Math and Numeracy and the results of the new math assessment are valuable tools that should be used to inform classroom instruction.

The Frameworks provide teachers with Standards, Benchmarks and Examples that describe what it is adult learners need to know and be able to do, while the new math assessment will help identify how well students are acquiring the skills and knowledge as well as their ability to apply the skills and knowledge outlined in the Frameworks. By using the Frameworks and assessment results to inform instruction, programs and teachers can achieve the goal of aligning curriculum, instruction and assessment.

The skill numbers in the frameworks directly correspond with the skill numbers on the math test. The skills within each level are assessed at <u>that</u> level unless otherwise noted as shown in the example on page 8, and below.

	At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
Skill ⇒	2P-3.4 Read and understand positive and negative numbers as showing direction and change	2P-3.4.1 Know that *positive* refers to values greater than zero	Reading thermometers Riding an elevator below ground level
Assessment ⇒ (See page 11)	***<u>Assessed by 3P-3.7</u>***	2P-3.4.2 Know that *negative* refers to values less than zero	Staying "in the black" or going "into the red" on bill paying
		2P-3.4.3 Use a horizontal or vertical number line to show positive and negative values.	

The math frameworks endeavor to expose students at all levels to the four strands: N-*Number Sense;* P-*Patterns, Functions, and Algebra;* S-*Statistics and Probability; and G-Geometry and Measurement* with the realization that some material introduced at one level might need to be expanded on in a later level. For this reason, there is overlap between the levels. Positive and negative numbers, for example, may be discussed with basic applications at Level 2, but the learner will not be expected to demonstrate knowledge and skill with the topic until Level 3 as shown above with the reference to 3P-3.7

Adult learners come to our classes with a wide range of prior learning, but often they have gaps in their knowledge. A student who is well-read may be familiar with interpreting graphs and tables, but struggle to understand the principles of area and volume relating to home decor. Some adults who are very capable with computation may have developed a mental block against algebraic notation. The Frameworks, therefore; encourages multi-level exploration within the classroom while more clearly defining skills to be demonstrated at each assessment level.

Core Concepts

Adults develop numeracy skills and mathematical fluency through actions involving problem solving, reasoning, decision-making, communicating and connecting in curriculums that link to their own mathematics knowledge, experiences, strategies and goals. Fluency is enhanced by instruction that requires learners to strive for a constant interplay of accuracy, efficiency and flexibility in their work.

Problem solving is an important key to independence for adults. Problem solving enables learners to:

- reach their own solutions,
- generalize problem solving strategies to a wide range of significant and relevant problems,
- use appropriate problem solving tools including real objects, calculators, computers, and measurement instruments.

Mathematical reasoning provides adults with access to information and the ability to orient themselves to the world. It enables learners to:

- validate their own thinking and intuition,
- pose their own mathematical questions,
- evaluate their own arguments, and
- feel confident as math problem solvers.

Success as an adult involves decision-making as a parent, citizen and worker. **Mathematical decision-making** enables learners to:

- determine the degree of precision required by a situation,
- define and select data to be used in solving a problem, and
- apply knowledge of mathematical concepts and procedures to figure out how to answer a question, solve a problem, make a prediction, or carry out a task that has a mathematical dimension.

The ability to communicate mathematically means having an expanded voice and being heard in a wider audience. **Mathematical communication** enables learners to:

- interact with others,
- define everyday, work-related or test-related mathematical situations using concrete, pictorial, graphical or algebraic methods,
- reflect and clarify their own thinking about mathematical outcomes, and
- make convincing arguments and decisions based on discussion and reflection.

Connecting everyday life with mathematics helps adults access essential information and make informed decisions. **Mathematical connections** enable the learner to:

- view mathematics as an integrated whole that is connected to past learning, the real world, adult life skills, and work-related settings, and
- apply mathematical thinking and modeling to solve problems that arise in other disciplines, as well as in the real world and work-related settings.

The thinking skills of **accuracy, efficiency and flexibility** are essential tools for success in a rapidly changing world. In mathematics, such fluency enables the learner to:

- develop a sense of the appropriate ballpark for a solution,
- be able to keep track of how a solution is reached,
- develop the practice of double-checking results,
- use robust strategies that work efficiently for solving different kinds of problems, and
- take more than one approach to solving a class of problems.

Guiding Principles

The Guiding Principles summarize a broad vision of adult numeracy that guides all instructional efforts. They address the specific and unique characteristics of both the subject of math and the adult mathematics learner.

Curriculum: A real life context for mathematical concepts and skills across mathematical content areas is the driving force behind curriculum development. Within that setting, mathematics instruction transcends textbook-driven computation practice to include experiences in understanding and communicating ideas mathematically, clarifying one's thinking, making convincing arguments, and reaching decisions individually and as part of a group.

Assessment: Mathematical assessment occurs in a framework of purposes for learning relevant to the successful performance of a variety of everyday adult mathematical tasks and the pursuit of further education. Learners are active partners in identifying these purposes, in setting personal learning goals, and in defining measures of success.

Equity: Adult numeracy learners at every level of instruction have access to all mathematics domains (number sense, patterns, relations and functions, geometry and measurement, probability and statistics).

Life Skills: Adult mathematics literacy education strives to create instruction that helps learners become less fearful and more confident in tasking risks, voicing their opinions, making decisions, and actively participating in today's world.

Teaching: Mathematics instruction mirrors real-life activity through the use of both hands-on and printed instructional materials, group as well as individual work, and short-term and long-term tasks.

Technology: Adult numeracy instruction offers all learners experience with a broad range of technological tools (such as calculators, rulers, protractors, computer programs, etc.) appropriate to a variety of mathematical settings.

Habits of Mind

Habits of Mind are practices that strengthen learning. In numeracy instruction, habits of mind involve reflection, inquiry and action. They are developed by teachers and programs that offer challenging mathematical tasks in settings that support learners' curiosity, respect for evidence, persistence, ownership, and reflection about what is learned and how it is learned. These habits flourish in instructional environments that favor uncovering mathematical concepts and connections rather than mimicking algorithms.

The following chart defines the habits of mind crucial to adults' numeracy development. It also lists questions students and teachers may share to assess their own mathematical habits.

Habits of Mind	
Habit	**Learner Question**
Curiosity A curious and open attitude towards the presentation of new ideas or ways of approaching problems, even when confusion arises, facilitates learning.	Do I ask "Why," "How," or "What If" questions?
Respect for Evidence To evaluate reasoning, it is essential to see evidence. Reasoning is demonstrated by the appropriate use of verbal and visual mathematical evidence to support solutions and ideas.	Do I listen carefully for others' use of evidence, and do I include evidence to support my solutions and ideas?
Persistence Solutions in mathematics are not always apparent at first glance. Persistence is necessary to work through challenging problems that stretch our understanding.	Do I keep going when I feel lost or discouraged while solving problems?
Ownership What we own has meaning for us, and taking ownership of our work encourages us to do our best. Although someone else might assign a mathematical task to us, we must treat the problem as important to us, as though it was our own, if we are to produce high quality work and learn from experience.	In what ways do I show that my work is purposeful and important to me?
Reflection To become an autonomous learner, it is necessary to think about how our learning happens. We need to consider how we learn from mathematical experiences.	Do I notice and analyze how and what I learn?

Content Strands and Learning Standards

Following is a chart that outlines the content strands and learning standards for the Mathematics and Numeracy curriculum framework. After this chart, you will find a more detailed explanation of each content strand and the learning standards that go along with it.

Strands	**Standards** *Learners will demonstrate the ability to…*
Number Sense	N-1 Represent and use numbers in a variety of equivalent forms in contextual situations

	N-2 Understand meanings of operations and how they relate to one another N-3 Compute fluently and make reasonable estimates
Patterns, Functions and Algebra	P-1 Explore, identify, analyze, and extend patterns in mathematical and adult contextual situations P-2 Articulate and represent number and data relationships using words, tables, graphs, rules, and equations P-3 Recognize and use algebraic symbols to model mathematical and contextual situations P-4 Analyze change in various contexts
Statistics and Probability	S-1 Collect, organize, and represent data S-2 Read and interpret data representations S-3 Describe data using numerical descriptions, statistics, and trend terminology S-4 Make and evaluate arguments and statements by applying knowledge of data analysis, bias factors, graph distortions, and context S-5 Know and apply basic probability concepts
Geometry and Measurement	G-1 Use and apply geometric properties and relationships to describe the physical world and identify and analyze the characteristics of geometric figures G-2 Use transformations and symmetry to analyze mathematical situations G-3 Specify locations and describe spatial relationships using coordinate geometry and other representational systems G-4 Understand measurable attributes of objects and the units, systems, and processes of measurement and apply appropriate techniques, tools, and formulas to determine measurements

The Strand Number Sense

Number Sense is the foundation of numeracy. Sound number sense enables us to interpret and represent the world in which we live. It is evident in all we do, whether in complex examples such as the Gross National Product, basic issues such as the family budget, or as personal as a blood pressure reading. Mathematical intuition grows with a strong basic understanding of numbers and, with that, our ability to do mathematical problem solving.

To be efficient workers or consumers in today's world, adults must have a strongly developed conceptual understanding of arithmetic operations, as well as the procedural knowledge of computation and number facts. They must be able to perceive the idea of place

value and be able to read, write, and represent numbers and numerical relationships in a wide variety of ways. Simple paper-and-pencil computation skills are not enough. Adults must be able to make decisions regarding the best method of computation (mental math, paper-and-pencil, or calculator/computer) to use for a particular situation. Knowledge of numbers, operations and computation must include both a well-developed number sense and the ability to use basic mathematics-related technologies.

Number sense promotes accuracy in estimation and flexibility and efficiency in mental math. While calculators and computers are used to do most of the complex computations in today's world, the ability to estimate is critical for lifelong learners. Adults use informal measurements in life skill activities such as cooking, shopping, buying clothes, or estimating the time required for daily tasks. Estimation is a valuable skill for checking the reasonableness of computation or accuracy in problem solving, and is an aid in timed-test situations such as the GED. It builds on adult experience and knowledge. Good estimators use a variety of strategies and techniques for computational estimation that can be explored and shared by learners.

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to:

- Standard N-1. Represent and use numbers in a variety of equivalent forms in contextual situations,
- Standard N-2. Understand meanings of operations and how they relate to one another, and in
- Standard N-3. Compute fluently and make reasonable estimates.

The Strand Patterns, Functions, and Algebra

Mathematics has been defined as the study of patterns. Learning to recognize, analyze, describe, and represent patterns and number relationships connects math to the world and helps us to appreciate fully the intrinsic value of such pleasures as poetry, art, music, and science. Math concepts formerly taught only in basic algebra courses are increasingly part of the culture and vocabulary of modern life. Headlines and news reports speak of exponential growth of the national debt, a variable rate mortgage, or a balanced budget, while medical literature uses terms like "HIV-positive," or "RH-negative."

Being able to see and use patterns has been identified as a fundamental skill needed for developing mathematical understanding. The Patterns, Functions, and Algebra strand is positioned after the Number Sense strand because of the importance of building pre-number skills such as patterning which, in turn, enable adult learners to learn multiplication tables and number relationships necessary for efficient and fluent computation skills. The strand also encompasses skills that are necessary for developing concepts in the Data and Geometry and Measurement strands.

Algebra serves as a bridge between arithmetic and more broadly generalized mathematical situations. These generalizations can be expressed in words, tables and charts, the notation of formulas, and graphs. Life experience has afforded adult basic education learners with a broad base of real-world ties that can be readily linked to the concepts of equation, function, variable, and graph. From baby formulas to chemical formulas, algebra offers a succinct way to define real-world situations that can aid adults in the home and in the workplace.

Algebra impacts the competency of workers, parents and citizens, and algebraic thinking skills are crucial if adults are to compete in the global economy. Workplace skills requiring competencies in "information," "systems," and "technology" stress the need for organizing, interpreting and communicating information and employing computers as a tool for those tasks, as well as the ability to "discover a rule or principle underlying the relationship between two or more objects and apply it in solving a problem." Identifying and expressing pattern, relation and function are the algebraic skills imbedded within these competencies.

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to:

- Standard P-1. Explore, identify, analyze, and extend patterns in mathematical and adult contextual situations,
- Standard P-2. Articulate and represent number and data relationships using words, tables, graphs, rules, and equations,
- Standard P-3. Recognize and use algebraic symbols to model mathematical and contextual situations, and
- Standard P-4. Analyze change in various contexts.

The Strand Statistics and Probability

The Statistics and Probability strand links numeracy and literacy learning. Numbers, logical reasoning, and texts interweave to describe phenomena visually, numerically and verbally in what we term *data*, which is the heart of this strand.

Data is a wide-ranging topic that touches on many areas of academic study and tells us much about our world. For instance, we learn about preferences, predilections and group characteristics when we read and interpret data. We learn about the power of evidence as we develop the skills to make statements and evaluate arguments based on data. We learn the power of the question and the framer of the question when we collect and represent data, and we learn that sometimes true, sometimes false, pictures are created when we compress data into statistics. Data is a powerful descriptive tool.

So powerful is data that agencies of authority often use it to generate, promote and, sometimes, evaluate decisions. Citizens, therefore, must understand the ways of data in order to exercise their collective and individual intelligence by responding to the expanding presence of this dense expression of information.

The learning standards in the Statistics and Probability strand provide adult learners with the tools for dealing with data.

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to:

- Standard S-1. Collect, organize and represent data,
- Standard S-2. Read and interpret data representations,
- Standard S-3. Describe data using numerical descriptions, statistics and trend terminology,
- Standard S-4. Make and evaluate arguments or statements by applying knowledge of data analysis, bias factors, graph distortions and context, and
- Standard S-5. Know and apply basic probability concepts

The Strand Geometry and Measurement

Geometry and measurement help us represent in an orderly fashion what we see in our world. Whether we are cooking or cartooning, shopping or shipping, painting a canvas or a wall, designing an addition for a house or a play yard for preschool, we continually bump up against these mathematical organizers. Lifelong learners should know and understand these interconnected and symbiotic mathematical domains.

Adult learners who attend basic mathematics classes at any level share a wealth of pragmatic experience surrounding geometric and spatial concepts. They have probably built

a bookcase, laid out a garden, applied wallpaper or tiled a floor, all the while discovering informally the rules which formally govern the study of geometry itself

Geometry and measurement often spark a renewed interest in mathematics for those students who have been turned off for some reason or heretofore have felt unsuccessful with mathematics learning. Investigating problems that involve geometry and measurement broadens all students' mathematical understanding and engages them as they explore mathematical ideas.

Hands-on, interactive investigations using nonstandard and standard units help adult basic education students develop an understanding of the many measurable attributes of physical objects. Measurement sense including length, time, temperature, capacity, weight, mass, area, volume, and angle will benefit from this approach. This realistic approach helps build an accessible measurement vocabulary and a meaningful comprehension of what it means to measure.

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to:

- Standard G-1. Use and apply geometric properties and relationships to describe the physical world and identify and analyze the characteristics of geometric figures,
- Standard G-2. Use transformations and symmetry to analyze mathematical situations,
- Standard G-3. Specify locations and describe spatial relationships using coordinate geometry and other representational systems,
- Standard G-4. Understand measurable attributes of objects and the units, systems, and processes of measurement and apply appropriate techniques, tools and formulas to determine measurements.

Outline of Learning Levels

Level 1. Beginning Adult Numeracy

See "How to Use This Document (Teacher's Guide) and (Connecting Curriculum, Instruction and Assessment)," pages 8-10.
At this time, the Massachusetts ABE Test for Math does not assess students' knowledge at Level 1.

Strand: Number Sense

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 1N-1. Represent and use numbers in a variety of equivalent forms in contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
1N-1.1 Count reliably forward and backward up to 20 items.	1N-1.1.1 Demonstrate an understanding that if items are rearranged, the numbers stay the same 1N-1.1.2 Count forward and backward from ten or less 1N-1.1.3 Count forward and back from 11-20	Counting children in a group to make sure no one is missing Counting dollar bills to pay for a purchase Counting items at the grocery express line Using the remote channel tuner for a TV Watching a digital timer on a microwave count down the time
1N-1.2 Recognize odd and even numbers up to 100.	1N-1.2.1 Demonstrate an understanding that even numbers represent amounts that can be paired 1N-1.2.2 Demonstrate an understanding that odd numbers represent amounts that when paired have one remaining	Identifying the number of possible couples at a dance or a dinner party Recognizing when house numbers go up in odd or even numbers Finding a room in a hospital or hotel
1N-1.3 Read, write, and compare numbers from 0 up to 100.	1N-1.3.1 Explain how the position of a digit signifies its value 1N-1.3.2 Demonstrate an understanding of directionality in reading numbers and comparisons from left to right. 1N-1.3.3 Explain what each digit in a two-digit number represents, including the use of zero as a place holder 1N-1.3.4 Distinguish between *greater than and less than,* and	Telling which address falls in a given block, knowing the first number on the block Writing a money order for a whole dollar amount (no change)

	recognize *between-ness* when comparing numbers	
1N-1.4 Using a 100 chart, skip count by 2's, 5's, and 10's.	1N-1.4.1 Know the multiples of 2, 5, and 10 to 100	Counting nickels and dimes Finding the amount of money in a small stack of $2, $5, or $10 bills

Standard 1N-2. Understand meanings of operations and how they relate to one another		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
1N-2.1 Demonstrate an understanding of different meanings of addition (e.g. counting on, combining) of numbers up to 20.	1N-2.1.1 Add by counting on (e.g. four objects plus three objects can be totaled by counting on three more than four (or five, six, seven), or counting on four more than three (or four, five, six, seven) Demonstrate an understanding that combining two amounts into one larger total is adding. 1N-2.1.2 Use objects, pictures, or tallies to show addition 1N-2.1.3 Demonstrate the ability to visualize grouping of objects	Paying a twelve dollar amount by using a ten dollar bill and two ones Figuring hours of work or sleep by using fingers to count Figuring hours of sleep by joining the hours slept before and after midnight
1N-2.2 Demonstrate an understanding of subtraction as taking away or separating from numbers up to 20.	1N-2.2.1 Subtract by counting back (e.g. taking away four of seven objects by counting back--six, five, four, three)	Figuring how much of $20 is left while paying out $14
1N-2.3 Demonstrate an understanding of how addition and subtraction relate to each other.	1N-2.3.1 Add back to check subtraction (e.g. 10 – 6 = 4, 6 + 4 = 10)	Making change (e.g. for a twenty dollar bill, by counting on from the price to $20)

Standard 1N-3. Compute fluently and make reasonable estimates		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
1N-3.1 Know all pairs of numbers with a total of 10.	1N-3.1.1 Combine amounts that add to 10 without having to count	Adding using mental math
1N-3.2 Add numbers with totals to 20.	1N-3.2.1 Use the operation of addition and related vocabulary (e.g., *add, sum of, total, plus,* etc.)	*Calculating* totals, e.g., five reams of paper in a full box plus three packs on the shelf
1N-3.3 Subtract single-digit numbers from numbers up to 20.	1N-3.3.1 Use the operation of subtraction and related vocabulary (e.g. *difference, take away, less than)* 1N-3.3.2 Know subtraction facts for pairs of numbers with totals to 10 (e.g. 10 – 6 = 4) 1N-3.3.3 Know how to add back to check subtraction (e.g. 10 – 6 = 4, and 6 + 4 = 10)	Working out the shortfall in numbers, e.g. eggs for a recipe, plants to fill a display tray, cups to serve visitors
1N-3.4 Double whole numbers to 10.	1N-3.4.1 Know doubles of numbers to 10	Finding the cost of tickets for an amusement ride for two children. Planning fare for round trip subway travel at $1 a token
1N-3.5 Finding half of whole numbers up to 20.	1N-3.5.1 Know doubles of numbers to 10 1N-3.5.2 Demonstrate the ability to separate amounts in two piles	Sharing the cost of pizza between two people.
1N-3.6 Use a calculator to check calculations using whole numbers.	1N-3.6.1 Identify the signs for addition, subtraction, equals 1N-3.6.2 Recognize the numerals 0 – 9 1N-3.6.3 Demonstrate an understanding of the order to key in numbers and operators 1N-3.6.4 Demonstrate the ability to clear the display, and recognize that this should be done before starting a new calculation	Finding the total score for a card game Finding the total price of 3 items ordered from a menu Finding the change for a purchase

Strand: Patterns, Functions, and Algebra

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 1P-1. Explore, identify, analyze, and extend patterns in mathematical and adult contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
1P-1.1 Sort up to 20 objects or lists by color, shape, number, letter, or size.	1P-1.1.1 Identify attributes of objects and classify such as shape, size, number and/or size	Sorting laundry Sorting bottles for recycling facility Sorting telephone numbers by area code and figuring which are long distance calls Shelving stock
1P-1.2 Recognize and create simple repeating patterns (e.g. color, rhythmic, shape, number, and letter) and identify the unit being repeated.	1P-1.2.1 Count forward and back by 1's from 1 to 20 1P-1.2.2 Read and write whole numbers from 1 to 100 1P-1.2.3 Skip count by 2's, 5's, and 10's from 1 to 100 1P-1.2.4 Identify odd and even	Knowing on which side of the hall or street a room or a house is Counting pennies or 1 dollar bills Counting nickels or five dollar bills Counting things 2 at a time Counting dimes or 10 dollar bills Counting beats in music Designing a necklace and describing the assembly rule Laying tile on a floor

Standard 1P-2. Articulate and represent number and data relationships using words, tables, graphs, rules, and equations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
1P-2.1 Explore basic number relationships (e.g., find all the ways numbers to 10 can be written as sums).	1P-2.1.1 Know all pairs of numbers with totals to 10 1P-2.1.2 Decompose numbers into sums of smaller numbers 17 = 10 + 7 1P-2.1.3 Demonstrate an understanding that 2 + 3 and 3 + 2 yield the same sum; therefore, they are counted once in a list	Playing card games Preparing for further study

Standard 1P-3. Recognize and use algebraic symbols to model mathematical and contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
1P-3.1 Use and interpret +, -, and = to represent combining, taking away, and equivalence.	1P-3.1.1 Demonstrate recognition that + represents operations of combining 1P-3.1.2 Demonstrate recognition that - represents operations of separation 1P-3.1.3 Demonstrate recognition that = represents vocabulary such as: *is equal to, is the same as,* and *gives you.*	Using a four-function calculator to find the total whole dollar amount of a grocery bill Using a calculator to find how much change you get from a $20.00 bill Helping children with homework.
1P-3.2 Understand simple number sentences such as: 9 + 1 = 10 and ___ + 5 = 10 and 8 - 3 = ___ where the ___ represents a missing amount.	1P-3.2.1 Demonstrate an understanding that an underlined blank space represents a missing value in addition and subtraction equations	Helping children with homework. Test taking when seeking employment
1P-3.3 Make statements of inequality e.g.: 2 is less than 10 10 is greater than 8 99 is less than 100 $6 + 5 \neq 10$	1P-3.3.1 Explain that directionality of reading numbers and expressions moves from left to right	Helping children with homework Test-taking when seeking employment

Standard 1P-4. Analyze change in various contexts		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
1P-4.1 Describe qualitative change, such as lengthening or decreasing hours of daylight, or rising or falling of temperature over time.	1P-4.1.1 Observe physical change over time 1P-4.1.2 Compare changes which go up or increase with those which go down or decrease	Discussing weather patterns Describing seasons, daylight savings time, or tides

Strand: Statistics and Probability

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 1S-1. Collect, organize and represent data		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
1S-1.1 Gather data to answer posed questions.	1S-1.1.1 Demonstrate that observing and asking relevant questions and counting gathered responses can produce answers	Planning a neighborhood party Planning what kind of pizza or sandwiches to order for an employee luncheon
1S-1.2 Group objects or responses by a single criterion.	1S-1.2.1 Demonstrate an understanding of the concept of categories by grouping items by shape, size, color, or yes or no responses 1S-1.2.2 Know how to count each category for subtotals up to 20	Keeping track of who will or will not attend party Sorting stock by size

Standard 1S-2. Read and interpret data representations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
1S-2.1 Identify graphs in available resources.	1S-2.1.1 Explain how graph is a visual representation	Reading a graph in an ad or poster
1S-2.2 Extract simple information from a list or two-column table.	1S-2.2.1 Identify how lists can be ordered in different ways (e.g. alphabetically, numerically, or randomly) 1S-2.2.2 Make a 1-1 correspondence within a row in charts with two columns	Checking items against a stock list
1S-2.3 Read values on a bar graph up to 100.	1S-2.3.1 Skip-count by 2, 5, or 10 1S-2.3.2 Demonstrate an understanding and that the height of the bar is equal to the amount on the axis across from it	Reading a nutrition graph in a health poster
1S-2.4 Make comparative statements about relative values on a bar graph.	1S-2.4.1 Explain how comparative statements such as *greater than* or *less than* can be made based on the height of the bars	Conversing about information contained in newspapers and magazines
1S-2.5 Connect simple graphs and tables to arguments or statements.	1S-2.5.1 Demonstrate how to locate titles 1S-2.5.2 Explain that titles indicate subject matter	Reading a chart or graph in a health pamphlet.

