Grade 3 • Module 2

Place Value and Problem Solving with Units of Measure

OVERVIEW

In this 27-day module, students explore measurement using kilograms, grams, liters, milliliters, and intervals of time in minutes. They understand time as a continuous measurement through exploration with stopwatches, and use the number line, a continuous measurement model, as a tool for counting intervals of minutes within 1 hour (**3.7C**). Students see that an analog clock is a portion of the number line shaped into a circle. They use both the number line and clock to represent addition and subtraction problems involving intervals of minutes within 1 hour (**3.7C**).

Introduced in Topic B, kilograms and grams are measured using digital and spring scales. Students use manipulatives to build a kilogram and then decompose it to explore the relationship between the size and weight of kilograms and grams (**3.7D, 3.7E**). An exploratory lesson relates metric weight and liquid volume measured in liters and milliliters, highlighting the coherence of metric measurement. Students practice measuring liquid volume using the vertical number line and a graduated beaker (**3.7D, 3.7E**). Building on the estimation skills with metric length gained in Grade 2, students in Grade 3 use kilograms, grams, liters, and milliliters to estimate the weights and liquid volumes of familiar objects. Finally, they use their estimates to reason about solutions to one-step addition, subtraction, multiplication, and division word problems involving metric weight and liquid volume given in the same units (**3.7D, 3.7E**).

In Topic C, students extend their understanding of place value from Grade 2 (**2.2B–E**) to name numbers up to 100,000 (**3.2A**). The place value chart is fundamental to Topic C. Building upon their previous knowledge of bundling, students learn that 10 hundreds can be composed into 1 thousand, and 10 thousands can be composed into 1 ten thousand. Students represent these numbers in various forms including base ten numerals, number names, expanded form, and expanded notation (**3.2A, 3.2B**). Student then use place value as a basis for comparing whole numbers using the symbols <, >, and = to record the comparison (**3.2D**).

Now more experienced with measurement and estimation using different units and tools, students further develop their skills by learning to round in Topic D (**3.2B, 3.2C, 3.4B**). They measure and then use place value understandings and the number line as tools to round up to five-digit measurements (**3.2B, 3.2C, 3.4B, 3.7C, 3.7D, 3.7E**).

Students measure and round to solve problems in Topics E and F (**3.2B, 3.2C, 3.4B**). In these topics, they use estimations to test the reasonableness of sums and differences precisely calculated using standard algorithms. From their work with metric measurement,[1] students have a deeper understanding of the composition and decomposition of units. They demonstrate this understanding in every step of the addition and subtraction algorithms with two- and three-digit numbers, as 10 units are changed for 1 larger unit or 1 larger unit is changed for 10 smaller units (**3.2A, 3.4A**). Both topics end in problem solving involving metric units or intervals of time. Students round to estimate and then calculate precisely using the standard algorithm to add or subtract two- and three-digit measurements given in the same units (**3.2B, 3.2C, 3.4B, 3.2A, 3.4A, 3.7C, 3.7D, 3.7E**).

Notes on Pacing for Differentiation

If pacing is a challenge, consider the following modifications and omissions.

Consolidate Lessons 17 and 18. Within the lesson that results, include some problems that require regrouping once to add and some problems that require regrouping twice.

Consolidate Lessons 18 and 19. Within the lesson that results, include some problems that require regrouping once to subtract and some problems that require regrouping twice.

Omit Lesson 22. While it engages students in a study of estimation and provides practice with reasoning about the relationships between quantities, the lesson does not present new skills.

Focus Grade Level Standards

Number and Operations

The student applies mathematical process standards to represent and compare whole numbers and understand relationships related to place value. The student is expected to:

3.2A compose and decompose numbers up to 100,000 as a sum of so many ten thousands, so many thousands, so many hundreds, so many tens, and so many ones using objects, pictorial models, and numbers, including expanded notation as appropriate;

3.2B describe the mathematical relationships found in the base-10 place value system through the hundred thousands place;

3.2C represent a number on a number line as being between two consecutive multiples of 10; 100; 1,000; or 10,000 and use words to describe relative size of numbers in order to round whole numbers;

3.2D compare and order whole numbers up to 100,000 and represent comparisons using the symbols >, <, or =.