Standard 1S-3. Describe data using numerical descriptions, statistics, and trend terminology		
Not applicable at this level.		
Standard 1S-4. Make and evaluate arguments and statements by applying knowledge of data analysis, bias factors, graph distortions, and context		
Not applicable at this level.		

Standard 1S-5. Know and apply basic probability concepts		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
1S-5.1 Discuss events as likely or unlikely.	1S-5.1.1 Develop an understanding 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 Making the call when flipping a coin

Strand: Geometry and Measurement

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 1G-1. Use and apply geometric properties and relationships to describe the physical world and identify and analyze the characteristics of geometric figures		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
1G-1.1 Recognize, name, describe and compare common basic 2-D shapes (square, circle, rectangle, triangle) using everyday language (straight, curved, etc.).	1G-1.1.1 Identify the names of shapes 1G-1.1.2 Demonstrate an understanding that shape is independent of size and orientation 1G-1.1.3 Show two triangles or two rectangles in different positions and sizes	Identifying things (e.g. a curved road, a straight highway, a rotary) Recognizing the shape and meaning of a triangular yield sign and other shapes in buildings and everyday structures
1G-1.2 Understand the conventions for naming a rectangle by its length and width.	1G-1.2.1 Demonstrate an understanding that the longer side is called the *length*. 1G-1.2.2 Demonstrate an understanding that the shorter side is called the *width*.	Purchasing window shades or coverings Describing a rectangular photo or frame; or a room size by its length and width

Standard 1G-2. Use transformations and symmetry to analyze mathematical situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
1G-2.1 Estimating where a line of symmetry falls in a basic shape.	1G-2.1.1 Demonstrate an understanding concepts of *sameness* or *half-ness* 1G-2.1.2 Divide a figure in half	Cutting a cake in half Folding objects

Standard 1G-3. Specify locations and describe spatial relationships using coordinate geometry and other representational systems		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
1G-3.1 Use the cardinal directions to describe where one location is relative to another.	1G-3.1.1 Know the convention that is *North* is the opposite direction from *South* and that *East* and *West* are opposite 1G-3.1.2 Explain the difference between vertical and horizontal	Reading a road sign or route sign which uses *north* or *south*, *east* or *west* Making a simple map with cardinal directions Locating offices, apartments that are labeled with cardinal directions
1G-3.2 Understand and use location prepositions and everyday language of position appropriately.	1G-3.2.1 Know the meaning of terms such as *left, right, bottom, top, down, up, behind, over, through,* etc.	Assembling a piece of furniture from a diagram Giving oral directions for getting from one place to another

Standard 1G-4. Understand measurable attributes of objects and the units, systems, and processes of measurement and apply appropriate techniques, tools, and formulas to determine measurements		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
1G-4.1 Show equivalent amounts of money using different bills and coins.	1G-4.1.1 Know coin & bill names and values	Getting out money to pay at the register Verifying change given at a store
1G-4.2 Read, record, and use date concepts in common formats.	1G-4.2.1 Know the months and corresponding numbers, days of week	Completing forms (birth date, etc.)
1G-4.3 Read, record, and understand time of the day.	1G-4.3.1 Count to 60 by 5's and 10's	Reading a bus schedule that uses AM and PM
1G-4.4 Read analog and digital clocks.	1G-4. 4.1 Demonstrate an understanding that each hour of digital time is read to 59 minutes	Looking at clock outside a bank and know if one is on time
1G-4.5 Compares familiar quantities, length, mass, capacity, time, temperature, using informal comparative language and methods (e.g. taller, heavier, smallest).	1G-4.5.1 Explain how the suffixes – *er, -est*, and *how, more, less,* and *too* will change the quantity	Sorting by size to organize a kitchen cabinet Understanding a child's growth chart
1G-4.6 Read a ruler to the nearest whole inch.	1G-4.6.1 Line up the edge of a ruler to measure an object	Measuring the length and width of photo
1G-4.7 Begins to develop personal reference points of measure (one's height, weight).	1G-4.7.1 Demonstrate a general recognition of common heights and weights for women, men and children	Give one's height or weight on a medical form
1G-4.8 Find the perimeter of rectangles up to 20 units.	1G-4.8.1 Know that the two lengths are of equal measure and the two widths are of equal measure 1G-4.8.2 Know that the perimeter of a rectangle is equal to the total of the four sides	Buying weather stripping Buying wood for a picture frame or baseboard Finding the length of fencing around a garden

Level 2: Beginning ABE Mathematics

See "How to use This Document (Teacher's Guide) and (Connecting Curriculum, Instruction and Assessment)," pages 8-10.

Strand: Number Sense

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 2N-1. Represent and use numbers in a variety of equivalent forms in contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
2N-1.1 Count, read, write, order, and compare two and three-digit numbers.	2N-1.1.1 Know that the position of a digit signifies its value 2N-1.1.2 Know what each digit in a three-digit number represents, including the use of zero as a place holder 2N-1.1.3 Count on or back in 10s or 100s starting from any two-digit or three-digit number, up to 1,000	Carrying out a stock inventory Finding items for an order from bin numbers Checking grocery receipt against purchases
2N-1.2 Distinguish between odd and even numbers up to 1,000.	2N-1.2.1 Recognize that even numbers end in 0, 2, 4, 6, or 8 2N-1.2.2 Recognize that odd numbers end in 1, 3, 5, 7, or 9	Telling which side of a street a house will be on from its number Knowing on what days lawn watering is permitted under rationing by odd or even house number
2N-1.3 Read, write, and compare halves and quarters of quantities.	2N-1.3.1 Know the words, *half, fourth* and the symbols 1/2, 1/4 2N-1.3.2 Demonstrate an understanding that 1/2 means one group or unit separated into 2 equal parts 2N-1.3.3 Demonstrate an understanding that two halves make one whole 2N-1.3.4 Demonstrate an understanding that 1/4 means one group or unit separated into 4 equal parts and that four quarters make one whole 2N-1.3.5 Demonstrate an understanding that two fourths and one half are equivalent	Sharing money or brownies
2N-1.4 Use 50% as equivalent for *one-half*.	2N-1.4.1 Understand that 100% represents the whole of something 2N-1.4.2 Understand that 50% means separating a set or dividing an amount into two equal parts	Buying something discounted at 50% off
2N-1.5 Skip count forward or	2N-1.5.1 Know the multiples of 2, 5, and 10	Checking two-sided copies

backward by 2's, 5's, or 10's.		for missing or out of order pages Counting five and ten dollar bills

Standard 2N-2. Understand meanings of operations and how they relate to one another		
2N-2.1 Demonstrate an understanding of different meanings of addition (counting on, combining) of two- and three-digit numbers.	2N-2.1.1 Know that adding can be done by counting on by ones, tens, or hundreds 2N-2.1.2 Demonstrate an understanding that when combining two amounts the total will be the same for 2 + 4 as for 4 + 2 (commutative property) 2N-2.1.3 Know that 4 + 2 + 3 gives the same total as 3 + 2 + 4 2N-2.1.4 Demonstrate an understanding that adding zero leaves a number unchanged	Paying an amount in the hundreds using ten dollar bills Checking totals by adding again in a different order. Figuring how many coffees are needed for a group that includes non-coffee drinkers
2N-2.2 Demonstrate an understanding of efficient and flexible strategies of subtraction of two and three digit numbers.	2N-2.2.1 Know that subtracting can be done by counting back by ones, tens, or hundreds 2N-2.2.2 Know that subtraction can be used to answer the questions: How much more or less? (Comparing) 2N-2.2.3 Demonstrate an understanding that subtracting zero leaves a number unchanged 2N-2.2.4 Demonstrate an understanding that having 4 and giving away 2 is not the same as having 2 and giving away 4. (Subtraction is not commutative)	Figuring out how much is left of an amount in the hundreds by counting back as ten dollar bills are paid out Balancing a checkbook Finding the difference between two distances or amounts.
2N-2.3 Demonstrate an understanding of how addition and subtraction relate to each other for numbers up to 1,000.	2N-2.3.1.1 Know how to add back to check, e.g. 10 – 6 = 4 because 6 + 4 = 10	Making change of whole dollar amounts by counting on from the price to the amount given
2N-2.4 Demonstrate an understanding of different meanings of multiplication of numbers up to 12 (repeated addition, grouping, and arrays).	2N-2.4.1 Know that multiplication is a shorter way to do repeated addition, (e.g. 3 × 4 = 3 + 3 + 3 + 3) 2N-2.4.2 Relate skip counting to multiplication 2N-2.4.3Know how to use multiplication to find groups of items numbering 2 – 12. 2N-2.4.4 Use area models to build arrays to show multiplication 2N-2.4.5 Use an area model to demonstrate distributive property by adding two rectangles (e.g. 8 × 12 = (8 × 10) + (8 × 2)	Checking delivery of goods in small batches Finding price of 2 cartons of milk or 6 bottles of soda. Calculating total number (e.g. three days a week for four weeks) Generating results using mental methods of multiplication when solving problems In shopping, when you

		buy 2 different items with different prices.
2N-2.5 Demonstrate an understanding of different meanings of division (separating into equal groups, discovering the number of equal groups contained within).	2N-2.5.1 Know that division is a shorter way to do repeated subtraction (e.g. $12 \div 4 = 3$ because $12 - 4 - 4 - 4 = 0$) 2N-2.5.2 Know how to find how many groups of a given number of items when given the total of items (e.g. . $6 \div 3$ means 6 candies shared by three people or 6 candies given (or dealt) 3 to each person 2N-2.5.3 Know that division means partitioning into groups of equal size 2N-2.5.4 Demonstrate an understanding of the concept that division is not commutative (e.g.. that $12 \div 4 \neq 4 \div 12$)	Working out how many cars are needed to transport a group of people Finding how many pairs of socks when given a total number of socks Finding how many dozens in a given amount of eggs (e.g. 24 eggs) Knowing that order of entry is critical when using a calculator to perform division
2N-2.6 Demonstrate an understanding of how multiplication and division of one and two digit numbers relate to each other.	2N-2.6.1 Demonstrate an understanding of the relation between doubling and halving 2N-2.6.2 Know how to multiply to check division (e.g., $12 \div 4 = 3$ because $3 \times 4 = 12$)	Generating the solution to a division problem by using guess and check with multiplying

Standard 2N-3. Compute fluently and make reasonable estimates		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
2N-3.1 Add two- and three-digit whole numbers flexibly, efficiently, and accurately.	2N-3.1.1Know how to align numbers in column addition 2N-3.1.2 Know that regrouping occurs when the total in a column exceeds 9 2N-3.1.3 Recall addition facts to 20 2N-3.1.4 Compose and decompose numbers to aid addition (e.g. 97 + 23 = 90 + 20 + 7 + 3) 2N-3.1.5 Demonstrate that there are different strategies for adding 2N-3.1.6 Demonstrate an understanding that there are different methods of checking answers (e.g. adding in a different order, using inverses, collecting 10's, and using a calculator) 2N-3.1.7 Estimate answers to addition	Calculating the production shortfall from a daily target Performing mental addition Verifying deposits in a checking account.
2N-3.2 Estimate to the nearest 10 or 100 in numbers up to 1,000.	2N-3.2.1 Know benchmark numbers of 5 and 50 are *halfway* in intervals of 10 and 100 (e.g. 35 is halfway between 30 and 40 and 250 is halfway between 200 and 300) 2N-3.2.2 Tell whether a number is greater than benchmark numbers of 5 and 50 2N-3.2.3 Demonstrate an understanding of rounding to the nearest 10 or 100 using algorithm	Estimating amount of purchase to nearest 10 dollars. Estimating distances between cities. Giving ballpark figures for numbers in a crowd.
2N-3.3 Subtract using two- and three-digit whole numbers flexibly, efficiently, and accurately.	2N-3.3.1 Know how to align numbers in column subtraction 2N-3.3.2 Know that "borrowing" is regrouping 2N-3.3.3 Recall subtraction facts to 20 2N-3.3.4 Estimate answers 2N-3.3.5 Compose and decompose numbers to aid subtraction (e.g. 107 - 83 = 100 - 80 + 7 – 3) 2N-3.3.6 Demonstrate an understanding of strategies or methods for subtraction such as borrowing or counting up	Performing mental subtraction

2N-3.4 Multiply two-digit whole numbers by numbers 1,2,3,4,5,10 and 11.	2N-3.4.1 Use doubling or repeated addition when multiplying by 2 or 4, e.g. To find 26 x 4, do 26 + 26, 52 + 52 2N-3.4.2 Demonstrate an understanding the operation of multiplication and related vocabulary (e.g. *multiplied by, times, lots of)* 2N-3.4.3 Recall multiplication facts (e.g. multiples of 2, 3, 4, 5, 10) 2N-3.4.4 Recognize two- and three-digit multiples of 2, 5, or 10 and three-digit multiples of 50 and 100 2N-3.4.5 Know that multiplication can be performed in any order, so that 2(3)(4) = 4(2)(3)	Calculating the total number of items in batches (e.g. 5 crates with 16 boxes to a crate)
2N-3.5 Know halves of even numbers up to 100.	2N-3.5.1 Double one- and two-digit numbers up to 50	Separating members into two groups
2N-3.6 Divide two-digit whole numbers by single-digit whole numbers.	2N-3.6.1 Demonstrate an understanding that division is the inverse of multiplication 2N3.6.2 Recall multiplication facts	Working out the number of cars needed to transport a group of people Finding the number of pairs that can form in class or on a dance floor
2N-3.7 Approximate by rounding to the nearest tens or hundreds in numbers up to 1,000.	2N-3.7.1 Demonstrate an understanding of place value for units, tens, hundreds	Rounding numbers to make approximate calculations
2N-3.8 Use a calculator to check calculations using whole numbers.	2N-3.8.1 Demonstrate an understanding of the order to enter a two-digit number 2N-3.8.2 Demonstrate an understanding of the order to key in numbers and operators 2N-3.8.3 Know how to clear the display and cancel a wrong entry	Performing any calculations at this level

Strand: Patterns, Functions and Algebra

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 2P-1. Explore, identify, analyze, and extend patterns in mathematical and adult contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
2P-1.1 Complete simple repeating number patterns up to 1,000 and identify the unit being repeated.	2P-1.1.1 Skip count forward or backward by 2's, 3's, 4's, 5's, and 10's	Seeing if pages are missing or out of order in a duplicating job Estimating how many exits there are on the highway
2P-1.2 Recognize and create repeating patterns and identify the unit being repeated.	2P-1.2.1 Isolate smallest unit of repetition	Laying tile on a floor Designing a tiled floor and describing the pattern Knitting

Standard 2P-2. Articulate and represent number and data relationships using words, tables, graphs		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
2P-2.1 Create tables to show the patterns inherent in addition and multiplication of number pairs from 0 to 12.	2P-2.1.1 Know addition and multiplication facts 2P-2.1.2 Recognize and extend patterns	Helping children with homework Preparing for further study

Standard 2P-3. Recognize and use algebraic symbols to model mathematical and contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
2P-3.1 Use and interpret +, -, ×, ÷, and = to represent combining, comparing, separating and equivalence. *Assessed by 2P-3.6*	2P-3.1.1 Demonstrate an understanding that + represents operations of combining 2P-3.1.2 Demonstrate an understanding that - represents operations of separation or comparison 2P-3.1.3 Demonstrate an understanding that × stands for combining multiples 2P-3.1.4 Demonstrate an understanding that ÷ means separating into equal groups or discovering the number of equal groups contained within 2P-3.1.5 Demonstrate an understanding that = represents vocabulary such as: *is equal to, is the same as,* and *gives you*	Using a four-function calculator to find the total of a grocery bill Using a calculator to find how much change you get from a $20.00 bill Using a four function calculator to find hourly rate given weekly pay or to find weekly pay given hourly rate Helping children with homework

2P-3.2 Read and write simple number sentences such as $n + 5 = 10$, $8 - 3 = \square$, $5 \times \square = 10$, $8 \div 2 = \square$ $\square \div 3 = 5$ where the $\square$ represents a missing amount or n = a missing number	2P-3.2.1 Demonstrate an understanding that n or $\square$ represents a missing value in addition and subtraction equations	Helping children with homework. Test-taking when seeking employment
2P-3.3 Write statements of inequality for numbers up to 1,000.	2P-3.3.1 Demonstrate an understanding that > stands for greater than 2P-3.3.2 Demonstrate an understanding that < stands for less than	Selecting filter for data entry
2P-3.4 Read and understand positive and negative numbers as showing direction and change. *Assessed by 3P-3.7*	2P-3.4.1 Know that *positive* refers to values greater than zero 2P-3.4.2 Know that *negative* refers to values less than zero 2P-3.4.3 Use a horizontal or vertical number line to show positive and negative values	Reading thermometers Riding an elevator below ground level Staying "in the black" or going "into the red" on bill paying
2P-3.5 Use a number line to represent the counting numbers.	2P-3.5.1 Demonstrate an understanding that a horizontal number line moves from left to right using lesser to greater values 2P-3.5.2 Demonstrate an understanding that intervals on a number line must follow a consistent progression	Reading and interpreting scales
2P-3.6 Write a simple expression or equation representing a verbal expression to demonstrate an understanding of the four operations and the equal sign.	2P-3.6.1Translate simply worded problems into simple equations (e.g. Write a number sentence for the sum of four and five is nine)	Entering an expression in a spread sheet

Standard 2P-4. Analyze change in various contexts		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
2P-4.1 Describe qualitative change, such as lengthening hours of daylight or increasing heat.	2P-4.1.1 Observe steady change over time	Reporting and planning in accordance with weather changes
2P-4.2 Describe quantitative change, such as saving 3 cents a day for one month.	2P-4.2.1 Record and save data 2P-4.2.2 Know basic arithmetic skills	Following the growth in height or weight of babies and young children

Strand: Statistics and Probability

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 2S-1. Collect, organize and represent data		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
2S-1.1 Gather data to answer posed questions.	2S-1.1.1 Know that answers can be found by observing and asking relevant questions and counting responses	Planning a party or meeting
2S-1.2 Group objects or responses by a single criterion.	2S-1.2.1 Demonstrate an understanding of categories such as shape, size, color, or yes or no responses 2S-1.2.2 Know how to count each category for subtotals	Sorting stock by size Keeping track of who will or will not attend a party
2S-1.3 Represent information so that it makes sense to others (e.g. using a list, table or diagram).	2S-1.3.1 Demonstrate an understanding that information can be represented in different ways such as in a list, table, or a diagram 2S-1.3.2 Demonstrate an understanding of the importance of labeling information in a list, table, or diagram	Reporting on responses to party or meeting Keeping records for a club
2S-1.4 Find a total from subtotaled categories of two- or three-digits to verify inclusion of all data.	2S-1.4.1 Demonstrate an understanding that when objects or responses are divided into categories all data must be included	Checking monthly totals against weekly totals

Standard 2S-2. Read and interpret data representations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
2S-2.1 Identify graphs and tables in available resources.	2S-2.1.1 Demonstrate an understanding that a graph is a visual representation	Reading newspapers and magazines
2S-2.2 Find graphs and tables from external sources.	2S-2.2.1 Recognize that graphs can be found in many publications	Reading advertisements.
2S-2.3 Extract simple information from a list or table.	2S-2.3.1 Demonstrate an understanding that lists can be ordered in different ways such as alphabetically, numerically, or randomly 2S-2.3.2 Demonstrate an understanding that tables are arranged in rows and columns 2S-2.3.3 Demonstrate an understanding that titles, labels, etc. provide essential information	Using the yellow pages Checking items against a stock list
2S-2.4 Read values on a bar graph up to 1,000.	2S-2.4.1 Demonstrate an understanding that the height of the bar is equal to the amount on the axis across from it	Reading newspapers and magazines

2S-2.5 Make numerical comparisons about relative values on a bar graph.	2S-2.5.1 Demonstrate an understanding that comparative statements such as *greater than* or *less than* can be made based on the height of the bars 2S-2.5.2 Demonstrate an understanding of relative numerical terms such as *twice* or *half*	Conversing about information contained in newspapers and magazines
Standard 2S-3. Make and evaluate statements by applying knowledge of data		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
2S-3.1 Match graphs and tables to statements.	2S-3.1.1 Know how to locate titles 2S-3.1.2 Titles indicate subject matter 2S-3.1.3 Know what to look for to connect data representations with statements	Reading a newsletter from the health service
2S-3.2 Determine whether or not a graph connects to an argument/ statement using title, labels and percent matches. *Assessed by 4S-4.1*	2S-3.2.1 Know how to locate data labels in tables and graphs to verify they match arguments/statements 2S-3.2.2 Locate and connect percent numbers in graphs and arguments	Reading insurance documents
2S-3.3 Support simple statements with data.	2S-3.3.1 Know that data can be collected to verify statements such as 'more people in class walk than drive to class' 2S-3.3.2 Know how to keep track of collected data	Taking political action to institute changes in the community
2S-3.4 Visually identify 'who has more' and identify obvious misstatements.	2S-3.4.1 Recognize that bar heights and circle wedges show quantity 2S-3.4.2 Knowing to connect bar heights and wedge sizes with statements/arguments to verify accuracy	Reading ads with bar graphs in newspaper article

Standard 2S-4. Know and apply basic probability concepts		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
2S-4.1 Discuss events as likely or unlikely.	2S-4.1.1 Demonstrate an understanding 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 Making the call when flipping a coin
2S-4.2 Give the probability of a single outcome in simple concrete situations such as tossing a coin or rolling a die. *Assessed by 3S-5.2*	2S-4.2.1 Demonstrate an understanding that probability depends on the total number of possibilities	Tossing a coin Rolling dice

Strand: Geometry and Measurement

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 2G-1. Use and apply geometric properties and relationships to describe the physical world and identify and analyze the characteristics of geometric figures		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
2G-1.1 Name, order, and group two- dimensional shapes by properties.	2G-1.1.1 Demonstrate familiarity with terms and concepts such as: *Curved vs. straight lines, equal lengths, number of sides parallel, square corners*	Sorting 2D and 3D shapes Matching patterns for home decorating by design and shape
2G-1.2 Investigate and explain common uses of shapes in the environment.	2G-1.2.1 Identify the names of basic 2D shapes (square, circle, rectangle, triangle) using everyday language (straight, curved, etc.) 2G-1.2.2 Demonstrate an understanding that shape is independent of size and orientation	Comparing use of shapes in house construction or room design

Standard 2G-2. Use transformations and symmetry to analyze mathematical situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
2G-2.1 Estimate where a line of symmetry falls in a basic shape. *Assessed by 3G-2.3*	2G-2.1.1 Demonstrate an understanding of concepts of sameness or half-ness	Creating designs Writing certain letters (e.g. A, C, D, E, H, etc.)
2G-2.2 Show more than one line of symmetry in a basic shape. *Assessed by 3G-2.3*	2G-2.2.1 Demonstrate an understanding of concepts of sameness or half-ness	Creating holiday designs for greetings cards or crafts

Standard 2G-3. Specify locations and describe spatial relationships using coordinate geometry and other representational systems		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
2G-3.1 Use the compass rose on a map with secondary (SW, NE, etc.) directions.	2G-3.1.1 Know the convention that is *North* is the opposite direction from *South* and that *East* and *West* are opposite 2G-3.1.2 Explain the difference between vertical and horizontal 2G-3.1.3 Demonstrate an understanding of diagonal direction between vertical and horizontal 2G-3.1.4 Demonstrate an understanding that secondary directions lie halfway between the cardinal directions (e.g. northeast is the diagonal direction between north and east	Appreciating wind directions stated during a weather forecast Reading directions from a map

2G-3.2 Use a street directory or a map with a coordinate grid (C5, etc.). *Assessed by 3G-3.1*	2G-3.2.1 Explain the difference between vertical and horizontal	Finding and explaining the route to a familiar place, or locating own street on map

Standard 2G-4. Understand measurable attributes of objects and the units, systems, and processes of measurement and apply appropriate techniques, tools, and formulas to determine measurements		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
2G-4.1 Calculate the total cost of many items and the change from a whole dollar amount.	2G-4.1.1 Use whole number addition 2G-4.1.2 Know the meaning and symbols used for money	Making everyday purchases
2G-4.2 Read, record, and understand time formats of quarter and half, with a digital and 12hour analog clock.	2G-4.2.1 Familiarity with quarter and half concepts	Telling time on various clocks
2G-4.3 Estimate, measure, and compare lengths, weights, capacity using standard and non-standard units.	2G-4.3.1 Ability to read scales such as a 12-inch ruler to ¼ inch, general knowledge of weight and capacity vocabulary and concepts 2G-4.3.2 Know that 2/4 = ½ 2G-4.3.3 Know that 3/4 is greater than ½	Following a recipe
2G-4.4 Use simple instruments graduated in familiar units (e.g. inches, feet, yards, pounds, fluid ounces, and centimeters). *Assessed by 3G-4.12*	2G-4.4.1 Know appropriate scales for familiar measures	Reading thermometer, scales
2G-4.5 Know the relationship of familiar units (e.g. 12 inches in a foot, 3 feet in a yard, 4 cups in a quart).	2G-4.5.1 Demonstrate how to find equivalent measures with rulers, yard sticks, and cup measures	Measuring a baby's length in inches Expressing a person's height in feet and inches Doubling or halving a recipe
2G-4.6 Read and compare positive temperatures in Fahrenheit.	2G-4.6.1 Read scale and digital read-outs 2G-4.6.2 Read and compare numbers	Understanding a weather chart and being able to describe the temperature in a given location using appropriate vocabulary (hot, warm, freezing, etc.)
2G-4.7 Develop personal benchmarks for temperatures.	2G-4.7.1 Read a thermometer	Knowing that a child has a fever when reading thermometer

2G-4.8 Find the perimeter of rectangles.	2G-4.8.1 Know that the two lengths are of equal measure and the two widths are of equal measure 2G-4.8.2 Know that the perimeter of a rectangle is equal to the total of the four sides	Buying weather-stripping
2G-4.9 Find the area of rectangles. *Assessed by 3G-4.11*	2G-4.9.1 Know that area measures the space within a figure in square units	Buying carpeting, tiles, or wall paper

Level 3: Intermediate ABE Mathematics

See "How to use This Document (Teacher's Guide) and (Connecting Curriculum, Instruction and Assessment)," pages 8-10.

Strand: Number Sense

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 3N-1. Represent and use numbers in a variety of equivalent forms in contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
3N-1.1 Read, write, order, and compare numbers up to 1,000,000.	3N-1.1.1 Demonstrate an understanding that the position of a digit signifies its value 3N-1.1.2 Know what each digit represents in a number up to six digits, including the use of zero as a place holder 3N-1.1.3 Demonstrate an understanding of the symbols for *greater than, less than*	Filing plans in numerical order Reading route numbers on delivery labels
3N-1.2 Read, write and compare common fractions (e.g. thirds, halves, and quarters).	3N-1.2.1 Demonstrate an understanding that the denominator indicates the number of equal parts in the whole 3N-1.2.2 Demonstrate an understanding that the numerator identifies how many of these equal parts are shown 3N-1.2.3 Demonstrate an understanding that a unit fraction is one part of a whole divided into equal parts (e.g. 1/4 indicates one of four equal parts is shown) 3N-1.2.4 Demonstrate an understanding that non-unit fractions are several equal parts of a whole, indicated by the numerator (e.g. 3/4 = 1/4 + 1/4 + 1/4) 3N-1.2.5 Demonstrate an understanding that the size of the fraction changes as the numerator and denominators change	Using a 1/4 cup measure to add 3/4 of a cup of flour to a recipe Reading fractions used in sale signs and special offers (e.g. 1/2 off)
3N-1.3 Recognize and use equivalent forms of common fractions (e.g.1/2 = 5/10). *Assessed by 4N-1.11*	3N-1.3.1 Demonstrate an understanding that equivalent fractions look different but have the same value 3N-1.3.2 Demonstrate an understanding that when the top and bottom number of a fraction are the same, the fraction is equivalent to 1	In the context of measures, recognizing relationships (e.g. that 2/8 inch = 1/4 inch)

3N-1.4 Read, write and compare decimals up to two decimal places in practical contexts (money in decimal notation, e.g. $10.35).	3N-1.4.1 Demonstrate an understanding that the decimal point separates dollars and parts of a dollar 3N-1.4.2 Demonstrate an understanding that a dime is a tenth of a dollar 3N-1.4.3 Demonstrate an understanding that a penny is a hundredth of a dollar 3N-1.4.4 Demonstrate an understanding of the use of zero as a placeholder 3N-1.4.5 Demonstrate an understanding of the use of a leading zero (e.g. $0.76)	Reading price tags Understanding prices on a menu Counting and recording total value of change received at a rummage sale
3N-1.5 Recognize fraction, decimal, and percent equivalents for a half and one quarter.	3N-1.5.1 Know ½ = 0.5 = 50% and 1/4 = 0.25 = 25%	Ordering a half pound at a deli that uses a digital scale Recognizing 50% off and half-price as the same
3N-1.6 Read, write, and compare positive and negative numbers in practical contexts. *Assessed by 4N-1.2*	3N-1.6.1 Demonstrate an understanding of the words *positive* and *negative* 3N-1.6.2 Demonstrate an understanding that a negative temperature is below zero 3N-1.6.3 Demonstrate an understanding that a negative amount of money represents money owed	Understanding wind-chill information Reading a thermometer
3N-1.7 Read, write, and compute squares and cubes of whole numbers.	3N-1.7.1 Read and write 4 (4) as 4^2 3N-1.7.2 Recognize that any value taken to the second power will form a square 3N-1.7.3 Read and write 4 (4)(4) as 4^3 3N-1.7.4 Recognize that any value taken to the third power will form a cube	Reading pollen count per cubic meter
3N-1.8 Understand that percent represents a ratio of a part to a whole where the whole is 100.	3N-1.8.1 Know that percent means per hundred 3N-1.8.2 Demonstrate an understanding of the percent ratio as a comparison based on division by 100 3N-1.8.3 Know that 100% of one dollar is one dollar and that 50% of a dollar is 50 cents out of one dollar	Figuring a 5% sales tax on a one dollar item

Standard 3N-2. Understand meanings of operations and how they relate to one another		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
3N-2.1 Demonstrate an understanding that multiplying a whole number by a unit fraction is the same as dividing the whole number by that fraction's denominator.	3N-2.1.1 Know that multiplying a whole number by a unit fraction can be seen as adding the fraction to itself that many times (e.g. $4 \times 1/2 = 1/2 + 1/2 + 1/2 + 1/2 = 2$), or as adding the whole number to itself the fractional number of times (e.g. 4 taken 1/2 times or $4 \div 2 = 2$)	Generating solutions using mental mathematics in situations involving common unit fractions
3N-2.2 Demonstrate an understanding of how squaring and taking the square root are related. *Assessed by 4N-2.5*	3N-2.2.1 Know that to square a number one multiplies the number by itself 3N-2.2.2 Know that to find the square root of an amount, one finds the number that multiplied by itself produces that amount 3N-2.2.3 Because 4 (4) = 16, $\sqrt{16} = 4$	Finding the area of a square room from the length of a side or to find the length of a side from the area
3N-2.3 Demonstrate an understanding of how addition and subtraction relate to each other for numbers up to 1,000,000.	3N-2.3.1 Know how to add back to check, e.g. 1,000 – 250 = 750 because 250 + 750 = 1,000	Checking the balance in a checkbook
3N-2.4 Choose the correct operation for solving a one-step narrative problem.	3N-2.4.1 Demonstrate an understanding that addition is combining, subtraction is separating or comparing, multiplication is repeated addition, and division is repeated subtraction	Taking a standardized or employment test
3N-2.5 Understand and use exponents to represent repeated multiplication.	3N-2.5 Recognize that exponents indicate the number of times that the base is written as a factor	Computing with formulas on a standardized test

Standard 3N-3. Compute fluently and make reasonable estimates		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
3N-3.1 Divide by two and three-digit whole numbers and interpret remainders. *Assessed by 3N-3.11*	3N-3.1.1 Demonstrate an understanding of the concept of remainder, and that remainders need to be interpreted in context when solving problems 3N-3.1.2 Demonstrate an understanding of when the context requires one to round off to a whole number 3N-3.1.3 Demonstrate an understanding of when to express remainders as decimals or fractions	Finding the average number of hotdogs per person sold at an event Finding how many buses are needed to transport three classes of children for a field trip
3N-3.2 Carry out calculations with three-digit whole numbers using efficient written methods. *Assessed by 3N-3.10 and 3.11*	3N-3.2.1 Demonstrate an understanding that there are different strategies for carrying out each of the four operations 3N-3.2.2 Demonstrate an understanding that there are different ways to check answers	Using written methods to generate results when solving problems with three-digit whole numbers

3N-3.3 Multiply and divide whole numbers by 10 and 100.	3N-3.3.1 Demonstrate an understanding of place value for whole numbers and to two-decimal places	Changing dollar amounts to dimes and pennies and vice versa Changing meters to centimeters and vice versa
3N-3.4 Carry out basic calculations with money.	3N-3.4.1 Demonstrate an understanding of place value for whole numbers and to two-decimal places	Balancing a checkbook Figuring one share of a restaurant bill that is divided equally
3N-3.5 Approximate by rounding numbers up to 1,000,000 to the nearest tens, hundreds, or thousands	3N-3.5.1 Demonstrate an understanding place value for units, tens, hundreds, thousands	Rounding numbers to make approximate calculations
3N-3.6 Find common parts of whole number quantities or measurements (e.g. ¾ of 12, 2/3 of 15).	3N-3.6.1 Demonstrate an understanding of the relationship between unit fractions and division when finding parts 3N-3.6.2 Demonstrate an understanding that there are different strategies for finding fractional parts	Reducing the quantities in a recipe
3N-3.7 Use equivalencies between common fractions and percentages to find part of whole-number quantities.	3N-3.7.1 Know common fraction and percent equivalents (e.g. 50% = ½, 25% = ¼, 75% = ¾)	Estimating savings using mental mathematics strategies at a percentage off sale
3N-3.8 Find squares, square roots, and cubes of whole-number quantities *Assessed by 3N-1.7*	3N-3.8.1 Know that a number is squared by multiplying it by itself 3N-3.8.2 Know that a number is cubed by multiplying it by itself three times 3N-3.8.3 Know that squaring and finding the square root are inverse operations 3N-3.8.4 Know the calculator keys that generate squares, square roots, and cubes of numbers	Finding the area of a square room Finding the volume of a square room
3N-3.9 Use a calculator to calculate whole numbers and decimals to two places to solve problems in context, and to check calculations.	3N-3.9.1 Know how to key in and interpret money calculations (e.g. key in 85 cents as $0.85, interpret 8.2 as $8.20) 3N-3.9.2 Demonstrate an understanding that a calculator will sometimes display a string of digits after the decimal point, and that it is only necessary (at this level) to read the first two (e.g. 1.333333 is $1.33) 3N-3.9.3 Know how to find the square and cube of a number 3N-3.9.4 Know how to key in a square root calculation 3N-3.9.5 Know and use strategies to check answers obtained with a calculator	Finding the total charge on a purchase Multiplying the monthly cable charge by twelve to find the annual charge Finding the area of a square room

3N-3.10 Carry out calculations using addition and subtraction with numbers up to 1,000,000 using efficient written methods, including ways to check answers.	3N-3.10.1 Compose and decompose numbers to aid addition (e.g. 1240 + 2040 = 1,000 + 2000 + 100 + 40 + 40) and estimate answers to addition 3N-3.10.2 Demonstrate that there are different strategies for adding 3N-3.10.3 Demonstrate an understanding that there are different methods of checking answers (e.g. adding in a different order, using inverses, collecting 10's and using a calculator) 3N-3.10.4 Know how to align numbers in column subtraction 3N-3.10.5 Know that "borrowing" is regrouping 3N-3.10.6 Can compose and decompose numbers to aid subtraction (e.g. 1007 - 803 =1,000 - 800 + 7 – 3) 3N-3.10.7 Demonstrate an understanding of strategies or methods for subtraction such as borrowing or counting up	Calculating the production shortfall from a daily target Performing mental addition Checking deposits in a checking account
3N-3.11 Carry out calculations using multiplication and division with two and three digit numbers using efficient written methods, including ways to check answers and interpret remainders.	3N-3.11.1 Demonstrate an understanding that division is the inverse of multiplication and that the answer to a division problem can be checked by multiplication 3N-3.11.2 Demonstrate the ability to determine the placement of the decimal points in multiplication of decimal numbers of up to two places 3N-3.11.3 Demonstrate an understanding of the concept of remainder, and that remainders need to be interpreted in context when solving problems 3N-3.11.4 Demonstrate an understanding of when the context requires one to round off to a whole number 3N-3.11.5 Demonstrate an understanding of when to express remainders as decimals or fractions	Calculating miles per gallon that a car attains Estimating travel time in hours based on distance and speed
3N-3.12 Compute percentages when part and whole are given using friendly numbers (e.g. 10%, 25%, 50%, and 75%).	3N-3.12.1 Know percent and fraction equivalents for benchmark numbers (e.g. 10%, 25%, 50%, and 75%) 3N-3.12.2 Demonstrate an understanding of part-whole relationship inherent in fractions and percents	Calculating a percent increase in pay or demographics

Strand: Patterns, Functions, and Algebra

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 3P-1. Explore, identify, analyze, and extend patterns in mathematical and adult contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
3P-1.1 Complete number sequences with whole numbers involving two-step progressions.	3P-1.1.1 Know multiplication tables	Using rate tables for postage
3P-1.2 Recognize and create repeating patterns and identify the unit being repeated. *Assessed by 3P-1.1*	3P-1.2.1 Isolate smallest unit of repetition 3P-1.2.2 Use a notation system to record patterns	Creating Sales Tax tables Using mental math strategies
3P-1.3 Given a table of amounts, generalize the relationship between the quantities using simple patterns such as doubling.	3P-1.3.1 Read tables 3P-1.3.2 Recognize and verbalize patterns	Using rate tables for prices

Standard 3P-2. Articulate and represent number and data relationships using words, tables, graphs		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
3P-2.1 Write an expression or equation representing verbal situations with one or two operations.	3P-2.1.1 Translate simple worded problems involving unknown quantities into simple equations	Entering an expression in a spreadsheet
3P-2.2 Develop and use simple formulas from tables with one or two arithmetical steps for real life contexts.	3P-2.2.1 Discover patterns in an "in-out" table 3P-2.2.2 Verbalize a rule for finding values in an "in-out" table 3P-2.2.3 Write a general expression for finding values in an "in-out" table 3P-2.2.4 Write an equation 3P-2.2.5 Decide on the effectiveness of a developed formula by substituting known values	Converting temperature between Celsius and Fahrenheit Finding interest on a loan from a table

Standard 3P-3. Recognize and use algebraic symbols to model mathematical and contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
3P-3.1 Use and interpret +, -, ×, ÷, and = to represent combining, comparing, and equivalence. *Assessed by 3P-3.2*	3P-3.1.1 Demonstrate an understanding that + represents operations of combining 3P-3.1.2 Demonstrate an understanding that – represents operations of separation or comparison 3P-3.1.3 Demonstrate an understanding that × stands for combining multiples 3P-3.1.4 Demonstrate an understanding that ÷ means separating into equal groups or discovering the number of equal groups contained within 3P-3.1.5 Demonstrate an understanding that = represents vocabulary such as *is equal to, is the same as,* and *gives you*	Using a four-function calculator to find the total of a grocery bill Using a calculator to find how much change you get from a $20.00 bill Using a four function calculator to find hourly rate given weekly pay, or to find weekly pay given hourly rate Helping children with homework
3P-3.2 Read, write, and solve expressions using algebraic notation for addition, subtraction, multiplication, division, and parentheses with one or two operations.	3P-3.2.1 Read and write 5 (10) for 5×10 3P-3.2.2 Read and write $\frac{10}{2}$ for $10 \div 2$ 3P-3.2.3 Know that the contents of parentheses must be worked out first	Following convention in notation and order of operation Test-taking when seeking employment
3P-3.3 Substitute the value for the variable in one-step expressions using whole numbers when the value is given, such as finding $x + 4$ and $10 - x$ when x has a value of 1	3P-3.3.1 Demonstrate an understanding that a variable represents a missing value in addition and subtraction expressions	Preparing for further study
3P-3.4 Find the value of the variable in one-step equations with whole numbers e.g.: $x + 25 = 100$ $x - 16 = 42$ $3y = 42$ $y/5 = 200$.	3P-3.4.1 Recognize that addition and subtraction are inverse operations 3P-3.4.2 Recognize that multiplication and division are inverse operations 3P-3.4.3 Know the unknown of a one-step equation can be found by using the inverse of the operation present	Preparing for further study
3P-3.5 Use a number line to represent the counting numbers. *Assessed within 4P-3.9*	3P-3.5.1 Demonstrate an understanding that a horizontal number line moves from left to right using lesser to greater values 3P-3.5.2 Demonstrate an understanding that intervals on a number line must follow a constant progression by values including positive numbers and common fractions and decimals	Reading and interpreting scales
3P-3.6 Write statements of	3P-3.6.1 Demonstrate an ability to use the	Using mathematical

inequality for numbers up to 1,000,000.	symbols > and < in number statements with larger numbers.	language and symbols to compare and order (e.g. less than, greater than, at most, at least, <, >, =) in place of longer spoken/written sentence.
3P-3.7 Read and understand positive and negative numbers as showing direction and change on both horizontal and vertical number lines.	3P-3.7.1 Demonstrate an understanding that a horizontal number line moves from left to right using lesser to greater values 3P-3.7.2 Demonstrate an understanding that a vertical number line moves from the bottom up using lesser to greater values.	Viewing an automotive electrical gauge to determine if the battery is charging or discharging.

Standard 3P-4. Analyze change in various contexts		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
3P-4.1 Investigate how a change in one variable relates to a change in a second variable.	3P-4.1.1 Record data 3P-4.1.2 Represent data in graphical form	Tracking wages when paid an hourly rate on a variable work schedule
3P-4.2 Identify and describe situations with constant or varying rates of change and compare them.	3P-4.2.1 Record data in table form 3P-4.2.2 Represent data in graphical form	Following monthly bills (e.g. rent, heating and telephone, in order to budget)

Strand: Statistics and Probability

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 3S-1. Collect, organize and represent data		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
3S-1.1 Pose questions about themselves and their surroundings and gather data to answer posed questions. *Assessed by 2S-1.1*	3S-1.1.1 Know that answers can be found by observing and asking relevant questions and counting responses.	Planning a party or meeting Conducting a political survey
3S-1.2 Group objects or responses by a single criterion. *Assessed by 2S-1.2*	3S-1.2.1 Demonstrate an understanding of the concept of categories, such as shape, size, color, or yes or no responses 3S-1.2.2 Know how to count each category for subtotals	Keeping track of who will or will not attend party. Sorting stock by size
3S-1.3 Represent information so that it makes sense to others.	3S-1.3.1 Demonstrate an understanding that information can be represented in different ways such as a list, table, or a diagram. 3S-1.3.2 Demonstrate an understanding of the importance of labeling information in a list, table, or diagram	Reporting on responses to party or meeting Keeping records for a club
3S-1.4 Find a total from subtotaled categories to verify inclusion of all data.	3S-1.4.1 Demonstrate an understanding that when objects or responses are divided into categories all data must be included in one and only one category; therefore, categories must identify distinct sets	Checking monthly totals against weekly totals
3S-1.5 Represent categorical data on a line plot.	3S-1.5.1 Demonstrate an understanding that each *X* in a line plot represents one and only one item or response; therefore, it is verifiable that the number of responses is equal to the number of *X*'s	Keeping a visual tally of responses by category

Standard 3S-2. Read and interpret data representations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
3S-2.1 Identify graphs and tables in available resources. *Assessed by 2S-2.1*	3S-2.1.1 Demonstrate an understanding that a graph is a visual representation 3S-2.1.2 Demonstrate an understanding that a table arranges information in rows and columns	Reading newspapers and magazines
3S-2.2 Find graphs and tables in external sources. *Assessed by 2S-2.2*	3S-2.2.1 Recognize that graphs and tables can be found in many publications	Reading advertisements Finding current interest rates
3S-2.3 Sort graphs and tables by type.	3S-2.3.1 Know that a bar graph uses bars of various heights to display amount 3S-2.3.2 Know that line graphs use lines to display changes in amount 3S-2.3.3 Know that a circle or pie graph represents the whole	Participating in conversations about represented data
3S-2.4 Extract simple information from a list or table. *Assessed by 2S-2.3*	3S-2.4.1 Demonstrate an understanding that lists can be ordered in different ways such as alphabetically, numerically, or randomly 3S-2.4.2 Demonstrate an understanding that tables are arranged in rows and columns 3S-2.4.3 Demonstrate an understanding that titles, labels, etc provide essential information	Using the yellow pages Checking items against a stock list
3S-2.5 Read values on a bar or line graph up to 1,000,000.	3S-2.5.1 Demonstrate an understanding that the height of the bar is equal to the amount on the axis across from it. 3S-2.5.2 Know how to read a scale on an axis 3S-2.5.3 Demonstrate an understanding that specific data points on a line graph correspond with the labels on both axes.	Reading newspapers and magazines
3S-2.6 Make numerical comparisons about relative values on a bar graph.	3S-2.6.1 Demonstrate an understanding that comparative statements such as greater than or less than can be made based on the height of the bars. 3S-2.6.2 Demonstrate an understanding of relative numerical terms such as *twice* or *half.*	Conversing about information contained in newspapers and magazines

Standard 3S-3. Describe data using numerical descriptions, statistics and trend terminology		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
3S-3.1 Identify the minimum,	3S-3.1.1 Be familiar with terms-	Reading temperature charts

maximum, spread and shape of data. *Assessed by 5S-3.1*	minimum, maximum, and spread. Recognition of gaps, holes, and clusters in the data set to determine where data is missing and where it is heavily represented.	
3S-3.2 Use "most of" statements to describe data.	3S-3.2.1 Recognize that values in the data set can be repeated and some values may be repeated more frequently than others.	Analyzing results of a survey or group consensus
3S-3.3 Find the average (mean) and range for a data set.	3S-3.3.1 Know that mean is "average" and that average in this case is about equal distribution. 3S-3.3.2 Know that the average can be found by adding all values in the data set and dividing by the number of values in the set.	Estimating one's daily expenses.
3S-3.4 Find the median. *Assessed by 4S-3.4*	3S-3.4.1 Know that median is the middle value. 3S-3.4.2 Know that when there is an even number of values in the data set, the median is found by calculating the mean of *two* middle values.	Explaining the median salary or median years worked in company statistics