[1]Students work with customary units in Modules 4 and 6.

Number and Operations

The student applies mathematical process standards to develop and use strategies and methods for whole number computations in order to solve problems with efficiency and accuracy. The student is expected to:

3.4A solve with fluency one-step and two-step problems involving addition and subtraction within 1,000 using strategies based on place value, properties of operations, and the relationship between addition and subtraction;

3.4B round to the nearest 10 or 100 or use compatible numbers to estimate solutions to addition and subtraction problems.

Geometry and Measurement

The student applies mathematical process standards to select appropriate units, strategies, and tools to solve problems involving customary and metric measurement. The student is expected to:

3.7C determine the solutions to problems involving addition and subtraction of time intervals in minutes using pictorial models or tools such as a 15-minute event plus a 30-minute event equals 45 minutes;

3.7D determine when it is appropriate to use measurements of liquid volume (capacity) or weight;

3.7E determine liquid volume (capacity) or weight using appropriate units and tools.

Foundational Standards

Geometry and Measurement

The student applies mathematical process standards to select and use units to describe length, area, and time. The student is expected to:

2.9A find the length of objects using concrete models for standard units of length;

2.9D determine the length of an object to the nearest marked unit using rulers, yardsticks, meter sticks, or measuring tapes;

2.9G read and write time to the nearest one-minute increment using analog and digital clocks and distinguish between a.m. and p.m.

Focus Mathematical Process Standards

Mathematical Process Standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

MPS(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;

MPS(E) analyze mathematical relationships to connect and communicate mathematical ideas;

MPS(F) analyze mathematical relationships to connect and communicate mathematical ideas.

Overview of Module Topics and Lesson Objectives

TEKS	ELPS		Topics and Objectives	Days
3.2A **3.7C**	1.A 1.C 1.E 2.I 3.E 4.B 4.D 4.G	A	**Time Measurement and Problem Solving** Lesson 1: Explore time as a continuous measurement using a stopwatch. Lesson 2: Solve word problems involving time intervals within 1 hour by counting backward and forward using the number line and clock. Lesson 3: Solve word problems involving time intervals within 1 hour by adding and subtracting on the number line.	3
3.2A **3.4A** **3.4B** **3.7D** **3.7E**	1.A 1.C 2.C 2.I 3.F 3.H 4.D 4.G 5.B	B	**Measuring Weight and Liquid Volume in Metric Units** Lesson 4: Build and decompose a kilogram to reason about the size and weight of 1 kilogram, 100 grams, 10 grams, and 1 gram. Lesson 5: Develop estimation strategies by reasoning about the weight in kilograms of a series of familiar objects to establish mental benchmark measures. Lesson 6: Solve one-step word problems involving metric weights within 100 and estimate to reason about solutions. Lesson 7: Decompose a liter to reason about the size of 1 liter, 100 milliliters, 10 milliliters, and 1 milliliter. Lesson 8: Estimate and measure liquid volume in liters and milliliters using the vertical number line. Lesson 9: Solve mixed word problems involving all four operations with grams, kilograms, liters, and milliliters given in the same units.	6
			Mid-Module Assessment: Topics A–C (assessment ½ day, return ½ day, remediation or further applications 1 day)	2
3.2A **3.2B** **3.2D**	1.A 1.C 2.C 2.I 3.E 4.B 4.G 5.B	C	**Place Value and Comparing Multi-Digit Whole Numbers** Lesson 10: Name numbers up to 100,000 by building understanding of the place value chart and placement of commas for naming base thousand units. Lesson 11: Read and write numbers to 100,000 using base ten numerals, number names, expanded form, and expanded notation. Lesson 12: Comparing numbers based on meaning of the digits using <, >, or = to record the comparison.	3