Standard 3S-4. Make and evaluate arguments or statements by applying knowledge of data analysis		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
3S-4.1 Match more than one graph or table with statements. *Assessed by 2S-3.1*	3S-4.1.1 Know how to locate titles 3S-4.1.2 Titles indicate subject matter 3S-4.1.3 Know what to look for to connect data representations with statements	Presenting information to children or co-workers
3S-4.2 Determine whether or not a graph/table connects to a statement using title, data labels and percent matches. *Assessed by 4S-4.1*	3S-4.2.1 Know how to locate data labels in tables and graphs to verify they match statements 3S-4.2.2 Locate and connect percent *numbers* in graphs and statements	Reading insurance documents to decide if the what they state matches what they show
3S-4.3 Visually identify "who has more," and use some numbers to compare quantities. *Assessed by 2S-3.4*	3S-4.3.1 Recognize bar heights and circle wedges show quantity	Understanding graphic presentations in newspapers and magazines
3S-4.4 Support simple statements with data.	3S-4.4.1 Know that data can be collected to verify statements such as "more people in class walk than drive to class." Know how to keep track of collected data	Taking political actions to institute changes in the community
3S-4.5 Use "most of" statements to support arguments. *Assessed by 3S-4.4*	3S-4.5.1 Know ways to compare numbers	Discussing numbers with peers and co-workers

3S-4.6 Know statements using "double" and "half" or fifty percent are accurate.	3S-4.6.1 Double and halving numbers 3S-4.6.2 Fifty percent equals one half	Reading and/or responding to consumer materials
3S-4.7 Know when percent figures don't add up to 100%. *Assessed by 4S-4.6*	3S-4.7.1 Awareness that circle graphs usually represent 100%, and all figures in them should add to 100 or statements based on the graph are suspect	Reading budget reports
3S-4.8 Recognize that mean and median numbers are considered "averages," and that averages represent numbers typical of the data that can support an argument. *Assessed by 4S-3.4*	3S-4.8.1 Awareness that what are termed "averages" are numbers supposedly "typical" of data 3S-4.8.2 Know ways in which "averages" are "typical" of data – median is the middle value and mean implies equal distribution of all data	Debating proposed rent increases
3S-4.9 Recognize that bar widths can provide misleading information.	3S-4.9.1 Visual messages are given by bar widths – thin relays message of "less" and wide relays message of "more." Visual messages can contradict or enhance evidence	Reading advertisements to make choices
3S-4.10 See where authors of data reports can manipulate data to benefit themselves or malign others in provided materials. *Assessed by 5S-4.7*	3S-4.10.1 Know how to recognize who produced a data report and how their interests might affect the report – conflict of interest	Reading advertisements to make choices
3S-4.11 Identify obvious misstatements.	3S-4.11.1 Recognize where to look for numbers representing relevant quantities 3S-4.11.2 Knowing to connect numbers with statements/arguments to verify accuracy	Reading newspaper articles and deciding if what they state accurately matches what they show
3S-4.12 Use statements that refer to "double" and "half" or fifty percent of the data.	3S-4.12.1 Demonstrate and ability to double and find half of numbers 3S-4.12.2 Demonstrate and awareness that fifty percent equals one half	Calculating the cost of items marked "one-half" off. Calculating the down payment for an item requiring 50% down

Standard 3S-5. Know and apply basic probability concepts		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
3S-5.1 Discuss events as likely or unlikely using benchmarks.	3S-5.1.1 Demonstrate an understanding that while some events are impossible, some are certain to happen and some are more likely to occur than others.	Making decisions about how weather may affect outdoor plans Predicting the outcome of a sporting event based on a team's past performance.
3S-5.2 Give the probability of a single outcome in simple concrete situations such as tossing a coin or rolling a die.	3S-5.2.1 Demonstrate an understanding that probability depends on the total number of possibilities	Tossing a coin Rolling dice
3S-5.3 State probability as a ratio in multiple forms (colon, words, and fractions) with simple scenarios.	3S-5.3.1 Know that probability is the ratio of the potential successful outcomes to total possibilities 3S-5.3.2 Know that such ratios can be written in fraction form 3S-5.3.3 Know that ratio fractions can be simplified	Determining the chances of winning a prize in a drawing

Strand: Geometry and Measurement

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 3G-1. Use and apply geometric properties and relationships to describe the physical world and identify and analyze the characteristics of geometric figure		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
3G-1.1 Use informal visual methods to describe and compare shape, dimension, perimeter, area, angles and sides in two dimensional and 3-D objects. 3D objects – *Assessed by 4G-1.3*	3G-1.1.1 Be able to solve practical problems using the properties of 2D and 3D figures 3G-1.1.2 Demonstrate an understanding that that area is conserved, but perimeter is not when 2-D objects are combined 3G-1.1.3 Build 3D figures using 2-D plans and blocks	Organizing a closet Packing a trunk Covering a package with paper Tying string around a package
3G-1.2 Identify properties, locations, and functions of right angles.	3G-1.2.1 Know that a right angle is 90 degree or a quarter turn, that two right angles make a straight line, and four right angles fill a space	Creating tiling patterns

Standard 3G-2. Use transformations and symmetry to analyze mathematical situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
3G-2.1 Estimate where a line of symmetry falls in a basic shape. *Assessed by 3G-2.3*	3G-2.1.1 Demonstrate an understanding of concepts of *sameness* or *half-ness*	Cutting cake in half Folding objects
3G-2.2 Show more than one line of symmetry in a basic shape. *Assessed by 3G-2.3*	3G-2.2.1 Demonstrate an understanding of concepts of *sameness* or *half-ness*	Designing and making a quilt
3G-2.3 Identify where a line of symmetry falls in a basic shape.	3G-2.3.1 Demonstrate an understanding of concepts of sameness or half-ness	Recognizing patterns and symmetry in design and architecture

Standard 3G-3. Specify locations and describe spatial relationships using coordinate geometry and other representational systems		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
3G-3.1 Use direction, distance, coordinates, simple scales, labels, symbols, and keys to read and use maps and plans.	3G-3.1.1 Use the compass rose on a map with secondary (SW, NE, etc) directions 3G-3.1.2 Demonstrate an understanding of latitude and longitude, or horizontal and vertical indices on a map	Planning an automobile trip Finding a city on a globe
3G-3.2 Draw 2 dimensional (2-D) shapes in different orientations on a grid. *Assessed by 4G-3.3*	3G-3.2.1 Use graph paper to draw 2-D shapes 3G-3.2.2 Be able to change the orientation and copy object.	Creating a pattern for a model plane

Standard 3G-4. Understand measurable attributes of objects and the units, systems, and processes of measurement and apply appropriate techniques, tools and formulas to determine measurements		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
3G-4.1 Add, subtract, multiply and divide sums of money including decimal notation.	3G-4.1.1 Demonstrate an understanding of place value for whole numbers and to two-decimal places 3G-4.1.2 Know how to round off thousandths (mils) to the nearest hundredths (cents) 3G-4.1.3 Know how to use a calculator	Balancing a checkbook Figuring one's share of a restaurant bill being divided equally Finding cost of multiples units of an item
3G-4.2 Demonstrate a general understanding of inter-relatedness of distance, time, and speed.	3G-4.2.1 Investigate how a change in one variable (speed) relates to a change in a second variable (time, distance) 3G-4.2.2 Identify and describe situations with constant or varying rates of change and compare them (e.g. acceleration, slowing down, stopping)	Estimating time of arrival with slower or faster speeds
3G-4.3 Read and interpret scales with marked and unmarked labels. *Assessed by 4G-3.1*	3G-4.3.1 Skip counting by 5, 10, 100, 500 3G-4.3.2 Making visual estimates of lengths	Inferring distances on a road map
3G-4.4 Measures with a ruler to 1/8inch and metric ruler in cm and mm.	3G-4.4.1 Know that a foot equals 12 inches	Knowing when more exact measure is needed (e.g. woodworking project)
3G-4.5 Can make informal comparisons between inches and centimeters.	3G-4.5.1 Demonstrate an understanding of making a one-to-one correspondence between different rulers and units. 3G-4.5.2 Make visual estimates of the number of centimeters per inch. 3G-4.5.3 Create physical (bodily) benchmarks for units (e.g. fingernail = 1 cm; thumb joint = 1 inch.)	Using a ruler with both inches and centimeter scales Selecting the appropriately sized wrench when working on a European-made car Mixing cleaning chemicals in the correct proportions by comparing metric to standard liquid measure Measuring correct doses of medication.
3G-4.6 Can convert units of measure in the same systems.	3G-4.6.1 Know the relationship of familiar units (e.g. 12 inches in a foot, 3 feet in a yard, 4 cups in a quart) 3G-4.6.2 Know when to multiply and when to divide when converting units of measure	Substituting the use of foot rulers for a yardstick or a one cup measure for a quart measure Doing home repairs and carpentry projects
3G-4.7 Use and apply concepts of weight and capacity to solve problems.	3G-4.7.1 Know the difference between weight and capacity	Correctly loading a washing machine to maintain balance throughout the cycle Reading the capacity of a

		liquid to near exact measure
3G-4.8 Use, read, and compare positive and negative Fahrenheit temperatures.	3G-4.8.1 Demonstrate an understanding that temperature increases as it goes up and decreases as it goes down 3G-4.8.2 Know that the sign of the temperature changes when crossing the zero degree point	Reading weather forecasts Understanding wind-chill factor
3G-4.9 Use and interpret the 24 hour clock.	3G-4.9.1 Demonstrate an understanding of standard notation for A.M and P.M. 3G-4.9.2 Addition and multiplication facts to 12 3G-4.9.3 Familiarity with quarter and half concepts	Matching 12 and 24 hour times
3G-4.10 Calculate times using the appropriate value and converting between time formats (including elapsed time).	3G-4.10.1 Know equivalencies for hours, seconds, minutes, days, weeks, months, decades, and centuries. 3G-4.10.2 Know multiplication and division by 2-digit numbers 3G-4.10.3 Use mental math skills	Understanding that 2 centuries is 200 years to appreciate past events and their place in history
3G-4.11 Directly measures perimeter in linear units and area in square units (sq. in., sq. ft., sq. cm.).	3G-4.11.1 Use a ruler to measure length and width 3G-4.11.2 Compare two figures by laying them on top of each other to determine larger area 3G-4.11.3 Cover a figure with square units and count the units 3G-4.11.4 Use addition and multiplication skills to aid in counting units	Planning renovations or paint for a room Making a cover for a counter top Sewing a chair cover
3G-4.12 Estimate, measure, and compare whole number weights using simple instruments, graduated in familiar units (ounces and pounds) and know when to use appropriate measures.	3G-4.12.1 Use a scale to measure weight 3G-4.12.2 Compare two figures holding them to determine which is heavier 3G-4.12.3 Place two objects on a balance scale 3G-4.12.4 Use addition and multiplication skills to aid in counting units	Placing objects of various weights on shelves or hanging them on walls Shopping for fresh vegetables in a market

Level 4: Pre-GED / ABE Standards

See "How to use This Document (Teacher's Guide) and (Connecting Curriculum, Instruction and Assessment)," pages 8-10.

Strand: Number Sense

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 4N-1. Represent and use numbers in a variety of equivalent forms in contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
4N-1.1 Read, write, order and compare numbers, including large numbers (millions or billions).	4N-1.1.1 Demonstrate an understanding that the position of a digit signifies its value 4N-1.1.2 Know what each digit represents in a number up to seven digits, including the use of zero as a place holder 4N-1.1.3 Demonstrate an understanding of the symbols for *greater than* and *less than*	Filing plans in numerical order Reading route numbers on delivery labels
4N-1.2 Recognize positive and negative numbers in practical contexts.	4N-1.2.1 Demonstrate an understanding of the words *positive* and *negative* 4N-1.2.2 Demonstrate an understanding that a negative temperature is below zero 4N-1.2.3 Demonstrate an understanding that a negative amount of money represents money owed	Reading wind-chill chart Reading a thermometer
4N-1.3 Read, write, order, and compare fractions and mixed numbers.	4N-1.3.1 Know common equivalent fractions (e.g. equivalent to a half, quarters, thirds, fifths, tenths) 4N-1.3.2 Demonstrate an understanding that in unit fractions, the larger the denominator, the smaller the fraction 4N-1.3.3 Demonstrate an understanding that non-unit fractions must be ordered by their closeness to the whole	Reading fractions used in recipes Comparing interest rates (e.g. 1 ¼% versus 1 ½%)
4N-1.4 Read, write, order, and compare decimals up to three decimal places.	4N-1.4.1 Demonstrate an understanding that the position of a digit signifies its value 4N-1.4.2 Know that the decimal point separates whole numbers from decimal fractions 4N-1.4.3 Know what each digit represents, including the use of zero as a place holder	Reading and comparing gas prices Reading and comparing metric measurements
4N-1.5 Recognize and use	4N-1.5.1 Know any fraction is equivalent	Understanding how to read

equivalencies between fractions and decimals.	to a decimal that ends or has a repeating pattern, and vice versa	adigital scale when placing a fraction order at the deli
4N-1.6 Can convert fractions to decimals and decimals to fractions.	4N-1.6.1 Demonstrate an understanding that a fraction can be converted to an equivalent decimal by dividing the numerator of a fraction by the denominator 4N-1.6.2 Demonstrate an understanding that a decimal can be converted to an equivalent fraction by writing the decimal value over 10, 100, or 1,000 and reducing to simplest form	Understanding how the scale works at the deli counter Using an electronic calculator to make volume and area computations based on measurements made by a standard tape measure
4N-1.7 Read, write, order, and compare simple percentages.	4N-1.7.1 Demonstrate an understanding of percentage as the number of parts in every 100 4N-1.7.2 Know that 100% is the whole	Finding 20% off in a sale
4N-1.8 Demonstrate an understanding of simple percentage of increase and decrease. *Assessed by 5N-1.4*	4N-1.8.1 Demonstrate an understanding of percentage as the number of parts in every 100 4N-1.8.2 Know that 100% is the whole 4N-1.8.3 Demonstrate an understanding that a 10% pay increase is more than a 5% pay increase, but the actual increase depends on the number operated on	Finding a price increase of 10% Finding a cost-of-living salary increase
4N-1.9 Recognize equivalencies between common fractions, percentages and decimals (e.g. 50% = ½, 0.25 = ¼) and use these to find part of whole-number quantities. *Assessed by 5N-1.5*	4N-1.9.1 Know common fraction equivalents (e.g. half, quarter, fifths, tenths) 4N-1.9.2 Recognize 50% off and half-price as the same 4N-1.9.3 Know ½ as 0.5 when solving a problem with a calculator	Computing discounts efficiently and flexibly using percents or fraction equivalencies Finding 25% discount by dividing by 4 Finding a tip using mental math
4N-1.10 Use ratio and proportion to solve one-step percent problems.	4N-1.10.1 Demonstrate an understanding that equal ratios are equal fractions 4N-1.10.2 Recognize the term *proportion* for a statement of equal ratios 4N-1.10.3 Calculate for the missing term in a proportion by a variety of methods	Adjusting a recipe for a larger or smaller number of servings Converting measurements from one standard to another (e.g. miles per hour to feet per second)

4N-1.11 Recognize and use equivalent forms of common fractions (e.g. ½ = 5/10).	4N-1.11.1 Demonstrate an understanding that equivalent fractions look different but have the same value 4N-1.11.2 Demonstrate an understanding that when the top and bottom number of a fraction are the same, the fraction is equivalent to 1	Calculating the size of a container required to hold a variety of portions (e.g. ¼ cup of *x* plus ¼ cup of *y* plus ½ cup of *z*)

Standard 4N-2. Demonstrate an understanding meanings of operations and how they relate to one another		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
4N-2.1 Choose the correct operation for solving a multi-step narrative problem.	4N-2.1.1 Demonstrate an understanding that addition is combining, subtraction is separating or comparing, multiplication is repeated addition, and division is repeated subtraction	Taking a standardized test
4N-2.2 Perform multiplication operations reliably, accurately, and efficiently.	4N-2.2.1 Demonstrate an understanding that multiplication is commutative, but that in context changing order changes meaning	Knowing that taking two tablets four times a day is different from taking four tablets twice a day
4N-2.3 Use ratios to describe the relationship between two sets of objects.	4N-2.3.1 Know when something is separated into equal groups 4N-2.3.2 Demonstrate an understanding of ratio as comparison based on division	Recognizing when a solution can be generated by the use of proportion
4N-2.4 Read, write, and compute with exponents.	4N-2.4.1 Be familiar with the *terms square, cube*, and *square root* 4N-2.4.2 Recognize that any value taken to the second power will form a square and that any value taken the third power will form a cube 4N-2.4.3 Recognize that exponents represent repeated multiplication 4N-2.4.4 Recognize that exponents indicate the number of times that the base is written as a factor 4N-2.4.5 Read and write expressions such as 6(6) (6) (6) (6) (6) (6) as 6^7	Preparing for further study Understanding exponential growth of bacteria or virus such as HIV
4N-2.5 Calculate square roots of perfect squares, estimate within range of square root value, and demonstrate an understanding of how squaring and taking the square root are related.	4N-2.5.1 Know that a number is squared by multiplying it by itself 4N-2.5.2 Know the values of perfect squares up to 15^2 4N-2.5.3 Know that square root is the inverse of squaring 4N-2.5.4 Know the square roots of perfect squares up to the square root of 225	Estimating the number of 12-inch tiles needed to cover a rectangular floor.

	4N-2.5.5 Know that the square roots of values which are not perfect squares fall between two whole numbers	

Standard 4N-3. Compute fluently and make reasonable estimates		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
4N-3.1 Round decimals in practical contexts and verbal problems.	4N-3.1.1 Know how to read decimals up to four decimal places 4N-3.1.2 Recognize that rounding a decimal to a particular decimal place requires analyzing the digit in the following decimal place	Performing estimations of mathematical problems to check work
4N-3.2 Add, subtract, multiply, and divide decimals up to three places.	4N-3.2.1 Know and use strategies to check answers (e.g. approximate calculations using whole numbers) 4N-3.2.2 Know how to align numbers for column addition and subtraction 4N-3.2.3 Know how to multiply decimal factors to produce decimal placement in product 4N-3.2.4 Know how to multiply divisor and dividend by the same value to determine quotient	Working out the total amount due for an order Working out change needed from a purchase (e.g. $20 less $14.99)
4N-3.3 Evaluate one number as a fraction of another.	4N-3.3.1 Demonstrate an understanding of equivalent fractions 4N-3.3.2 Demonstrate an understanding of simplest form 4N-3.3.3 Know how to bring a fraction to its simplest form (e.g. by recognizing equivalent fractions, by using factors to "cancel") 4N-3.3.4 Recognize prime numbers (e.g. numbers that can't be canceled) 4N-3.3.5 Demonstrate an understanding that quantities must be in the same units to evaluate one as a fraction of another	Changing minutes to fractions of an hour to fill in a time sheet Representing the outcome of observations as a fraction
4N-3.4 Use fractions to add, subtract, multiply, and divide amounts or quantities.	4N-3.4.1 Know some common addition and subtraction facts (e.g. ½ + ¼ = ¾, ¾ – ½ = ¼) 4N-3.4.2 Demonstrate an understanding of how to change fractions to equivalent fractions for the purpose of adding and subtracting 4N-3.4.3 Know some common multiplication and division facts (e.g. ½ x ½ = ¼, ¼ ÷ ½ = ½)	Adding hours on a time sheet that includes fractions Finding time-and-a-half pay rate when working overtime

4N-3.5 Work out simple ratio and direct proportion.	4N-3.5.1 Demonstrate an understanding of simple ratio as the number of parts (e.g. *three parts to one part)* 4N-3.5.2 Demonstrate an understanding of direct proportion as the same rate of increase or decrease (e.g. *double, half)*	Diluting a liquid in a given ratio (e.g. weed killer, paint) Changing quantities in a recipe to make twice as much
4N-3.6 Follow order of operations in evaluating number sentences with more than one operation. *Assessed by 3P-3.2*	4N-3.6.1 Applies the rule for order in a horizontal notation	Solving algebra equations containing multiple operations
4N-3.7 Add and subtract integers.	4N-3.7.1 Demonstrate an understanding of positive and negative numbers	Balancing a checkbook.
4N-3.8 Estimate answers to calculations.	4N-3.8.1 Know how to make approximate calculations 4N-3.8.2 Demonstrate an understanding that knowledge of context enables 'guessing' at answers (e.g. *it should be about*…), or judging if answers are sensible (e.g. *that's far too big; it doesn't make sense to have an answer less than 1,* etc.)	Estimating to check that answers are reasonable
4N-3.9 Use a calculator to calculate efficiently using whole numbers, fractions, decimals, and percentages.	4N-3.9.1 Know how to change a fraction to a decimal 4N-3.9.2 Know how to change a percentage to a decimal 4N-3.9.3 Know how to interpret a rounding error such as 6.9999999 as 7 4N-3.9.4 Know and use strategies to check answers obtained with a calculator	Doing any calculations at this level
4N-3.10 Carry out calculations using addition and subtraction with numbers of any size using efficient written methods including ways to check answers.	4N-3.10.1 Know and use strategies to check answers (e.g. approximate calculations, estimation)	Using mental and written methods of calculation to generate results when solving problems using whole numbers of any size
4N-3.11 Carry out calculations using multiplication and division using efficient written methods including ways to check answers.	4N-3.11.1 Demonstrate an understanding of the words *multiple* and *factor* and relate them to multiplication and division facts 4N-3.11.2 Demonstrate an understanding of the word *prime* and know prime numbers up to 20	Using mental and written methods of calculation to generate results when solving problems using whole numbers of any size

4N-3.12 Multiply whole numbers and decimals by 10, 100, and 1,000 to understand the impact on place value.	4N-3.12.1 Recognize the impact on place value of zeros added to whole numbers 4N-3.12.2 Recognize the impact on place value as the position of the decimal point changes	Simplifying large numbers to estimate products
4N-3. 13 Divide whole numbers and decimals by 10, 100, and 1,000 to understand the impact on place value.	4N-3.13.1 Recognize the impact on place value of zeros are cancelled in whole numbers 4N-3.13.2 Recognize the impact on place value as the position of the decimal point changes	Simplifying large numbers to estimate quotients

Strand: Patterns, Functions and Algebra

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 4P-1. Explore, identify, analyze, and extend patterns in mathematical and adult contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
4P-1.1 Complete number sequences (all whole numbers, simple fractions and decimals) involving two-step progressions.	4P-1.1.1 Know multiplication tables	Using rate tables for postage
4P-1.2 Recognize and create repeating patterns, identify the unit being repeated, and generalize.	4P-1.2.1 Isolate smallest unit of repetition 4P-1.2.2 Use a notation system to record patterns	Creating Sales Tax tables Using mental math strategies
4P-1.3 Given a table of amounts, generalize the relationship between the quantities.	4P-1.3.1 Read tables 4P-1.3.2 Recognize and verbalize patterns	Using rate tables for prices

Standard 4P-2. Articulate and represent number and data relationships using words, tables, graphs		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
4P-2.1 Write a simple expression or equation representing verbal situations including multiple operations, fractions, exponents, and parentheses.	4P-2.1.1 Translate simple worded problems involving unknown quantities into simple equations	Entering an expression in a spreadsheet
4P-2.2 Develop and use simple formulas from tables with one or two arithmetical steps for real life contexts.	4P-2.2.1 Discover patterns in an "in-out" table 4P-2.2.2 Verbalize a rule for finding values in an "in-out" table 4P-2.2.3 Write a general expression for finding values in an "in-out" table 4P-2.2.4 Write an equation 4P-2.2.5 Decide on the effectiveness of the developed formula by substituting known values	Converting temperature between Celsius and Fahrenheit Finding interest on a loan

Standard 4P-3. Recognize and use algebraic symbols to model mathematical and contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
4P-3.1 Use and interpret the +, -, x, ÷, and = to represent combining, comparing, and equivalence. *Assessed by 4P-3.2*	4P-3.1.1 Demonstrate an understanding that + represents operations of combining 4P-3.1.2 Demonstrate an understanding	Using a four-function calculator to find the total of a grocery bill Using a calculator to balance

	that – represents operations of separation or comparison 4P-3.1.3 Demonstrate an understanding that × stands for combining multiples 4P-3.1.4 Demonstrate an understanding that ÷ means separating into equal groups or discovering the number of equal groups contained within 4P-3.1.5 Demonstrate an understanding that = represents vocabulary such as *is equal to, is the same as,* and *gives you*	a checkbook Using a four-function calculator to find hourly rate given weekly pay, or to find weekly pay given hourly rate. Helping children with homework.
4P-3.2 Read and write number operations using algebraic notation for multiplication, division, and parentheses.	4P-3.2.1 Read and write 5 (10) for multiplication of 5 times 10 4P-3.2.2 Read and write $\frac{10}{2}$ for 10 ÷ 2 4P-3.2.3 Know that the contents of parentheses must be worked out first 4P-3.2.4 Know that exponents and roots are simplified before multiplication or division	Following convention in notation and the order of carrying out operations Test-taking when seeking employment
4P-3.3 Demonstrate appropriate use of the universally accepted "order of operations".	4P-3.3.1 Read and write number expressions which follow the rule of order for simplifying: *Parentheses* *Exponents and roots* *Multiplication or division* *Addition or subtraction*	Helping children with homework Preparing for further study
4P-3.4 Substitute the value for the variable in an addition or subtraction expression when the value is given, such as finding $x + 4$ and $10 - x$ when x has a value of 1.	4P-3.4.1 Demonstrate an understanding that a variable represents a missing value in addition and subtraction expressions	To prepare for further study
4P-3.5 Substitute the value for the variable in a multiplication or division expression when the value is given (e.g. finding $2x$ and $8/x$ *w*hen $x = 2$ including exponents.	4P-3.5.1 Demonstrate an understanding that a variable represents a missing value in a multiplication and division expression 4P-3.5.2 Demonstrate an understanding that when there is no operator between a number and a variable or two variables that multiplication is implied	To prepare for further study
4P-3.6 Evaluate expressions and make whole number substitutions in given formula to produce results.	4P-3.6.1 Demonstrate an understanding that when there is no operator between a number and a bracket or parentheses that multiplication is implied 4P-3.6.2 Know order of operations	Informally using $d = rt$ to make estimates regarding speed or time of departure
4P-3.7 Read and understand positive and negative integers.	4P-3.7.1 Demonstrate an understanding of the words *positive, negative, and zero* 4P-3.7.2 Know that *positive* refers to	Reading thermometers Riding an elevator below ground level

	values more than zero 4P-3.7.3 Know that *negative* refers to values below zero	Staying "in the black" or going "into the red"
4P-3.8 Demonstrate an understanding addition and subtraction of integers.	4P-3.8.1 Be able to solve expressions such as: 20 – 30 -6 + 10	Finding temperature change
4P-3.9 Use a number line to represent values.	4P-3.9.1 Demonstrate an understanding that a horizontal number line moves from left to right using lesser to greater values 4P-3.9.2 Demonstrate an understanding that intervals on a number line must follow a constant progression between values 4P-3.9.3 Demonstrate an understanding that numbers to the left of zero are negative and those to the right of zero are positive	Using a "thermometer" to represent the progress of a fund raiser Preparing for further study in algebra or higher math
4P-3.10 Write statements of inequality for integers of any size e.g.: 2 < 10 10 > 8 99 < 100 1,000 > 999.99 -12 < - 11.	4P-3.10.1 Demonstrate an understanding that > stands for greater than 4P-3.10.2 Demonstrate an understanding that < stands for less than	Preparing for further study in algebra or higher math Helping children with homework
4P-3.11 Find the value of a variable in multi-step equations e.g.: $3x + 25 = 100$ $2x - 16 = 42$ $3y + 3 = 42$ $m/5 - 25 = 200$.	4P-3.11.1 Recognize that addition and subtraction are inverse operations 4P-3.11.2 Recognize that multiplication and division are inverse operations 4P-3.11.3 Recognize that using the inverse operation can solve equations	Preparing for further study in algebra or higher math Helping children with homework

Standard 4P-4. Analyze change in various contexts		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
4P-4.1 Use graphs to analyze the nature of changes in quantities in linear relationships.	4P-4.1.1 Know vocabulary to describe linear change (e.g. *rises steadily, falls, gradually declines)* 4P-4.1.2 Know mechanics of making a line graph	Interpreting information presented in graphical form in newspapers or magazines

Strand: Statistics and Probability

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 4S-1. Collect, organize and represent data		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
4S-1.1 Pose questions about themselves and their surroundings and gather data to answer posed questions.	4S-1.1.1 Know that answers can be found by observing and asking relevant questions and counting responses	Conducting a survey for community planning
4S-1.2 Group objects or responses by single or double criteria.	4S-1.2.1 Demonstrate an understanding of the concept of categories such as shape, size, color or yes or no responses 4S-1.2.2 Know how to count each category for subtotals	Organizing findings in a chart or table
4S-1.3 Represent information so that it makes sense to others in any graphical form.	4S-1.3.1 Demonstrate an understanding that information can be represented in different ways such as a list, table, or a line plot 4S-1.3.2 Demonstrate an understanding of the importance of labeling information in a list, table, or line plot	Writing a health pamphlet
4S-1.4 Find a total from subtotaled categories to verify inclusion of all data. *Assessed by 3S-1.4*	4S-1.4.1 Demonstrate an understanding that when objects or responses are divided into categories all data must be included in one and only one category; therefore, categories must identify distinct sets	Estimating the total cost of a variety of products, each of which is priced individually (e.g. corn – 6/$1.00, cucumbers - $.39 each, beans - $.99/pound)
4S-1.5 Display categorical data in a bar graph or simple fractions of data in a circle graph.	4S-1.5.1 Demonstrate an understanding that the one axis displays the categories 4S-1.5.2 Demonstrate an understanding that the other axis is numbered sequentially 4S-1.5.3 Demonstrate an understanding that the height (or length) of the bar is equal to the amount on the corresponding axis 4S-1.5.4 Demonstrate an understanding that fractions of data sets (1/4,1/3,1/2, 2/3,3/4) can be represented as wedges of a circle graph	Showing various groups' responses to school activities or programs
4S-1.6 Convert a bar graph into a circle graph.	4S-1.6.1 Demonstrate an understanding that all data must be included so that the circle graph represents 100% of the data	Participating in class to understand interconnections between graphic representations
4S-1.7 Translate data from a numerical table to a line graph and vice versa.	4S-1.7.1 Demonstrate an understanding that a table can display the same data as a line or bar graph but in rows and columns 4S-1.7.2 Demonstrate an understanding of	Creating a bar graph to illustrate weight gain/loss over a one-week period Creating a line graph to

	the importance of labeling each axis 4S-1.7.3 Demonstrate an understanding that single data points are to be connected by a line to create the line graph	illustrate temperatures over a one-week period

Standard 4S-2. Read and interpret data representations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
4S-2.1 Identify graphs and tables in available resources. *Assessed by 2S-2.1*	4S-2.1.1 Demonstrate an understanding that a graph is a visual representation 4S-2.1.2 Demonstrate an understanding that a table arranges information in rows and columns	Reading newspapers and magazines
4S-2.2 Find graphs and tables in external sources. *Assessed by 2S-2.2*	4S-2.2.1 Recognize that graphs and tables can be found in many publications	Reading advertisements Looking up taxes payments Finding current interest rates
4S-2.3 Name and sketch various types of graphs and a table.	4S-2.3.1 Know that a bar graph uses bars of various heights to display amount 4S-2.3.2 Know that line graphs use lines to connect data points 4S-2.3.3 Know that a circle or pie graph represents the whole or 100%	Participating in a class or working with a child on homework
4S-2.4 Extract simple information from a list or table. *Assessed by 2S-2.3*	4S-2.4.1 Demonstrate an understanding that lists can be ordered in different ways such as alphabetically, numerically, or randomly 4S-2.4.2 Demonstrate an understanding that tables are arranged in rows and columns. 4S-2.4.3 Demonstrate an understanding that titles, labels, etc. provide essential information	Using the yellow pages Checking items against a stock list
4S-2.5 Read values on a bar, line, or circle graph.	4S-2.5.1 Demonstrate an understanding that the height of the bar is equal to the amount on the axis across from it 4S-2.5.2 Know how to read a scale on an axis 4S-2.5.3 Demonstrate an understanding that specific data points correspond with the labels on both axes	Using car mileage graphs
4S-2.6 Make numerical comparisons about relative values on a bar graph or circle graph.	4S-2.6.1 Demonstrate an understanding that comparative statements such as *greater than* or *less than* can be made based on the height of the bars or wedge sizes	Creating a circle graph illustrating how earnings are broken down and distributed by categories of expenses

	4S-2.6.2 Demonstrate an understanding of relative numerical terms such as twice or half	

Standard 4S-3. Describe data using numerical descriptions, statistics and trend terminology		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
4S-3.1 Identify the minimum, maximum, spread and shape of data. *Assessed by 5S-3.1*	4S-3.1.1 Be familiar with the terms *minimum*, *maximum*, and *spread*. 4S-3.1.2 Recognition of gaps, holes, and clusters in the data set to determine where data is missing and where it is heavily represented.	Reading temperature charts
4S-3.2 Use "most of" statements to describe data. *Assessed by 3S-3.2*	4S-3.2.1 Recognize that values in the data set can be repeated and some values may be repeated more frequently than others	Using a graph to illustrate the breakdown of household expenses while describing them orally
4S-3.3 Find the mean.	4S-3.3.1 Know that mean is "average" and that average in this case is about equal distribution 4S-3.3.2 Know that the average can be found by adding all values in the data set and dividing by the number of values in the set 4S-3.3.3 Demonstrate an understanding that what are termed "averages" are numbers supposedly "typical" of data	Estimating one's daily expenses
4S-3.4 Find the median and mode.	4S-3.4.1 Know that median is the middle value 4S-3.4.2 Know that when there is an even number of values in the data set, the median is found by calculating the mean of *two* middle values 4S-3.4.3 Know that mode is the number or item that occurs most often in a set of data 4S-3.4.4 Know ways in which "averages" are supposed to be "typical" of data – median is the middle value and mean implies equal distribution of all data	Explaining the median salary or median years worked in company statistics Examining house sale prices to determine which towns are most likely to have affordable housing stock
4S-3.5 Identify the effect of spread on mean and median. *Assessed by 5S-4.5*	4S-3.5.1 Know the minimum or maximum value can greatly affect the mean but will not affect the median	Interpreting statistical data accurately

Standard 4S-4. Make and evaluate arguments or statements by applying knowledge of data analysis		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
4S-4.1 Determine whether or not a graph/table connects to an argument/ statement using title, data labels, and percent matches.	4S-4.1.1 Know how to locate data labels in tables and graphs to verify they match arguments/statements 4S-4.1.2 Locate and connect percent numbers in graphs and arguments/ statements	Reading insurance documents to decide if the what they state matches what they show
4S-4.2 Visually identify "who has more," use numbers to compare quantities and identify obvious misstatements. *Assessed by 2S-3.4*	4S-4.2.1 Recognize bar heights and circle wedges show quantity 4S-4.2.2 Recognize where to look for numbers representing relevant quantities 4S-4.2.3 Knowing to connect numbers with statements/arguments to verify accuracy	Reading newspaper articles and deciding if what they state accurately matches what they show
4S-4.3 Make statements about data trends to support or reject arguments/ statements forwarded by others. *Assessed by 5S-4.4*	4S-4.3.1 Demonstrate an understanding that lines going up mean increase; lines tilting down mean decrease and that they can vary over time 4S-4.3.2 Know that a flat line means no change 4S-4.3.3 Specific vocabulary to describe trends (e.g. "sharp" increase, "plummeted," etc.)	Looking at reports on stock market to see if they reflect the trends represented
4S-4.4 Know statements using "double" and "half" or fifty percent are accurate. *Assessed by 3S-4.6*	4S-4.4.1 Double and halving numbers 4S-4.4.2 Fifty percent equals one half	Using consumer reports to make decisions
4S-4.5 Verify that statements using three times or four times, one fourth or one tenth are accurate.	4S-4.5.1 Know ways to estimate multiples of large numbers 4S-4.5.2 Know ways to estimate one fourth or one tenth of a number	Using consumer reports to make decisions
4S-4.6 Know when percent figures don't add up to 100% and when numbers and percent figures (50%, 25%, 10%) don't match up.	4S-4.6.1 Demonstrate an understanding that circle graphs usually represent 100%, and all figures in them should add to 100 4S-4.6.2 Know ways to estimate or easily calculate 50%, 25% and 10% of a number	Reading expenditure reports from local or national governments to determine if money spent is totally accounted for Analyzing income data reports to see if the percents given reflect the amounts represented
4S-4.7 Compare and contrast provided graphs to evaluate for contradictory or unsupported statements.	4S-4.7.1 Recognize that statements or arguments based on data are sometimes generated by comparing or contrasting graphs	Analyzing accident-related data

	4S-4.7.2 Recognize that statements or arguments based on one graph are sometimes contradicted in another	

Standard 4S-5. Know and apply basic probability concepts		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
4S-5.1 Discuss events as likely or unlikely. *Assessed by 3S-5.1*	4S-5.1.1 Demonstrate an understanding that while some events are impossible, some are certain to happen, and in other events some are more likely to occur than others.	Deciding to avoid or use certain products
4S-5.2 Give the probability of a single outcome in simple concrete situations such as tossing a coin or rolling a die. *Assessed by 3S-5.2*	4S-5.2.1 Demonstrate an understanding that probability depends on the total number of possibilities	Tossing a coin Rolling dice
4S-5.3 State probability as a ratio fraction.	4S-5.3.1 Know that probability is the ratio of the potential successful outcomes to total possibilities. 4S-5.3.2 Know that such ratios can be written in fraction form. 4S-5.3.3 Know that ratio fractions can be simplified	Determining the chances of winning a prize in a drawing
4S-5.4 Find the probability of independent events.	4S-5.4.1 Know that probability is the ratio of the potential successful outcomes to total possibilities. 4S-5.4.2 Know that such ratios can be written in fraction form or as one value compared to another 4S-5.4.3 Know that ratio fractions can be simplified	Designing and conducting experiments using 1, 2, 3, and 4 different colored balls to determine the likelihood of randomly selecting a specific color by chance
4S-5.5 State the probability as a percent.	4S-5.5.1 Know that ratio fractions can be expressed as a percent by expressing a proportion with the percent out of 100	Converting a specific set of outcomes as likelihood of the event happening in 100 attempts

Strand: Geometry and Measurement

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 4G-1. Use and apply geometric properties and relationships to describe the physical world and identify and analyze the characteristics of geometric figures		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
4G-1.1 Directly measure and compare the radius, diameter and circumference of a circle	4G-1.1.1 Use a ruler and string to make measurements 4G-1.1.2 Demonstrate an understanding that the radius is half of the diameter 4G-1.1.3 Demonstrate an understanding that the circumference is a little more than three diameters and that the ratio is known as *pi*	Measuring automobile tires Designing circular gardens
4G-1.2 Directly measure different angles with a protractor. *Assessed by 5G-1.7*	4G-1.2.1 Estimate the measure of an angle using benchmarks of 90 degrees and 180 degrees	Cutting molding for a corner
4G-1.3 Use informal visual methods to describe and compare shape, dimensions, perimeters, area, and angles, sides in two-dimensional (2-D) and three-dimensional (3D) objects.	4G-1.3.1 Be able to solve practical problems using the properties of 2-D and 3-D figures 4G-1.3.2 Demonstrate an understanding that that area is conserved, but perimeter is not when 2-D objects are combined 4G-1.3.3 Build 3-D figures using 2-D plans and blocks	Organizing a closet Packing a trunk Covering a package with paper Tying string around a package
4G-1.4 Identify shapes that are congruent or similar.	4G-1.4.1 Know that congruent shapes are exactly the same with equal sides and angles 4G-1.4.2 Know that similar shapes are the same shape, but different sizes 4G-1.4.3 Know that the corresponding angles of congruent and similar shapes are congruent 4G-1.4.4 Know that similar shapes are proportional to each other	Assembling items bought unassembled (e.g. toys, exercise equipment, some furniture)
4G-1.5 Identify types of angles such as right, obtuse, acute, and straight.	4G-1.5.1 Know that an acute angle has a measure of less than 90° 4G-1.5.2 Know that a right angle has a measure of 90° 4G-1.5.3 Know that an obtuse angle has a measure of more than 90 but less than 180° 4G-1.5.4 Know that a straight angle has a	Using the basic properties of different types of triangles to prove basic theories and solve problems

	measure of 180°	
4G-1.6 Understand the relationship of angles when you have a system of parallel lines cut by a transversal.	4G-1.6.1 Know that a line that crosses two parallel lines is called a transversal 4G-1.6.2 Know that a transversal crosses two lines that are parallel to each crosses both lines at the same angle 4G-1.6.3 Know that when a transversal crosses two parallel lines the corresponding angles are equal to each other	Cutting molding at a correct angle so that both ends meet with no space in between
4G-1.7 Identify different names of triangles by properties, such as isosceles, right, and equilateral.	4G-1.7.1 Know that the sum of the angles of any triangle is 180° 4G-1.7.2 Know that equilateral triangles have three equal sides 4G-1.7.3 Know that each of the angles of an equilateral (equiangular) triangle measures 60° 4G-1.7.4 Know that any triangle with a 90° angle is a right triangle 4G-1.7.5 Know that any triangle with two equal sides is an isosceles triangle 4G-1.7.6 Know that the angles opposite the equal sides of an isosceles triangle are called the base angles, and that base angles are equal to each other	Following plans when working on carpentry projects
4G-1.8 Estimate the measure of an angle using benchmarks.	4G-1.8.1 Know the range of the measure for acute, right, obtuse, and straight angles 4G-1.8.2 Demonstrate an ability to estimate the measure of an angle based on that knowledge	Estimating where a line of symmetry would fall in a rectangular object

Standard 4G-2. Use transformations and symmetry to analyze mathematical situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
4G-2.1 Estimate where a line of symmetry falls in a basic shape.	4G-2.1.1 Demonstrate an understanding of concepts of sameness or half-ness	Cutting cake in half Folding objects
4G-2.2 Show more than one line of symmetry in a complex shape.	4G-2.2.1 Demonstrate an understanding of concepts of sameness or half-ness	Creating a "snowflake" or hanging decoration using folded paper and scissors
Standard 4G-3. Specify locations and describe spatial relationships using coordinate geometry and other representational systems		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
4G-3.1 Read, interpret, and use a distance scale to find the shortest route between two locations on a map.	4G-3.1.1 Reading a map using horizontal and vertical indices or latitude and longitude 4G-3.1.2 Reading a scale	Reading a map to plan a hiking trip

	4G-3.1.3 Use proportional reasoning	
4G-3.2 Measure common three-dimensional (3-D) shapes (e.g. a room) and represent the information on an appropriate diagram drawn to scale.	4G-3.2.1 Demonstrate an understanding of 3-D coordinate graph 4G-3.2.2 Locate points in 3-D graphs 4G-3.2.3 Use proportional reasoning	Creating plans for building a model
4G-3.3 Draw two-dimensional (2-D) shapes in different orientations on a grid.	4G-3.3.1 Use graph paper to draw 2-D shapes 4G-3.3.2 Be able to change the orientation and copy objects	Drawing plans for a carpentry project Creating a pattern for a sewing project
4G-3.4 Use coordinate grid to identify and locate specific points on the *x* and *y* axes.	4G-3.4.1 Know that the horizontal axis on a coordinate grid is labeled *x* 4G-3.4.2 Know that the vertical axis on a coordinate grid is labeled *y* 4G-3.4.3 Know that the intersection of the *x* and *y* axes is called origin 4G-3.4.4 Know that the coordinates of all points on the coordinate grid are given (*x, y*). 4G-3.4.5 Know that the coordinates of all points on the coordinate axes are counted from the origin point (0,0).	Organizing and displaying data to detect patterns and departures from patterns

Standard 4G-4. Understand measurable attributes of objects and the units, systems, and processes of measurement and apply appropriate techniques, tools and formulas to determine measurements		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
4G-4.1 Convert units of measure in different systems by using own informal methods.	4G-4.1.1 Know common equivalences of measurement units 4G-4.1.2 Demonstrate an understanding of proportionality 4G-4.1.3 Know how to solve ratio and proportion problems	Estimating number of pints of blood in the human body given the number of liters
4G-4.2 Read, measure, and compare Fahrenheit and Celsius temperatures.	4G-4.2.1 Reading scales 4G-4.2.2 Making one-to-one correspondence between scales 4G-4.2.3 Estimating distances between markings on a scale 4G-4.2.4 Read and compare negative numbers	Reading a thermometer

4G-4.3 Estimate and approximate an understanding of inter-relatedness of distance, time, and speed.	4G-4.3.1 Investigate how a change in one variable (speed) relates to a change in a second variable (time, distance) 4G-4.3.2 Identify and describe situations with constant or varying rates of change and compare them (acceleration, slowing, down, stopping)	Estimating the time a trip will take from point "A" to point "B" traveling at the normal speed limit
4G-4.4 Measure with a ruler to 1/16 inch and metric ruler in cm and mm.	4G-4.4.1 Know that a foot equals 12 inches 4G-4.4.2 Know the relationship between the fractions of an inch (16ths, 8ths, 4ths, and halves) 4G-4.4.3 Know that the metric numbers on a ruler represent centimeters (cm) and a one-foot ruler is approximately 33 cm long 4G-4.4.4 Know that the 10 divisions of a centimeter are called millimeters (mm) 4G-4.4.5 Know that a metric length is most commonly represented by a decimal. For example 4 cm 3mm would be 4.3 cm	Completing a project demanding fairly precise measurements
4G-4.5 Use the language (prefixes) of metric units to describe environment.	4G-4.5.1 Know that meters measure length 4G-4.5.2 Know that grams measure mass or weight 4G-4.5.3 Know that liters measure volume 4G-4.5.4 Know the metric prefixes *milli* equal to 1/1,000. *centi* equal to 1/100, *deci* equal to 1/10, *deca* equal to 10, *hecto* equal to 100, and *kilo* equal to 1,000	Traveling or communicating with people outside of the United States
4G-4.6 Make informal comparisons between grams and ounces, liters and quarts.	4G-4.6.1 Know that an ounce is approximately equal to 28 grams and that a paper clip weighs approximately 1 gram 4G-4.6.2 Know that a kilogram is approximately 2.2 pounds 4G-4.6.3 Know that a liter is a little larger than a quart (1.1 qts.)	Measuring medications Replacing automotive fluids

4G-4.7 Estimate, measure, and compare capacity using simple instruments graduated in standard units and know when to use appropriate measures.	4G-4.7.1 Demonstrate familiarity with measures of cups, quarts, gallons, inches, feet, yards, ounces, and pounds 4G-4.7.2 Demonstrate familiarity with measures of liters, grams, kilograms, centimeters, meters, and kilometers	Buying beverages for a large group
4G-4.8 Work out simple volumes of cubes, cylinders, and rectangular containers.	4G-4.8.1 Using formulas for volume of cubes, cylinders, and rectangular containers be able to solve for the total	Filling a sand box or garden with mulch
4G-4.9 Find perimeter/area of combination shapes using what you know about rectangles and triangles.	4G-4.9.1 Demonstrate an ability to redefine shapes formed as combinations of rectangles and triangles and calculate the perimeter and area using these smaller parts	Estimating amount of material required to cover a piece of furniture

Level 5: ASE / GED Standards

See "How to use This Document (Teacher's Guide) and (Connecting Curriculum, Instruction, and Assessment)," pages 8-10.