TEKS	ELPS		Topics and Objectives	Days
3.2A **3.2C** **3.4B**	1.C 2.C 2.I 3.D 3.E 4.B 4.D 4.G 5.B	D	**Rounding to the Nearest Ten, Hundred, Thousand, and Ten Thousand** Lesson 13: Round two-digit measurements to the nearest ten on the vertical number line. Lesson 14: Round two- and three-digit numbers to the nearest ten on the vertical number line. Lesson 15: Round to the nearest hundred on the vertical number line. Lesson 16: Round four- and five-digit numbers using the vertical number line.	4
3.2A **3.4A** **3.4B** 3.2B 3.2C 3.7C–E	1.F 2.G 2.I 3.E 4.B 4.D 4.G 5.B	E	**Two- and Three-Digit Measurement Addition Using the Standard Algorithm** Lesson 17: Add measurements using the standard algorithm to compose larger units once. Lesson 18: Add measurements using the standard algorithm to compose larger units twice. Lesson 19: Estimate sums by rounding and apply to solve measurement word problems.	3
3.2A **3.4A** **3.4B** 3.2B 3.2C 3.7C–E	1.D 2.E 2.I 3.C 3.E 3.F 4.B 4.D 4.G	F	**Two- and Three-Digit Measurement Subtraction Using the Standard Algorithm** Lesson 20: Decompose once to subtract measurements including three-digit minuends with zeros in the tens or ones place. Lesson 21: Decompose twice to subtract measurements including three-digit minuends with zeros in the tens and ones places. Lesson 22: Estimate differences by rounding and apply to solve measurement word problems. Lesson 23: Estimate sums and differences of measurements by rounding, and then solve mixed word problems.	4
			End-of-Module Assessment: Topics A–F (assessment ½ day, return ½ day, remediation or further applications 1 day)	2
Total Number of Instructional Days				**27**

Terminology

New or Recently Introduced Terms and Symbols

- About (with reference to rounding and estimation, an answer that is not precise)
- Addend (the numbers that are added together in an addition equation, e.g., in 4 + 5, the numbers 4 and 5 are the addends)
- Capacity (the amount of liquid that a particular container can hold)
- Continuous (with reference to time as a continuous measurement)
- Endpoint[2] (used with rounding on the number line; the numbers that mark the beginning and end of a given interval)
- Gram (g, unit of measure for weight)
- Interval (time passed or a segment on the number line)
- Halfway (with reference to a number line, the midpoint between two numbers, e.g., 5 is halfway between 0 and 10)
- Kilogram (kg, unit of measure for mass)
- Liquid volume (the space a liquid takes up)
- Liter (L, unit of measure for liquid volume)
- Milliliter (mL, unit of measure for liquid volume)
- Plot (locate and label a point on a number line)
- Point (a specific location on the number line)
- Reasonable (with reference to how plausible an answer is, e.g., "Is your answer reasonable?")
- Round[3] (estimate a number to the nearest 10 or 100 using place value)
- Second (a unit of time)
- Standard algorithm (for addition and subtraction)
- ≈ (symbol used to show that an answer is approximate)

Familiar Terms and Symbols[4]

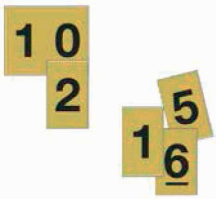
- Analog clock (a clock that is not digital)
- Centimeter (cm, unit of measurement)
- Compose (change 10 smaller units for 1 of the next larger unit on the place value chart)
- Divide (e.g., 4 ÷ 2 = 2)
- Estimate (approximation of the value of a quantity or number)

[2]Originally introduced in Grade 2, but treated as new vocabulary in this module.
[3]Originally introduced in Grade 2, but treated as new vocabulary in this module.
[4]These are terms and symbols students have used or seen previously.