Strand: Number Sense

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 5N-1. Represent and use numbers in a variety of equivalent forms in contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
5N-1.1 Read, write, order, and compare positive and negative numbers of any size in a practical context.	5N-1.1.1 Explain that the position of a digit signifies its value 5N-1.1.2 Know what each digit in a number represents, including the use of zero as a place holder 5N-1.1.3 Demonstrate an understanding of the meaning of negative numbers in a practical context (e.g. temperature below *zero*, loss in trading)	Understanding and comparing government spending figures on public services Understanding and comparing change in the value of stocks
5N-1.2 Read, write, order, and compare fractions and mixed numbers.	5N-1.2.1 Change fractions to equivalent fractions with a common denominator	Comparing overtime rates
5N-1.3 Read, write, order, and compare decimal numbers of any size.	5N-1.3.1 Explain that the position of a digit signifies its value 5N-1.3.2 Know that the decimal point separates whole numbers from decimal fractions 5N-1.3.3 Describe what each digit represents, including the use of zero as a place holder	Reading and comparing gas prices Reading and comparing metric measurements Comparing currency exchange rates
5N-1.4 Order and compare percentages and understand percentage of increase and decrease.	5N-1.4.1 Demonstrate an understanding of percentage as the number of parts in every 100 5N-1.4.2 Know that 100% is the whole 5N-1.4.3 Explain how a 10% pay increase is more than a 5% pay increase, but the actual increase depends on the number operated on	Understanding 20% off in a sale Understanding a price increase of 10%
5N-1.5 Identify and use equivalencies between fractions, decimals and percentages.	5N-1.5.1 Show that fractions, decimals, and percentages are different ways of expressing the same thing 5N-1.5.2 Know that percentages are fractions out of 100 5N-1.5.3 Demonstrate how decimal fractions are expressed in tenths,	Writing fractions of an hour as decimals on a time sheet, (e.g. ¾ hour as 0.75) Recognizing that a deli order for 1/3 pound will read about 0.33 on a digital scale

	hundredths, thousandths	
5N-1.6 Read and write numbers in scientific notation.	5N-1.6.1 Understand positive and negative exponent notation with ten as a base	Using a calculator to compute with small and large numbers

5N-2. Understand meanings of operations and how they relate to one another		
At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
5N-2.1 Demonstrate an understanding of the effects of each operation with fractions.	5N-2.1.1 Represent fractions using number lines and area models 5N-2.1.2 Demonstrate conceptual and procedural understanding of operations with fractions 5N-2.1.3 Know the meaning of commutative, associative, and distributive properties with whole and fractions numbers	Helping children with homework
5N-2.2 Demonstrate an understanding of the effects of each operation with integers.	5N-2.2.1 Represent integers using a number line. 5N-2.2.2 Use area models to demonstrate distributive law of multiplication over addition and subtraction 5N-2.2.3 Demonstrate procedural understanding of operations with integers. 5N-2.2.4 Know the meaning of commutative, associative, and distributive properties with whole numbers and integers	Helping children with homework
5N-2.3 Demonstrate an understanding that dividing by the denominator of a unit fraction produces the same result as multiplying by the decimal form of the fraction.	5N-2.3.1 Demonstrate procedural knowledge of multiplication and division of fractions and decimals	Finding a discount
5N-2.4 Recognizes equivalent fractions, decimals, and percents and can convert from each form to the other two.	5N-2.4.1 Use number lines and area models to represent fractions and decimals 5N-2.4.2 Know equivalences of fractions and decimals 5N-2.4.3 Know how to convert between fractions and decimal equivalences	Reading and using manufacturing specifications

Standard 5N-3. Compute fluently and make reasonable estimates		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
5N-3.1 Add, subtract, multiply and divide decimals of any size.	5N-3.1.1 Know and use strategies to check answers (e.g. approximate calculations using whole numbers) 5N-3.1.2 Align numbers for column addition and subtraction 5N-3.1.3 Demonstrate the ability to determine the placement of decimal points in multiplication of decimal numbers 5N-3.1.4 Demonstrate the ability to determine the placement of decimal points in division of decimal numbers	Converting sums of money between currencies
5N-3.2 Calculate ratio and direct proportion.	5N-3.2.1 Explain a ratio written in the form 3:2 5N-3.2.2 Know how to work out the number of parts in a given ratio, and the value of one part	Comparing the price of products of different weights or capacities Mixing household or workplace materials
5N-3.3 Add, subtract, multiply, and divide using fractions and mixed numbers.	5N-3.3.1 Demonstrate an understanding of how to change fractions to equivalent fractions for the purpose of adding and subtracting 5N-3.3.2 Demonstrate an understanding of how to find a fraction quotient through multiplication	Adding hours on a time sheet that includes fractions
5N-3.4 Add, subtract, multiply, and divide using integers in practical contexts.	5N-3.4.1 Understand how number direction affects the four operations	Finding the average temperature Figuring the net result of banking transactions
5N-3.5 Compute with percentage to solve problems in context.	5N-3.5.1 Demonstrate how to use proportion to figure with percentage	Figuring the effect on mortgage payments of a change in interest rates
5N-3.6 Use a calculator to calculate efficiently using whole numbers, integers, fractions, decimals, and percentages.	5N-3.6.1 Change the sign of a number 5N-3.6.2 Change a fraction to a decimal 5N-3.6.3 Change a percentage to a decimal 5N-3.6.4 Interpret a rounding error such as 6.9999999 as 7 5N-3.6.5 Interpret a calculator display employing scientific notation 5N-3.6.6 Demonstrate an understanding of the use of memory and constant	Calculating the total price on a item offered at 25 % off with 5% sales tax added

	functions 5N-3.6.7 Know and use strategies to check answers obtained with a calculator	
5N-3.7 Determine prime numbers up to 100.	5N-3.7.1 Know that a prime number is a positive integer greater than 1 that has no factors other than 1 and itself	Simplifying mathematical problems by factoring out numbers from each side of an equation

Strand: Patterns, Functions, and Algebra

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 5P-1. Explore, identify, analyze, and extend patterns in mathematical and adult contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
5P-1.1 Extend a pattern and when applicable hypothesize reasons, and analyze how both repeating and growing patterns are generated.	5P-1.1.1 Isolate smallest unit of repetition 5P-1.1.2 Use a notation system to record patterns 5P-1.1.3 Make a table using pattern values 5P-1.1.4 Verbalize a rule for finding values in the table 5P-1.1.5 Write a general expression for finding values in the table 5P-1.1.6 Decide on the effectiveness of the expression by substituting known values	Accurately describing patterns of heating bills and explaining the patterns Creating a compound interest table
5P-1.2 Demonstrate an understanding of graphical, tabular, or symbolic representations for a given pattern and/or relationship.	5P-1.2.1 Make a table using pattern values 5P-1.2.2 Verbalize a rule for finding values in the table 5P-1.2.3 Write a general expression for finding values in the table 5P-1.2.4 Decide on the effectiveness of the expression by substituting known values	Reading and explaining temperature conversion tables

Standard 5P-2. Articulate and represent number and data relationships using words, tables, graphs, rules, and equations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
5P-2.1 Create own equations, rules or sketch graphs from word problems or observed situations.	5P-2.1.1 Make a table using pattern values 5P-2.1.2 Verbalize a rule for finding values in the table 5P-2.1.3 Write a general expression for finding values in the table 5P-2.1.4 Decide on the effectiveness of the expression by substituting known values	Working out the standard elements of a household budget
5P-2.2 Convert between different representations, such as tables, graphs, verbal descriptions, and	5P-2.2.1 Recognize that a variety of problem situations may be modeled by the same function or type of function	Presenting results of data exploration

equations.		
5P-2.3 Develop algebraic expressions, rules, formulae, or sketch graphs to generalize straightforward number patterns or observable relationships between variables.	5P-2.3.1 Demonstrate an understanding of the parts of a graph	Translating graphic depictions of data into oral or written descriptions to explain relationships
5P-2.4 Draw graphs using techniques such as plotting points, sketching from known main features of algebraic function, or using technology like a graphing calculator or computer package.	5P-2.4.1 Know graphing techniques 5P-2.4.2 Understand use of a graphing calculator or spreadsheet	Making visual aids for depicting change patterns in business or industry
5P-2.5 Identify general shapes and major characteristics of linear and simple non-linear graphs and interpret their real world meanings.	5P-2.5.1 Recognize and use direct and indirect variation	Interpreting graphic presentations of data to analyze events and make predictions

Standard 5P-3. Recognize and use algebraic symbols to model mathematical and contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
5P-3.1 Find the value of an unknown in equations that require multi-step solutions e.g.: $2x + 4 = 6x - 8$ $0.5y^2 - 10 = 40$.	5P-3.1.1 Recognize that addition and subtraction are inverse operations 5P-3.1.2 Recognize that multiplication and division are inverse operations 5P-3.1.3 Recognize that using the inverse operation can solve equations	Preparing for further study Helping children with homework
5P-3.2 Evaluate formulas.	5P-3.2.1 Know that a variable is replaced by its number value within parentheses when a formula is evaluated 5P-3.2.2 Demonstrate an understanding that when there is no operator between a number and a bracket or parentheses that multiplication is implied 5P-3.2.3 Know order of operations	Informally using $d = rt$ to make estimates regarding speed or time of departure Using a calculator
5P-3.3 Solve linear and quadratic equations.	5P-3.3.1 Know the quadratic formula 5P-3.3.2 Know how to evaluate formulas	Helping children with homework Preparing for further study

Standard 5P-4. Analyze change in various contexts		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
5P-4.1 Approximate and interpret rates of change from graphical and numerical data. *Assessed by 5G-4.3*	5P-4.1.1 Understand that slope represents rate of change 5P-4.1.2 Know how to find the slope from a line graph or table of data	Looking for trends (e.g. in the price of items, in revenue for a business)

Strand: Statistics and Probability

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 5S-1. Collect, organize and represent data		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
5S-1.1 Pose both categorical and numerical questions about himself or his environment.	5S-1.1.1 Know that answers can be found by observing and asking relevant questions and counting responses	Working on a playground committee to select equipment
5S-1.2 Collect and organize responses to questions. *Assessed by 5S-1.1*	5S-1.2.1 Demonstrate an understanding of the concept of categories such as shape, size, country, ethnicity, income level or yes or no responses	Conducting research for travel or relocation purposes
5S-1.3 Choose an appropriate representation to display responses to all types of data.	5S-1.3.1 Demonstrate an understanding that categorical data is usually displayed on bar or circle graphs 5S-1.3.2 Demonstrate an understanding that numerical data and change over time is usually displayed on a line graph 5S-1.3.3 Know how to choose a suitable scale to fit the data set 5S-1.3.4 Calculate percents and find percents and/or fractions of 360 degrees 5S-1.3.5 Use a protractor 5S-1.3.6 Demonstrate an understanding that a table can be more accurate than a graph when recording precise numerical datum 5S-1.3.7 Explain the importance of labeling tables, graphs, and diagrams	Representing findings from data gathering in a manufacturing or business setting
5S-1.4 Collect comparative data on a single given question such as responses grouped by age group vs. responses grouped by gender.	5S-1.4.1 Know that responses grouped by different criteria must be recorded in separate data sets	Gathering data in the workplace and sorting it by criteria
5S-1.5 Display comparative data on a double bar or line graph.	5S-1.5.1 Explain why separate data sets must be identified by different colors or line patterns 5S-1.5.2 Demonstrate an understanding that a key to identify each data set must be provided	Comparing gathered work-related data by preparation of appropriate bar or line graphs

Standard 5S-2. Read and interpret data representations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
5S-2.1 Identify graphs and tables in available resources. *Assessed by 2S-2.1*	5S-2.1.1 Explain how a graph is a visual representation 5S-2.1.2 Describe how a table arranges information in rows and columns	Reading newspapers and magazines
5S-2.2 Know where graphs and tables are likely to be found. *Assessed by 2S-.2.2*	5S-2.2.1 Recognize that graphs and tables can be found in newspapers, magazines, research journals, and promotional materials 5S-2.2.2 Recognize that a table is an organizing tool used in manuals, tax forms, financial statements etc.	Reading advertisements Looking up taxes payments Finding current interest rates Reading graphic materials in the workplace
5S-2.3 Infer meaning from gaps, clusters and comparisons of data.	5S-2.3.1 Know ways to compare numbers. 5S-2.3.2 Know how to connect the shape and comparisons of data with text or background knowledge to infer causes for such phenomena	Reading exam questions Reading corporate or government reports
5S-2.4 Give a verbal description of bar, line, and circle graphs and tables.	5S-2.4.1 Know that a bar graph uses bars of various heights to display amount 5S-2.4.2 Know that line graphs use lines to connect data points 5S-2.4.3 Know that a circle or pie graph represents the whole or 100% 5S-2.4.4 Know that a table can display the same datum as a graph but in rows and columns	Helping with homework Training co-workers
5S-2.5 Make numerical comparisons about relative values on graphs and tables.	5S-2.5.1 Compare and contrast one set of numbers against another	Comparing prices of vacations represented in a brochure

Standard 5S-3. Describe data using numerical descriptions, statistics and trend terminology		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
5S-3.1 Identify the minimum, maximum, spread, shape, and range of data, mean, median, and mode to understand trends and statements.	5S-3.1.1 Explain the terms *minimum, maximum, and spread* 5S-3.1.2 Demonstrate an understanding that range is the difference between the smallest and largest values in the data set 5S-3.1.3 Recognize gaps, holes, and clusters in the data set to determine where data is missing and where it is heavily represented	Reading temperature charts Discussing with a financial planner the relative value of different retirement investment plans offered at work
5S-3.2 Identify the effect of spread on mean and median. *Assessed by 5S-4.5*	5S-3.2.1 Know the minimum or maximum value can greatly affect the mean but will not affect the median	Determining a grade point average

Standard 5S-4. Make and evaluate arguments or statements by applying knowledge of data analysis, bias factors, and graph distortions		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
5S-4.1 Choose the best graph to support a position.	5S-4.1.1 Distinguish between graphs by understanding the stories each tells	Working with a group to support or oppose a change in the neighborhood
5S-4.2 Support arguments with data and data representations and use number statements to demonstrate the power of an argument.	5S-4.2.1 Demonstrate the ability to collect data to support a conjecture, hypothesis or belief 5S-4.2.2 Represent collected data in a line plot, table, line or bar graph with an accurate scale, and circle graph 5S-4.2.3 Recognize that the greater the number of data supporting an argument, the more powerful the argument 5S-4.2.4 Use subtraction to compare 5S-4.2.5 Use division to demonstrate how many more times data support an argument	Initiating political actions to institute changes in the community Creating a survey or report to support a plea for changes in one's community

5S-4.3 Convert tables to graphs to support an argument, and convert graphs to narratives and narratives to graphs to forward a position.	5S-4.3.1 Show how to organize large sets of data in a table 5S-4.3.2 Use a table as the foundation for graphic displays 5S-4.3.3 Use appropriate language to describe graphic data in a way to show how the data supports an argument 5S-4.3.4 Know how to "read" the stories in graphs in order to state them as support an argument	Preparing or reading academic research Preparing reports favoring a political or social position, or to negotiate salaries
5S-4.4 Make statements about data trends to support or reject arguments/statements forwarded by others.	5S-4.4.1 Explain lines going up mean increase; lines tilting down mean decrease and that they can vary over time 5S-4.4.2 Explain that a flat line means no change 5S-4.4.3 Use specific vocabulary to describe trends (e.g. "*sharp" increase, "plummeted," etc.*	Checking reports on stock market or discussing smoking trends with children or peers Understanding changes reported in one's workplace
5S-4.5 Demonstrate an understanding of the impact of spread on mean and median, and which statistic, *mean*, *median*, or *mode,* is most appropriate for data.	5S-4.5.1 Finding the mean, median, and mode 5S-4.5.2 Know that mean and median are compressions of data 5S-4.5.3 Describe experiences with changes and spread and resulting changes or lack of changes in mean and median 5S-4.5.4 Explain why means and medians don't always represent what is typical, and so aren't always best used in creating an argument 5S-4.5.5 Describe some inappropriate uses of mean, median or mode 5S-4.5.6 Use appropriate statistic to support an argument	Reading advertisements or demographic reports in order to make decisions Negotiating salary increases Reading real estate sales reports; health and fitness data
5S-4.6 Recognize that bar widths, scale, and wedge size distortions can provide misleading information.	5S-4.6.1 Explain how visual messages are given by bar widths (e.g. thin relays message of "less" and wide relays message of "more") 5S-4.6.2 Explain why visual messages can contradict or enhance evidence 5S-4.6.3 Describe how scales are represented in regular increments 5S-4.6.4 Explain why size of the increments used in scales can make changes seem more or less significant	Creating promotional materials for social change Reading advertisements Reading environmental and corporate reports on pollution Checking out population preference or conditions' data to determine if it's accurate

	5S-4.6.5 Explain why wedge size in circle graphs should correspond roughly to fraction of data represented	
5S-4.7 Explain where and how authors of data reports can manipulate data to benefit themselves or malign others in mixed materials.	5S-4.7.1 Identify who produced a data report and how their interests might affect the report, resulting in a conflict of interest	Reading advertisements and product studies to make consumer choices
5S-4.8 Understand that different categorizations of data reveal different stories.	5S-4.8.1 Know how to categorize data in a variety of ways, including aggregate or disaggregate data 5S-4.8.2 Know how to make 'story' statements about what is seen in data and how these change as categories change 5S-4.8.3 Know how to use different categorizations appropriately to support an argument	Following demographic data reports or consumer goods' data with a critical eye
5S-4.9 Demonstrate an understanding of the impacts of data compression, and when compression helps or hinders an argument. *Not assessed, but important to teach at this level*	5S-4.9.1 Explain why data representations do not necessarily show each datum; therefore, individual variations are not visible 5S-4.9.2 Explain why personal or regional (subset) variations are sometimes more relevant to arguments/statements than aggregate data 5S-4.9.3 Discern the level at which an argument is best stated	Reading consumer preferences' or selections' data Preparing documents to advocate for school change Gathering data for statistical process control tasks
5S-4.10 Compare and contrast provided graphs to evaluate contradictory or unsupported statements, or to strengthen an argument. *Assessed by 4S-4.7*	5S-4.10.1 Explain how statements or arguments based on data are sometimes generated by comparing or contrasting graphs 5S-4.10.2 Explain how statements or arguments based on one graph are sometimes contradicted in another 5S-4.10.3 Explain how statements or arguments based on multiple graphs can be used to support or enhance each other and one's position	Comparing accident-related data to make a point concerning safety Comparing work-related progress from month to month

Standard 5S-5. Know and apply basic probability concepts		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
5S-5.1 Find the probability of both independent and dependent events.	5S-5.1.1 Explain that the probability is independent when the outcome of one event does not influence the outcome of another 5S-5.1.2 Explain that the probability is dependent when the outcome of one event directly influences the outcome of subsequent events	Interpreting the odds of contracting breast cancer or being in an airplane accident.
5S-5.2 Find the number of possible combinations given two or more sets of data.	5S-5.2.1 Know that the total number of possible combinations of items in lists can be found by multiplying the number of items in each list times each other 5S-5.2.2 Be able to find all of the possible combinations of a set of letters, digits, or items	Determining the number of coordinated outfits possible from a set of slacks and tops. Determining the possible combinations available on a menu. Determining the total number of combinations for a combination lock

Strand: Geometry & Measurement

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 5G-1. Use and apply geometric properties and relationships to describe the physical world and identify and analyze the characteristics of geometric figures		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
5G-1.1 Apply ratio and proportion in familiar situations that may use scales or magnification.	5G-1.1.1 Demonstrate an understanding of simple ratio as the number of parts (e.g. *three parts to one part)* 5G-1.1.2 Demonstrate an understanding of direct proportion as the same rate of increase or decrease (e.g. *double, half)*	Mixing various quantities of cleaning fluids based on one set of directions Calculating the proper distance to place a projector from its screen to achieve a particular image size
5G-1.2 Use the language (prefixes) of metric units to describe environment (*centi, milli, kilo, micro, mega*). *Assessed by 4G-4.5*	5G-1.2.1 Know definitions of measures of mass (grams), capacity (liters), and length (meter) 5G-1.2.2 Know meaning of prefixes 5G-1.2.3 Develop informal benchmarks for metric units (e.g. length of thumbnail = 1 cm; 1 meter is approximately 3 feet)	Representing measurement outcomes in the workplace
5G-1.3 Use spatial visualization to describe and analyze geometric figures. *Assessed 4G-1.3*	5G-1.3.1 Know meaning of horizontal and vertical 5G-1.3.2 Develop informal benchmarks for angles 5G-1.3.3 Know vocabulary for 2-D shapes and orientation	Identifying and describing objects to be measured
5G-1.4 Develop and use formulae that describe relationships between variables in familiar contexts (area and volume).	5G-1.4.1 Demonstrate an understanding of area and volume of 2-D and 3-D figures 5G-1.4.2 Use patterns to generalize	Using a formula to determine material required to build or cover an object
5G-1.5 Use properties of triangles to solve problems.	5G-1.5.1 Demonstrate understanding of congruent and similar triangles 5G-1.5.2 Explain the sum of the angles in a triangle in a plane equals 180 degrees 5G-1.5.3 Recognize situations where properties of right triangles apply 5G-1.5.4 Apply the Pythagorean theorem to right triangles	Building and measuring objects in the manufacturing trades
5G-1.6 Use properties of right triangles and Pythagorean relationship to solve problems.	5G-1.6.1 Know properties of right triangles, including angle measurement 5G-1.6.2 Demonstrate an understanding of similarity in triangles 5G-1.6.3 Apply proportional reasoning to find corresponding sides	Determining the line of symmetry of a right triangle

5G-1.7 Directly measure different angles with a protractor.	5G-1.7.1 Know how to align a protractor with the rays of an angle	Determining a specific angle of slope for installing housing gutters or drains

Standard 5G-2. Use transformations and symmetry to analyze mathematical situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
5G-2.1 Use coordinates to design and describe geometric figures or translations/rotations of geometric figures.	5G-2.1.1 Demonstrate an understanding of the coordinate graph system 5G-2.1.2 Know geometric shapes	Reading scientific diagrams Using CAD/CAM software to design a product

Standard 5G-3. Specify locations and describe spatial relationships using coordinate geometry and other representational systems		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
5G-3.1 Find, use, and interpret the slope of a line, the *y*-intercept of a line, and the intersection of two lines.	5G-3.1.1 Demonstrate an understanding of the coordinate graph system 5G-3.1.2 Know how to create a table of ordered pairs which satisfy an equation 5G-3.1.3 Generate a graph from a formula or equation 5G-3.1.4 Generate and equation or formula from a graph 5G-3.1.5 Identify co-efficients with graph steepness	Using linear modeling to determine optimal pricing

Standard 5G-4. Understand measurable attributes of objects and the units, systems, and processes of measurement and apply appropriate techniques, tools and formulas to determine measurements		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
5G-4.1 Solve and estimate solutions to problems involving length, perimeter, area, surface area, volume, angle measurement, capacity, weight, and mass.	5G-4.1.1 Explain the meaning of the terms *perimeter, area, volume, angle, capacity, weight* and *mass*	Estimating materials needs for a given job Solving problems relating to size, shape and capacity in business and industry
5G-4.2 Predict the impact of changes in linear dimensions on the perimeter, area, and volume of figures.	5G-4.2.1 Know the formulas for perimeter, area, and volume. 5G-4.2.2 Know how to list data in a chart or table 5G-4.2.3 Know how to graph data from a table 5G-4.2.4 Know how to describe and analyze patterns of change in a table or graph	Deciding whether and how suggested increases or decreases in measurement will change a manufacturing or building project
5G-4.3 Calculate and interpret rates of change from graphical and numerical data.	5G-4.3.1 Demonstrate an ability to extrapolate numerical data from graphic presentations 5G-4.3.2 Demonstrate an ability to accurately calculate percentages	Determine the rate of increase/decrease of gasoline prices based on newspaper reports
5G-4.4 Solve problems of area involving inscribed figures (e.g. a circle inscribed in square).	5G-4.4.1 Demonstrate a familiarity with the formulas for area of polygons and circles. 5G-4.4.2 Demonstrate an understanding of when areas in an inscribed figure are excluded requiring subtraction	Designing a pattern for a flower garden Determining an arrangement for furniture of various shapes in the home
5G-4.5 Use simplified formula to convert between Fahrenheit and Celsius temperatures.	5G-4.5.1 Demonstrate an understanding of the constants and variables provided in conversion formulas	Determining the temperature reported in an area using either the metric or ASE system

Level 6: ASE / Bridge to College Standards

See "How to Use This Document (Teacher's Guide) and (Connecting Curriculum, Instruction and Assessment)," pages 8-10. At this time, the Massachusetts ABE Test for Math does not assess students' knowledge at this level.

Strand: Number Sense

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 6N-1. Represent and use numbers in a variety of equivalent forms in contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
6N-1.1 Read, write, order and compare positive and negative numbers of any size.	6N-1.1.1 Demonstrate an understanding that the position of a digit signifies its value 6N-1.1.2 Know what each digit in a number represents, including the use of zero as a place holder 6N-1.1.3 Demonstrate an understanding that the meaning of negative numbers in a practical context (e.g. temperature below *zero*, loss in trading)	Understanding and comparing government spending figures on public services Understanding and comparing change in the value of stocks
6N-1.2 Read, write, order and compare fractions and mixed numbers.	6N-1.2.1 Change fractions to equivalent fractions with a common denominator	Comparing overtime rates
6N-1.3 Read, write, order and compare decimal numbers.	6N-1.3.1 Demonstrate an understanding that the position of a digit signifies its value 6N-1.3.2 Know that the decimal point separates whole numbers from decimal fractions 6N-1.3.3 Know what each digit represents, including the use of zero as a place holder	Reading and comparing gas prices Reading and comparing metric measurements Comparing currency exchange rates
6N-1.4 Order and compare percentages and understand percentage increase and decrease.	6N-1.4.1 Explain percentage as the number of parts in every 100 6N-1.4.2 Describe how 100% is the whole 6N-1.4.3 Demonstrate an understanding that a 10% pay increase is more than a 5% pay increase, but the actual increase depends on the number operated on	Understanding 20% off in a sale Understanding a price increase of 10%
6N-1.5 Identify and use equivalencies between fractions, decimals and percentages.	6N-1.5.1 Explain how fractions, decimals, and percentages are different ways of expressing the same thing 6N-1.5.2 Know that percentages are fractions out of 100 6N-1.5.3 Express decimal fractions in tenths, hundredths, thousandths	Writing fractions of an hour as decimals on a time sheet (e.g. ¾ hour as 0.75) Recognizing that a deli order for 1/3 pound will read about 0.33 on a digital scale

6N-1.6 Read and write numbers in exponential notation using integer exponents.	6N-1.6.1 Demonstrate an understanding that a positive exponent indicates the base is to be multiplied by itself that number of times 6N-1.6.2 Demonstrate an understanding that a negative exponent indicates the base is to be divided by itself that number of times	Using a calculator to compute with small and large numbers Using exponential notation for metric conversion

Standard 6N-2. Understand meanings of operations and how they relate to one another		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
6N-2.1 Demonstrate an understanding that use of the associative and commutative properties of addition and multiplication and the distributive property of multiplication over addition can simplify computations with decimals, fractions, and integers.	6N-2.1.1 Demonstrate conceptual and procedural understanding of operations with decimals, fractions, and integers. 6N-2.1.2 Know meaning of commutativity and associativity and distributive properties with whole numbers	Using a scientific calculator
6N-2.2 Demonstrate an understanding that raising a number to a negative integer is repeated division.	6N-2.2.1 Demonstrate an understanding of exponents 6N-2.2.2 Use rules of exponents for multiplication and division	

Standard 6N-3. Compute fluently and make reasonable estimates		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
6N-3.1 Add, subtract, multiply and divide decimals up to three places.	6N-3.1.1 Use strategies to check answers (e.g. approximate calculations using whole numbers) 6N-3.1.2 Know how to align numbers for column addition and subtraction 6N-3.1.3 Explain the placement of the decimal point in multiplying decimals 6N-3.1.4 Explain the placement of the decimal point when dividing decimals	Converting sums of money between currencies
6N-3.2 Calculate ratio and direct proportion.	6N-3.2.1 Demonstrate an understanding of a ratio written in the form 3:2 6N-3.2.2 Work out the number of parts in a given ratio, and the value of one part	Comparing the price of products of different weights or capacities
6N-3.3 Add, subtract, multiply and divide using fractions.	6N-3.3.1 Change fractions to equivalent fractions for the purpose of adding and subtracting 6N-3.3.2 Find a fraction quotient through multiplication	Adding hours on a time sheet that includes fractions
6N-3.4 Add, subtract, multiply and divide using integers.	6N-3.4.1 Explain how number direction affects the four operations	Finding the average temperature

		Figuring the net result of banking transactions Determining profit after totaling costs
6N-3.5 Compute with percentage.	6N-3.5.1 Demonstrate an understanding of how to use proportion to figure with percentage	Figuring the effect on mortgage payments of a change in interest rates
6N-3.6 Use a calculator to calculate efficiently using whole numbers, integers, fractions, decimals, percentages.	6N-3.6.1 Change the sign of a number 6N-3.6.2 Change a fraction to a decimal 6N-3.6.3 Change a percentage to a decimal 6N-3.6.4 Interpret a calculator display employing scientific notation 6N-3.6.5 Find a trigonometric function of a number (e.g. cos 90°) 6N-3.6.6 Interpret a rounding error such as 6.9999999 as 7 6N-3.6.7 Demonstrate an understanding of the use of memory and constant functions 6N-3.6.8 Use strategies to check answers obtained with a calculator	Any calculations at this level

Strand: Patterns, Functions, and Algebra

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 6P-1. Explore, identify, analyze, and extend patterns in mathematical and adult contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
6P-1.1 Describe, complete, extend, analyze, generalize, and create a wide variety of patterns, including iterative/recursive (e.g. Fibonnacci Numbers), linear, quadratic and exponential functions.	6P-1.1.1 Create and analyze different representations, such as tables, graphs, verbal descriptions, and equations 6P-1.1.2 Create algebraic expressions, rules, formulae, or sketch graphs to generalize number patterns or observable relationships between variables	Creating mathematical models
6P-1.2 Explain the difference between linear and exponential growth.	6P-1.2.1 Identify general shapes and major characteristics of linear and simple non-linear graphs and interpret their real world meanings 6P-1.2.2 Draw graphs using techniques such as plotting points; sketching from known main features of algebraic function; or using technology like a graphing calculator or computer package	Reading scientific or economic charts

Standard 6P-2. Articulate and represent number and data relationships using words, tables, graphs, rules, and equations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
6P-2.1 Convert between different representations, such as tables, graphs, verbal descriptions, and equations.	6P-2.1.1 Explain how a variety of problem situations may be modeled by the same function or type of function	Connecting visual information from a variety of sources to reach a decision about a process, product or service
6P-2.2 Develop algebraic expressions, rules, formulae, or sketch graphs to generalize straightforward number patterns or observable relationships between variables.	6P-2.2.1 Create own equations, rules or sketch graphs from word problems or observed situations 6P-2.2.2 Recognize and analyze patterns in number relationships and in charts and tables	Describing growth or change in workplace output
6P-2.3 Draw graphs using techniques such as plotting points; sketching from known main features of algebraic function; or using technology like a graphing calculator or computer package.	6P-2.3.1 Create a table of values for relations and functions 6P-2.3.2 Demonstrate an understanding of slope 6P-2.3.3 Can use slope-intercept form of equations 6P-2.3.4 Know spreadsheet conventions	
6P-2.4 Identify general shapes and major characteristics of linear and simple non-linear graphs and	6P-2.4.1 Recognize and use direct and indirect variation	Applying graphic information to the decision- making process

interpret their real world meanings.		

Standard 6P-3. Recognize and use algebraic symbols to model mathematical and contextual situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
6P-3.1 Recognize that a variety of problem situations may be modeled by the same function or type of function.	6P-3.1.1 Describe experience using common functions 6P-3.1.2 Describe observations of similarities between graphs of functions of the same type	Preparing for further study
6P-3.2 Convert between different representations, such as tables, graphs, verbal descriptions, and equations.	6P-3.2.1 Graph data in table form 6P-3.2.2 Form a table from data in graph form 6P-3.2.3 Find the equation of a line or how to figure slope and intercept from table data	Presenting findings of data exploration
6P-3.3 Evaluate formulas and functions.	6P-3.3.1 Explain that a variable is replaced by its number value within parentheses when a formula or function is evaluated 6P-3.3.2 Demonstrate an understanding that when there is no operator between a number and a bracket or parentheses that multiplication is implied 6P-3.3.3 Demonstrate knowledge of order of operations	Informally using $d = rt$ to make estimates regarding speed or time of departure Using a scientific calculator
6P-3.4 Solve equations (e.g. linear, quadratic, exponential, trigonometric) and systems of linear equations.	6P-3.4.1 Demonstrate fluency working with algebraic expressions 6P-3.4.2 Demonstrate experience with a graphing calculator	Preparing for further study Measuring angles in industrial settings
6P-3.5 Recognize and use direct and indirect variation.	6P-3.5.1 Describe experience using common functions 6P-3.5.2 Describe observations of similarities between graphs of functions of the same type	

Standard 6P-4. Analyze change in various contexts		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
6P-4.1 Approximate and interpret rates of change from graphical and numerical data.	6P-4.1.1 Demonstrate an understanding that slope represents rate of change 6P-4.1.2 Find the slope from a line graph or table of data	Looking for trends (e.g. in the price of items, in revenue for a business, in value of wages)

Strand: Statistics and Probability

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 6S-1. Collect, organize and represent data		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
6S-1.1 Pose both categorical and numerical questions about himself or his environment.	6S-1.1.1 Demonstrate that answers can be found by observing and asking relevant questions and counting responses	Working on a playground committee to select equipment
6S-1.2 Collect and organize responses to posed questions.	6S-1.2.1 Demonstrate an understanding that the concept of categories such as shape, size, color or yes or no responses	Gathering data for a report
6S-1.3 Choose appropriate representation to display responses to all types of data.	6S-1.3.1 Demonstrate an understanding that categorical data is usually displayed on bar or circle graphs 6S-1.3.2 Demonstrate an understanding that numerical data and change over time is usually displayed on a line graph 6S-1.3.3 Know how to calculate percents and find percents and/or fractions of 360 degrees 6S-1.3.4 Demonstrate an understanding that a table can be more accurate than a graph when recording precise numerical data as in decimal values.	Analyzing data from graphs in newspapers or periodicals
6S-1.4 Collect comparative data on a single given question such as responses grouped by age group vs. responses grouped by gender.	6S-1.4.1 Know that responses grouped by different criteria must be recorded in separate data sets	Gathering information regarding taxpayer groups in a community Gathering information regarding target audiences for products
6S-1.5 Display comparative data on a double bar or line graph.	6S-1.5.1 Explain why separate data sets must be identified by different colors or line patterns 6S-1.5.2 Demonstrate an understanding that a key to identify each data set must be provided	Showing results of data collection
6S-16 When computers and software are available, know how to use a spreadsheet.	6S-1.6.1 Understand that the rows and columns on a spreadsheet are user defined 6S-1.6.2 Understand that cells on the spreadsheet are the intersection of user defined rows and columns 6S-1.6.3 Demonstrate an ability to enter formulas for operations on cell data	Entering information on a spreadsheet in the workplace Creating a spreadsheet for personal finance records

Standard 6S-2. Read and interpret data representations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
6S-2.1 Identify graphs and tables in available resources.	6S-2.1.1 Demonstrate an understanding that a graph is a visual representation 6S-2.1.2 Understand that a table arranges information in rows and columns	Reading graphics in newspapers and magazines
6S-2.2 Know where graphs and tables are likely to be found.	6S-2.2.1 Explain that graphs and tables can be found in newspapers, magazines, research journals, and promotional materials 6S-2.2.2 Explain that a table is an organizing tool used in manuals, tax forms, financial statements etc.	Reading advertisements Looking up taxes payments Finding current interest rates
6S-2.3 Give a verbal description of bar, line, and circle graphs, and tables.	6S-2.3.1 Demonstrate an understanding that a bar graph uses bars of various heights to display amount 6S-2.3.2 Demonstrate an understanding that line graphs use lines to connect data points 6S-2.3.3 Demonstrate an understanding that a circle or pie graph represents the whole or 100%	Participating in class or work discussions about data representations
6S-2.4 Make numerical comparisons about relative values on graphs and tables.	6S-2.4.1 Demonstrate and ability to use number sense skills	Following changes on sales charts for business trends
6S-2.5 Infer meaning from gaps, clusters, and comparisons of data.	6S-2.5.1 Demonstrate ways to compare numbers 6S-2.5.2 Demonstrate how to connect the shape and comparisons of data with text or background knowledge to infer causes for such phenomena	Reading exam questions Reading corporate or government reports
6S-2.6 Infer consequences related to data outcomes.	6S-2.6.1 Project possible consequences from examining data and text and connecting these to similar situations	Reading exam questions Reading corporate or government reports

Standard 6S-3. Describe data using numerical descriptions, statistics and trend terminology		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
6S-3.1 Identify the minimum, maximum, spread, shape, and range of data.	6S-3.1.1 Explain terms *minimum, maximum*, and *spread* 6S-3.1.2 Demonstrate an understanding that range is the difference between the smallest and largest values in the data set 6S-3.1.3 Recognize gaps, holes, and clusters in the data set to determine where data is missing and where it is heavily represented	Reading temperature charts and in discussions with a financial planner about retirement investment plans offered at work.
6S-3.2 Use 'most of' statements to describe data.	6S-3.2.1 Recognize that values in the data set can be repeated and some values may be repeated more frequently than others	
6S-3.3 Find the mean.	6S-3.3.1 Know that *mean* is "average" and that average in this case is about equal distribution 6S-3.3.2 Describe how the average can be found by adding all values in the data set and dividing by the number of values in the set	Estimating one's daily expenses. Determining a grade point average
6S-3.4 Find the median.	6S-3.4.1 Know that *median* is the middle value 6S-3.4.2 Know that when there is an even number of values in the data set, the median is found by calculating the mean of *two* middle values	Explaining to someone what it means to say "the median salary is $X per hour," or that the median years worked at a company is X."
6S-3.5 Identify the effect of spread on mean and median.	6S-3.5.1 Recognize the minimum or maximum value can greatly affect the mean but will not affect the median 6S-3.5.2 Explain how the spread of data can affect the "closeness" of the mean and median values	Discussing with real estate brokers the "true" value of homes in a neighborhood
Standard 6S-4. Make and evaluate arguments or statements by applying knowledge of data analysis, bias factors and graph distortions		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
6S-4.1 Make statements about data trends to support or reject arguments/statements forwarded by others.	6S-4.1.1 Demonstrate an understanding that lines going up mean increase; lines tilting down mean decrease and that they can vary over time 6S-4.1.2 Explain that a flat line means no change 6S-4.1.3 Define vocabulary to describe trends (e.g. "*sharp" increase, "plummeted,"* etc.)	Analyzing reports on stock market Describing movement of a product, process or service
6S-4.2 Know when percents given and figures used don't match Make accurate statements using	6S-4.2.1 Describe ways for estimating and calculating percents of numbers	Analyzing social science reports

percents.	6S-4.2.2 Explain what it means to have an increase of more than 100 percent 6S-4.2.3 Demonstrate an understanding of the significance of large or small percent increases or decreases in various contexts	
6S-4.3 Recognize that mean, median, and mode numbers are considered "averages," and that averages represent numbers typical of the data that can support an argument.	6S-4.3.1 Explain that what are termed "averages" are numbers supposedly "typical" of data 6S-4.3.2 Describe ways in which "averages" are supposed to be "typical" of data; median is the middle value, mean implies equal distribution of all data	Examining house sale prices to determine which towns are most likely to have affordable housing stock Debating rent increases
6S-4.4 Demonstrate an understanding of the impact of spread on mean and median, and therefore, when the choice of statistic is appropriate and know that mean and medians are compressions of data.	6S-4.4.1 Use techniques for finding mean and median 6S-4.4.2 Describe with spread changes and resulting changes or lack of changes in mean and median 6S-4.4.3 Explain why means and medians don't always represent what is typical 6S-4.4.4 Describe why the choice of statistic is inappropriate or appropriate	Reading advertisements or demographic reports in order to make decisions Negotiating salary increases
6S-4.5 Determine which statistic, mean or median, is appropriate for data.	6S-4.5.1 Describe experience with inappropriate uses of mean and median 6S-4.5.2 Use appropriate statistic to support an argument	Consuming health and fitness data to determine a plan of action
6S-4.6 Recognize that bar widths can provide misleading information, and state how those distortions are used to affect the arguments/statements.	6S-4.6.1 Demonstrate an understanding that visual messages are given by bar widths (e.g. thin relays message of "less" and wide relays message of "more") 6S-4.6.2 Demonstrate an understanding that visual messages can contradict or enhance evidence 6S-4.6.3 Describe scale distortions and relate impacts on arguments/statements	Reading advertisements to make consumer choices
6S-4.7 Recognize scale distortions in research materials, and state how those distortions are used to affect the arguments/statements.	6S-4.7.1 Explain that scales are represented in regular increments 6S-4.7.2 Demonstrate an understanding that the size of the increments used in scales can make changes seem more or less significant 6S-4.7.3 Describe scale distortions and relate impacts on arguments/statements	Consuming or preparing environmental and/or corporate reports on pollution

6S-4.8 Recognize wedge size distortions, and state how those distortions are used to affect the arguments/statements.	6S-4.8.1 Wedge size in circle graphs should correspond roughly to fraction of data represented 6S-4.8.2 Know how to describe wedge distortions and relate impacts on arguments/statements	Working with population preference or condition data; understanding advertisements
6S-4.9 Note where authors of data reports can manipulate data to benefit themselves or malign others in mixed materials and state those bias factors.	6S-4.9.1 Determine who produced a data report and how their interests might affect the report (e.g. as in conflict of interest.) Know how to articulate information about conflicts of interest or bias when noted	Reading advertisements and product reports
6S-4.10 Demonstrate an understanding that different categorizations of data reveal different stories and state how and why such effects relate to arguments/statements.	6S-4.10.1 Categorize data in a variety of ways (e.g. aggregate or disaggregate data) 6S-4.10.2 Make "story" statements about what is seen in data and how that changes as categories change 6S-4.10.3 Describe possible shifts in data interpretation resulting from the choice of data categorization	Working with demographic data reports or consumer goods' data to refute a company's position or to take a stand on an issue
6S-4.11 Demonstrate an understanding of the impacts of data compression and state how and why such effects relate to arguments/statements.	6S-4.11.1 Explain why data representations do not necessarily show every datum; therefore, individual variations are not visible 6S-4.11.2 Explain how personal or regional (subset) variations are sometimes more relevant to arguments/statements than aggregate data 6S-4.11.3 State source and effects of data compression and relate to arguments/statements forwarded by others	Analyzing consumer preferences' or selections' data to determine if it truly reflects what it purports to Using statistical process control information in the workplace
6S-4.12 Compare and contrast graphs to evaluate for contradictory or unsupported statements.	6S-4.12.1 Explain that statements or arguments based on data are sometimes generated by comparing or contrasting graphs 6S-4.12.2 Explain that statements or arguments based on one graph are sometimes contradicted in another 6S-4.12.3 Where complementary data might be found	Preparing academic research reports Analyzing poll data
6S-4.13 Demonstrate an understanding of simple sample biases.	6S-4.13.1 Explain how sample size reflects on reliability of data. 6S-4.13.2 Explain how sample composition reflects on reliability of data	Preparing academic research reports Analyzing corporate reports

Standard 6S-5. Know and apply basic probability concepts		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
6S-5.1 Discuss events as likely or	6S-5.1.1 Demonstrate an understanding	Deciding to avoid or use

unlikely.	that while some events are impossible, some are certain to happen, and in other events some are more likely to occur than others	certain products
6S-5.2 Give the probability of a single outcome in simple concrete situations such as tossing a coin or rolling a die.	6S-5.2.1 Demonstrate an understanding that probability depends on the total number of possibilities	Tossing a coin or Rolling dice Explaining to children the probability of winning or losing in a competitive activity
6S-5.3 State probability as a ratio fraction.	6S-5.3.1 Describe how probability is the ratio of the potential successful outcomes to total possibilities 6S-5.3.2 Know that such ratios can be written in fraction form 6S-5.3.3 Know that ratio fractions can be simplified	Playing card games Interpreting the odds at a sporting event Understanding mortality rates related to certain diseases
6S-5.4 State probability as a percent.	6S-5.4.1 Understand that the likelihood of an event is measured on a scale of 0% being impossible and 100% being certain	Interpreting the odds at a sporting event Understanding mortality rates related to certain diseases
6S-5.5 Find the probability of both independent and dependent events.	6S-5.5.1 Demonstrate an understanding that the probability is independent when the outcome of one event does not influence the outcome of another 6S-5.5.2 Demonstrate an understanding that the probability is dependent when the outcome of one event directly influences the outcome of subsequent events	Interpreting the odds of contracting breast cancer and being in an airplane accident. Interpreting the odds of contracting lung disease from smoking and dying of lung cancer.

Strand: Geometry and Measurement

Learners engage in problem solving within adult contextual situations by communicating, reasoning, and connecting to the following standards:

Standard 6G-1. Use and apply geometric properties and relationships to describe the physical world and identify and analyze the characteristics of geometric figures		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
6G-1.1 Model and solve problems using the concepts of perpendicularity, parallelism, congruence and similarity of geometric figures (includes polygons, 3-D figures, and circles).	6G-1.1.1 Know and use geometric vocabulary 6G-1.1.2 Recognize and describe perpendicular and parallel lines Identify and label angles and figures 6G-1.1.3 Demonstrate an understanding of measure of angles and sides 6G-1.1.4 Demonstrate an understanding of similarity of 2-D figures 6G-1.1.5 Use proportional reasoning	Building and designing structures
6G-1.2 Use the Pythagorean theorem, similarity, and right-triangle trigonometry to model and solve problems.	6G-1.2.1 Know properties of right triangles, including angle measurement 6G-1.2.2 Demonstrate an understanding of similarity of triangles 6G-1.2.3 Apply proportional reasoning to find corresponding sides 6G-1.2.4 Know vocabulary for trigonometric functions. 6G-1.2.5 Know how to read a trig table or use a scientific calculator to find trig ratios 6G-1.2.6 Read, compare, or draw sketches of triangles	Designing products
6G-1.3 Use spatial visualization to describe and analyze geometric figures.	6G-1.3.1 Know meaning of horizontal and vertical 6G-1.3.2 Develop informal benchmarks for angles 6G-1.3.3 Know vocabulary for 2-D shapes	Identifying and describing objects to be measured

Standard 6G-2. Use transformations and symmetry to analyze mathematical situations		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
6G-2.1 Use coordinates to describe translations/rotations of geometric figures.	6G-2.1.1 Demonstrate an understanding of the coordinate graph system 6G-2.1.2 Know geometric shapes	Reading scientific diagrams Using CAD/CAM software to design a product

Standard 6G-3. Specify locations and describe spatial relationships using coordinate geometry and other representational systems		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
6G-3.1 Use coordinates to design and describe geometric figures or translations/rotations of geometric figures.	6G-3.1.1 Demonstrate an understanding of the coordinate graph system 6G-3.1.2 Know geometric shapes and angles 6G-3.1.3 Demonstrate an understanding of rotation and translation in plane	Studying vector forces on an object (e.g. in physics)

Standard 6G-4. Understand measurable attributes of objects and the units, systems, and processes of measurement and apply appropriate techniques, tools and formulas to determine measurements		
Benchmark: At this level an adult will be expected to:	**Enabling Knowledge and Skills**	**Examples of Where Adults Use It**
6G-4.1 Solve and estimate solutions to problems involving length, perimeter, area, surface area, volume, angle measurement, capacity, weight, and mass.	6G-4.1.1 Demonstrate an understanding of the terms *perimeter, area, volume, angle, capacity, weight* and *mass*	Building and measuring structures and objects
6G-4.2 Predict the impact of changes in linear dimension on the perimeter, area, and volume of figures.	6G-4.2.1 Know geometric formulae Identify how the change in one variable causes a change in another 6G-4.2.2 Know difference between linear and exponential change	

Appendices

Appendix A. Suggested Readings

Curry, D., Schmitt, M.J., and Waldron, S. (1996). *A Framework for Adult Numeracy Standards: The Mathematical Skills and Abilities Adults Need to be Equipped for the Future*, Boston, MA: The Adult Numeracy Practitioners Network.