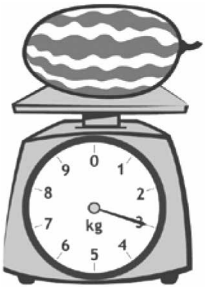
- Horizontal (with reference to how an equation is written, e.g., 3 + 4 = 7 is written horizontally)
- Measure (a quantity representing a weight or liquid volume or the act of finding the size or amount of something)
- Mental math (calculations performed in one's head, without paper and pencil)
- Meter (m, unit of measurement)
- Minute (a unit of time)
- Multiply (e.g., 2 × 2 = 4)
- Number line (may be vertical or horizontal; vertical number line shown on the next page)
- Rename (regroup units, e.g., when solving with the standard algorithm)
- Simplifying strategy (transitional strategies that move students toward mental math, e.g., *make ten* to add 7 and 6, ((7 + 3) + 3 = 13)
- Unbundle (regroup units, e.g., in the standard algorithm)
- Vertical (with reference to how an equation is written; equations solved using the standard algorithm are typically written vertically)

Suggested Tools and Representations

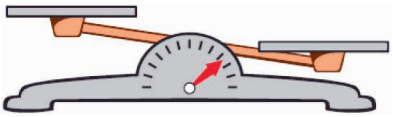
- Beaker (100 mL and optional 1 liter)
- Beans (e.g., pinto beans, used for making benchmark baggies at different weights)
- Bottles (empty, plastic, labels removed, measuring 2 liters; 1 for every group of 3 students)
- Clocks (analog and digital)
- Containers (clear plastic, 1 each: cup, pint, quart, gallon)
- Cups (16, clear plastic, with capacity of about 9 oz)
- Cylinder (a slim, cylindrical container whose sides are marked with divisions or units of measure)
- Dropper (for measuring 1 mL)
- Liter-sized container (a container large enough to hold and measure 1 liter)
- Meter strip (e.g., meter stick)
- Pan balance (pictured to the right)
- Pitchers (plastic, 1 for each group of 3 students)
- Place value cards (pictured to the right)
- Place value chart and disks (pictured to the right)
- Place value disks (pictured to the right)
- Popcorn kernels (enough to make baggies weighing 36 g per student pair)
- Rice (e.g., white rice, used for making benchmark baggies at different weights)

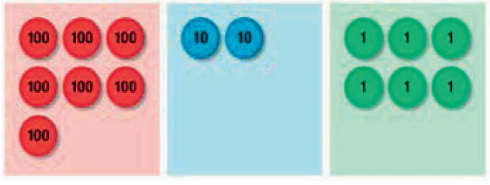


Place Value Cards



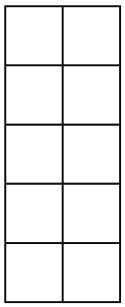
Spring Scale


Pan Balance

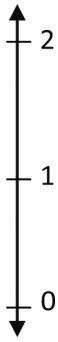


Sample place value chart without headings. Place value disks are shown in each column.

- Ruler (measuring centimeters)
- Scales (digital and spring, measures the mass of an object in grams)
- Sealable plastic bags (gallon-sized and sandwich-sized for making benchmark baggies)
- Stopwatch (handheld timepiece that measures time elapsed from when activated to when deactivated, 1 per student pair)
- Strip diagram (method for modeling)
- Ten-frame (pictured to the right)
- Vertical number line (pictured to the right)
- Weights (1 set per student pair: 1 g, 10 g, 100 g, 1 kg, or premeasured and labeled bags of rice or beans)



Ten-Frame



Vertical Number Line

Scaffolds

The scaffolds integrated into *A Story of Units*® give alternatives for how students access information as well as express and demonstrate their learning. Strategically placed margin notes are provided within each lesson elaborating on the use of specific scaffolds at applicable times. They address many needs presented by English language learners, students with disabilities, students performing above grade level, and students performing below grade level. Many of the suggestions are organized by Universal Design for Learning (UDL) principles and are applicable to more than one population.

Assessment Summary

Type	Administered	Format	Standards Addressed
Mid-Module Assessment Task	After Topic C	Constructed response with rubric	3.2A 3.2B 3.2D 3.4A 3.7C–E
End-of-Module Assessment Task	After Topic E	Constructed response with rubric	3.2A 3.4A 3.7C–E 3.4E[5]

[5]Although 3.4E is not a focus standard in this module, it does represent the major fluency for Grade 3. Module 2 fluency instruction provides systematic practice for maintenance and growth. The fluency page on the End-of-Module Assessment directly builds on the assessment given at the end of Module 1 and leads into the assessment that will be given at the end of Module 3.