Clermont, Yvan; Gal, Iddo; van Groenestijn, Mieke; Manly, Myrna; Schmitt, Mary Jane; and Tout, Dave. (2000). *Numeracy Conceptual Framework for the International Adult Literacy and Lifeskills (ALL) Survey*, Ottawa, Canada: Statistics Canada.

Gal, I. (Ed.). (2000). *Adult Numeracy Development: Theory, Research, Practice.* Cresskill, NJ: Hampton Press, Inc.

Ma, Liping. (1999). *Knowing and Teaching Elementary Mathematics,* Mahwah, New Jersey: Lawrence Erlbaum Associates.

Marr, Beth and Tout, Dave. (1998). *Certificates in General Education for Adults. Numeracy and Mathematics Stream.* Victoria, Australia: Adult, Community and Further Education Board.

Massachusetts ABE Math Team (Leonelli, E., Merson, M.W., Schmitt, M.J., and Schwendeman, R. (editors.), (1994). *The Massachusetts ABE Math Standards Project*. (2 Vols.). Holyoke, MA: Holyoke Community College SABES Regional Center.

Massachusetts Mathematics Educators. (Nov. 2000). *Mathematics for All.*

Moses, R. and Cobb, C. (2001). *Radical Equations: Math Literacy and Civil Rights.* Boston, MA: Beacon Press.

Mullinix, B. (1994). *Exploring What Counts: Mathematics Instruction in Adult Basic Education.* Boston, MA: World Education.

Principles and Standards for School Mathematics. (2000). Reston, VA: National Council of Teachers of Mathematics.

Sharma, Mahesh C. (1994). *Learning Problems in Mathematics: Diagnosis and Remedial Perspectives*. Framingham, MA: Center for Teaching/Learning of Mathematics.

Stein, S. (2000), *Equipped for the Future Content Standards: What Adults Need to Know and Be Able to Do in the 21st Century.* Washington, DC: National Institute for Literacy. ED Pubs document EX0099P.

The Basic Skills Agency. (May 2000). *The Adult Basic Skills Curriculum.* London, UK: Department of Education and Employment.

Massachusetts Mathematics Curriculum Framework. (Nov. 2000). Malden, MA: Massachusetts Department of Education.

Appendix B. Sample Instructional Units

Goodridge, B., Leonelli, E., Moses, M., Steinback, M., and Tierney, C. (1999). *Foundation for Algebra: ABE Math Curriculum Frameworks Unit,* Malden, MA: Massachusetts Department of Education.

Goodridge, B., Leonelli, E., Moses, M., Steinback, M., and Tierney, C. (1998). *Number Sense: ABE Math Curriculum Frameworks Unit,* Malden, MA: Massachusetts Department of Education.

Appendix C. Instructional Resources and Materials

Adult Numeracy Curriculum

Goddard, R., Marr, B, and Martin, J. (1996). *Strength in Numbers: A Resource Book for Teaching Adult Numeracy.* ARIS/Language Australia: Melbourne, Australia.

Holme, S. and Marr, B. (1999). *Mathematics: A New Beginning. A Resource Book for Teachers of Adults Returning To Study.* Language Australia: Australia.

Huntington, L., Leonelli, E., and Merson, M. (1998). *ABE Priority Math Curriculum: Number Sense, Measurement, Data.* Boston, MA: Adult Literacy Resource Institute.

Algebra, Patterns, and Relations

Goodridge, B., Leonelli, E., Moses, M., Steinback, M., and Tierney, C. (1999). *Foundation for Algebra: ABE Math Curriculum Frameworks Unit,* Malden, MA: Massachusetts Department of Education.

Meader, Pam, and Storer, Judy. (1998). *Math for All Learners. Pre-Algebra.* Portland, ME. J. Weston Walch. (Reproducible activity pages come with complete teacher notes.)

Meader, Pam, and Storer, Judy. (1998). *Math for All Learners. Algebra.* Portland, ME. J. Weston Walch, Publisher (Reproducible activity pages come with complete teacher notes).

Number Sense

Baratta-Lorton, Robert. (1977). *Mathematics…A Way of Thinking.* Reading, MA: Addison-Wesley Publishing Company.

Goodridge, B., Leonelli, E., Moses, M., Steinback, M., and Tierney, C. (1998). *Number Sense: ABE Math Curriculum Frameworks Unit,* Malden, MA: Massachusetts Department of Education.

Hope, Jack A., Reys, B., and Reys, R.E. (1988). *Mental Math in Junior High,* Palo Alto, CA: Dale Seymour Publications.

Hope, Jack A., Reys, B., and Reys, R.E. (1987). *Mental Math in the Middle Grades.* Palo Alto, CA: Dale Seymour Publications.

Phillips, Jan, (1995). Smart *Solutions: Whole Numbers and Money (with Teachers Manual),* Syracuse, NY: New Readers Press.

Reys, R.E., Trafton, P.R., Reys, B., Zawojewski, J. (1987). *Computational Estimation Grade 6.* Palo Alto, CA: Dale Seymour Publications.

All Strands

Burns, Marilyn, (1987). *A Collection of Math Lessons From Grades 1 Through 3.* White Plains, NY: Math Solutions Publications (Reprinted 1997).

Burns, Marilyn, A. (1987). *Collection of Math Lessons From Grades 3 Through 6.* White Plains, NY: Math Solutions Publications.

Stenmark, J. K., Thompson, V., and Cossey, R. (1986). *Family Math.* Berkeley, CA: Regents, University of California.

Problem-Solving

Cohen, Sandra R. (1992). *Figure It Out: Thinking like a Math Problem Solver, Books 1 - 6.* North Billerica, MA: Curriculum Associates, Inc.

Greenes, C., Immerzeel, G., Ockenga, E., Schulman, L., and Spungin, R. (1982). *Problem-Solving Skill Sheets, Blackline Masters. Techniques of Problem Solving (TOPS).* Palo Alto, CA: Dale Seymour Publications.

Greenes, C., Immerzeel, G., Ockenga, E., Schulman, L., and Spungin, R. (1982). *Techniques of Problem Solving (TOPS) 200 Illustrated Problem Cards with Teacher's Commentary.* Palo Alto, CA: Dale Seymour Publications.

GED Preparation

Manly, Myrna. (1992). *The GED Math Problem Solver, Reasoning Skills to Pass the Test.* Lincolnwood, IL: Contemporary Books.

Learning Differences and Disabilities

Bley, Nancy S. and Carol A Thornton. (1989). *Teaching Mathematics to Students with Learning Disabilities (Third Edition).* Austin, TX.

Burns, Marilyn . (1992). *About Teaching Mathematics: A K-8 Resource.* Sausalito, CA: Math Solutions Publications.

Cooper, Richard. (1992). *Tic Tac Toe Math (Workbook I).* Bryn Mawr, PA: Learning disAbilities Resources.

Johnson, Stanley W. (1979). *Arithmetic and Learning Disabilities: Guidelines for Identification and Remediation.* Boston, MA: Allyn and Bacon, Inc.

Miles, T.R. and E. Miles, editors. (1992). *Dyslexia and Mathematics.* New York, NY: Routledge.

Sharma, Mahesh C. (1994). *Learning Problems in Mathematics: Diagnosis and Remedial Perspectives*. Framingham, MA: Center for Teaching/Learning of Mathematics.

Thornton, Carol A. and Nancy.S. Bley, editors. (1994). *Windows of Opportunity: Mathematics for Students with Special Needs*. Reston, VA: National Council of Teachers of Mathematics.

Internet Resources

Adult Numeracy Network
http://www.literacynet.org/ann/

National Council of Teachers of Mathematics
http://www.nctm.org

Science and Numeracy Special Collection, National Institute for Literacy LINCS,
http://literacynet.org/sciencelincs/
or
http://www.nifl.gov/lincs/collections/collections.html

The Math Forum
http://www.mathforum.org/

The Numeracy List (electronic discussion list sponsored by the Adult Numeracy Network)
http://www.nifl.gov/lincs/discussions/numeracy/numeracy.html

Appendix D. Criteria for Evaluating Instructional Materials and Programs[2]

Considering Your Students, Your Teaching, and Materials You Will Use

Much good teaching comes from learning to ask the right kinds of questions, and paying attention to the answers you find. On the following pages, you will find lists of questions designed to help you determine:

- your style as a teacher, and how you might want to choose materials and strategies;
- who your students are, and what they want to learn;
- how to pull together materials that will help you meet your objectives.

Remember that one bad day in the classroom or one frustrated student does not make you a bad teacher.

The first thing to consider in planning instruction is your own comfort level; if you feel uncomfortable with your materials or planned activities, it doesn't matter how theoretically sound your plan is. You cannot teach well if you don't believe in what you're doing. Consider the following questions.

- How would you describe your relationship with your students?
- What expectations do you have about your students' readiness to learn? Are your expectations realistic?
- Do you know your students' study habits? Have you talked with them about the things they need to do outside of regular class sessions?
- Have you been direct and honest with students about how long it will take them to reach their goals?
- Do you think you have students who will never reach the goals they have set for themselves? How do you handle this?

There are no right or wrong answers to these questions, only honest and dishonest ones. These are the kinds of issues that will affect the climate of your classroom and your students' progress; too often, we don't consider them until we're faced with a dilemma. Taking the time to think about your expectations before a problem arises will help you to handle difficulties more calmly and professionally. Once you've taken the time to figure out your own approach to teaching the language arts, you need to consider the needs, expectations, and beliefs your students bring to the classroom. Try answering the questions above as you think your students would answer them, then ask yourself these additional questions.

- What are my students' approaches to learning? Do they have both short-term and long-term goals?
- How long have these students been out of school? How do they describe their past school experiences?

It's important to remember that we all carry the images and impressions of past school experiences, positive and otherwise, when we enter a new classroom. Most

[2] Adapted from the Massachusetts English Language Arts Curriculum Framework

students in adult education have had a number of negative experiences, and may be wary of the new educational experience, particularly if your classroom reminds them at first of others where they've spent time.

You should also get in the habit of helping your students to set goals. Not everyone will progress at the same pace; some students may feel as though they're making no progress at all, a feeling that will be exacerbated if others in the class are moving much more quickly. Having goals will give them something concrete to work toward, a way of measuring progress, and a sense of control over what they're doing.

Finally, you need to consider what you will be teaching. Much of this will be obvious, but within any given class there is an enormous range of possibilities. If you visit ten ASE classes, you will find ten different ways of proceeding, and all of the teachers will tell you they're working toward the same basic goals. Here are three questions that will help you to select materials for your class.

- What do you think your students need to learn?
- What do your students think they need to learn?
- What kinds of materials are you comfortable using?

Although your students are in your class because of their general skill level, each of them will have a different profile of strengths and weaknesses. Getting to know those profiles will help you make decisions about the skills you want to focus on in your class. Likewise, students may have some very specific reasons for attending your class beyond the general improvement of their literacy or their desire to earn a credential. The more you can address your students' specific goals, the more motivated and open they will be. Your attentiveness to and respect for their goals will help you establish a level of trust that will allow your students to move beyond their comfort zone, helping them to take the risks necessary for significant strides in learning.

Finally, consider what materials you are comfortable using. Do you want worksheets, or do you prefer to make up questions yourself? What kinds of readings will your students do? What language or situations, if any, would make your students uncomfortable in a classroom setting? You also need to consider what materials your program makes available to you, and how much time you have to look for additional materials. A mix of materials and teaching strategies is often helpful in teaching students with different learning styles.

These questions are a jumping off point. Planning and implementing curriculum will challenge and occasionally frustrate you, but as was noted in the previous section, when your lesson takes off and your students get more involved and excited than you ever would have hoped, you will find that the effort has been worthwhile.

Appendix E. Massachusetts Common Core of Learning[3]

The Massachusetts Common Core of Learning supports all Department of Education curriculum development efforts, including both K-12 and Adult Basic Education. To quote

[3] Adapted from the Massachusetts ABE English Language Arts Curriculum Framework

from the Massachusetts Department of Education website, "The Education Reform Act of 1993 called for statewide curriculum frameworks and learning standards for all students in all core academic subjects. During the first year of Education Reform (1994), the Common Core of Learning was developed to identify the broad educational goals for all students."

By identifying "what students should know and be able to do," the purpose of the Common Core of Learning is the first step in the process of education reform. It was followed by the development of state curriculum frameworks that contain academic content standards that establish a basis for objective measurement. The next step is the development of an assessment system to evaluate student performance and measure the success of schools and ABE programs.

The Common Core of Learning focuses on three main areas: Thinking and Communicating, Gaining and Applying Knowledge, and Working and Contributing.

Thinking and Communicating

All students should:
Read, Write and Communicate Effectively

- Read and listen critically for information, understanding, and enjoyment.
- Write and speak clearly, factually, persuasively, and creatively in standard English.
- Distinguish fact from opinion, identify stereotyping, and recognize bias.
- Read, write, and converse in at least one language in addition to English.

Use Mathematics, the Arts, Computers and Other Technologies Effectively

- Apply mathematical skills to interpret information and solve problems.
- Use the arts to explore and express ideas, feelings, and beliefs.
- Use computers and other technologies to obtain, organize, and communicate information and to solve problems.

Define, Analyze, and Solve Complex Problems

- Make careful observations and ask pertinent questions.
- Seek, select, organize, and present information from a variety of sources.
- Analyze, interpret, and evaluate information.
- Make reasoned inferences and construct logical arguments.
- Develop, test, and evaluate possible solutions.
- Develop and present conclusions through speaking, writing, artistic, and other means of expression.

Gaining and Applying Knowledge

All students should:
Acquire, Integrate and Apply Essential Knowledge

Literature and Language

- Read a rich variety of literary works including fiction, poetry, drama, and nonfiction from different time periods and cultures, relating them to human aspirations and life experiences.
- Analyze implications of literary works, and communicate them through speaking, writing, artistic, and other means of expression.
- Know and understand the development and structure of English and other languages and how learning another language fosters appreciation of peoples and cultures.

Mathematics, Science, and Technology

- Know and understand major mathematical concepts such as measurement, estimation, quantity, probability, and statistics; and explore the relationship of mathematics to other areas of knowledge.
- Recognize and use patterns, construct mathematical models, represent and reason about quantities and shapes, draw accurate conclusions from data, and solve, justify, and communicate solutions to problems.
- Apply the fundamental principles of the life sciences, physical sciences, earth/space sciences, and the science of technology to analyze problems and relate them to human concerns and life experiences.
- Investigate and demonstrate methods of scientific inquiry and experimentation.

Social Studies, History and Geography

- Know and make connections among important historical events, themes, and issues; recognize the role the past has played in shaping the present; and understand the process by which individuals and groups develop and work within political, social, economic, cultural, and geographic contexts.
- Synthesize and communicate information about important events and fundamental concepts in Massachusetts, United States and world history, including historical documents such as the Declaration of Independence, Constitution, Bill of Rights, Federalist Papers, and the Gettysburg Address.
- Know important information regarding the physical environment and understand concepts such as location and place, critical features of a region, demographic trends and patterns, and the relationship between people and the environment.

Visual and Performing Arts

- Know and understand the nature of the creative process, the characteristics of visual art, music, dance, and theatre, and their importance in shaping and reflecting historical and cultural heritage.
- Analyze and make informed judgments regarding the arts.
- Develop skills and participate in the arts for personal growth and enjoyment.

Health

- Know basic concepts of human development, mental health, sexuality, parenting, physical education and fitness, nutrition and disease prevention, and understand the implications of health habits for self and society.
- Make informed and responsible judgments regarding personal health, including avoidance of violence, tobacco, alcohol, drugs, teen pregnancy, and sexually transmitted diseases.
- Develop skills and participate in physical activities for personal growth, fitness, and enjoyment.

Working and Contributing

All students should:
Study and Work Effectively

- Set goals and achieve them by organizing time, workspace, and resources effectively.
- Monitor progress and learn from both successes and mistakes.
- Manage money, balance competing priorities and interests, and allocate time among study, work, and recreation.
- Work both independently and in groups.
- Work hard, persevere, and act with integrity.

Demonstrate Personal, Social and Civic Responsibility

- Accept responsibility for one's own behavior and actions.
- Know career options and the academic and occupational requirements needed for employment and economic independence.
- Treat others with respect and understand similarities and differences among people.
- Learn to resolve disagreements, reduce conflict, and prevent violence.
- Participate in meaningful community and/or school activities.
- Understand the individual's rights, responsibilities, and role in the community, state and nation.
- Understand how the principles of democracy, equality, freedom, law, and justice evolve and work in society.
- Analyze, develop, and act on informed opinions about current economic, environmental, political and social issues affecting Massachusetts, the United States, and the world.

Appendix F. Equipped for the Future Role Maps and Domain Skills[4]

As quoted from the National institute for Literacy's website www.nifl.gov/lincs/collections/eff/eff_roles.html, the *Equipped for the Future* Role Maps "describe what adults do when they are effective in their roles as parents/family members, workers, and citizens/community members. EFF partners developed the role maps by asking adults from many different walks of life to describe what they needed to be able to do to fulfill these three roles."

"Each role map includes the following parts: the key purpose or central aim of the role, broad areas of responsibility that are the critical functions that adults perform, and key activities through which the role is performed. We can use the role maps to identify what it is important for us to teach and learn."

Beginning on the following page are the Role Maps for Parent/Family, Worker, and Citizen/Community Worker, and finally, a list of skills form the four domains in the EFF Standards.

[4] Adapted from the Massachusetts ABE English Language Arts Curriculum Framework

Parent/Family Role Map

Effective family members contribute to building and maintaining a strong family system that promotes growth and development.

Broad Areas of Responsibility

Promote Family Members' Growth and Development	**Meet Family Needs and Responsibilities**	**Strengthen the Family System**
Family members support the growth and development of all family members, including themselves	Family members meet the needs and responsibilities of the family unit	Family members create and maintain a strong sense of family

Key Activities

▪ Make and pursue plans for self-improvement ▪ Guide and mentor other family members ▪ Foster informal education of children ▪ Support children's formal education ▪ Direct and discipline children	▪ Provide for safety and physical needs ▪ Manage family resources ▪ Balance priorities to meet multiple needs and responsibilities ▪ Give and receive support outside the immediate family	▪ Create a vision for the family and work to achieve it ▪ Promote values, ethics, and cultural heritage within the family ▪ Form and maintain supportive family relationships ▪ Provide opportunities for each family member to experience success ▪ Encourage open communication among the generations

Worker Role Map

Effective workers adapt to change and actively participate in meeting the demands of a changing workplace in a changing world.

Broad Areas of Responsibility

Do the Work	**Work With Others**	**Work Within the Big Picture**	**Plan and Direct Personal and Professional Growth**
Workers use personal and organizational resources to perform their work and adapt to changing work demands	Workers interact one-on-one and participate as members of a team to meet job requirements	Workers recognize that formal and informal expectations shape options in their work lives and often influence their level of success	Workers prepare themselves for the changing demands of the economy through personal renewal and growth

Key Activities

▪ Organize, plan and prioritize work ▪ Use technology, resources, ands other work tools to put ideas and work directions into action ▪ Respond to and meet new work challenges ▪ Take responsibility for assuring work quality, safety and results	▪ Communicate with others inside and outside the organization ▪ Give assistance, motivation, and direction ▪ Seek and receive assistance, motivation and direction ▪ Value people different from yourself	▪ Work within organizational norms ▪ Respect organizational goals, performance and structure to guide work activities ▪ Balance individual roles and needs with those of the organization ▪ Guide individual and organizational priorities based on industry trends, labor laws/ contracts, and competitive practices	▪ Balance and support work, career, and personal needs ▪ Pursue work activities that provide personal satisfaction and meaning ▪ Plan, renew, and pursue personal and career goals ▪ Learn new skills

Citizen/Community Member Role Map

Effective citizens and community members take informed action to make a positive difference in their lives, communities and the world.

Broad Areas of Responsibility

Become and Stay Informed	**Form and Express Opinions and Ideas**	**Work Together**	**Take Action to Strengthen Communities**
Citizens and community members find and use information to identify and solve problems and contribute to the community	Citizens and community members develop a personal voice and use it individually and as a group	Citizens and community members interact with each other people to get things done toward a common purpose	Citizens and community members exercise their rights and responsibilities as individuals and as members of groups to improve the world around them

Citizen/Community Member Role Map -- Key Activities

▪ Identify, monitor, and anticipate problems, community needs, strengths, and resources for yourself and others ▪ Recognize and understand human, legal, and civic rights and responsibilities for yourself and others ▪ Figure out how the system that affects an issue	▪ Strengthen and express a sense of self that reflects personal history, values, beliefs, and roles in the larger community ▪ Learn from others' experiences and ideas ▪ Communicate so that others understand ▪ Reflect on and re-evaluate your own opinions and ideas	▪ Get involved in the community and get others involved ▪ Respect others and work to eliminate discrimination and prejudice ▪ Define common values, visions, and goals ▪ Manage and resolve conflict ▪ Participate in group processes and decision-making	▪ Help yourself and others ▪ Educate others ▪ Influence decision-makers and hold them accountable ▪ Provide leadership within the community

works			
▪ Identify how to have an impact and recognize that individuals can make a difference ▪ Find, interpret, analyze, and use diverse sources of information, including personal experience			

Lists of Skills from the Four Domains in the EFF Standards

In order to fulfill responsibilities as parents/family members, citizens, community members, and workers, adults must be able to demonstrate these generative skills. (See also Appendix D: Content Framework for EFF Standards, where these generative skills are in context.)

Communication Skills

- Read with Understanding
- Convey Ideas in Writing
- Speak So Others Can Understand
- Listen Actively
- Observe Critically

Decision-making Skills

- Use Mathematics in Problem Solving and Communication
- Solve Problems and Make Decisions
- Plan

Interpersonal Skills

- Cooperate with Others
- Advocate and Influence
- Resolve Conflict and Negotiate
- Guide Others

Lifelong Learning Skills

- Take Responsibility for Learning
- Reflect and Evaluate
- Learn through Research
- Use Information and Communications Technology

Content Framework for EFF Standards

In order to fulfill responsibilities as parents/family members, citizens/community members, and workers, adults must be able to:

MEET THESE FOUR PURPOSES	ACCOMPLISH THESE COMMON ACTIVITIES	DEMONSTRATE THESE GENERATIVE SKILLS	UNDERSTAND AND BE ABLE TO USE THESE KNOWLEDGE DOMAINS
Access To information so adults can orient themselves in the world	Gather, Analyze, and Use Information	**Communication Skills**	How We Grow and Develop
	Manage Resources	Read with Understanding	How Groups and Teams Work
	Work Within the Big Picture	Convey Ideas in Writing	How Systems Work
	Work Together	Speak So Others Can Understand	Rights and Responsibilities Culture, Values, and Ethics
Voice To be able to express ideas and opinions with the confidence they will be heard and taken into account	Provide Leadership	Listen Actively	How the Past Shapes the World We Live In
	Guide and Support Others	Observe Critically	
	Seek Guidance and Support from Others	**Decision-Making Skills**	
	Develop and Express Sense of Self	Use Math to Solve Problems and Communicate	
	Respect Others and Value Diversity	Solve Problems and Make Decisions	
Independent Action To be able to solve problems and make decisions on one's own, acting independently, without having to rely on others	Exercise Rights and Responsibilities	Plan	
	Create and Pursue Vision and Goals	*Interpersonal Skills*	
	Use Technology and Other Tools to Accomplish Goals	Cooperate with Others	
	Keep Pace with Change	Advocate and Influence	
		Resolve Conflict and Negotiate	
Bridge to the Future Learn how to learn so adults can keep up with the world as it changes		Guide Others	
		Lifelong Learning Skills	
		Take Responsibility for Learning	
		Reflect and Evaluate	
		Learn Through Research	
		Use Information and Communications Technology	