

# Measurement

Michigan's Mathematics Grade Level Content Expectations in Measurement are categorized into three domains:

Units and systems of measurement (UN)

Techniques and formulas for measurement (TE)

Problem solving involving measurement (PS)

Across the grades, students should build their repertoire of measurement concepts and skills in order to understand the attributes of time, length, area, volume, weight, capacity, money, and temperature. The concepts can be developed using concrete models and measurement with non-standard units; students also need to be proficient in measuring with common tools. In the upper elementary and middle grades, the expectations call for understanding of equivalence of measurement units, knowledge of measurement formulas, and the application of measurement concepts in applied problems and contexts. Expectations in Measurement are related to expectations in Geometry; also, the Measurement strand allows for reinforcement and interesting contexts for problem solving involving number.

NUMBER & OPERATIONS

ALGEBRA

**MEASUREMENT**

GEOMETRY

DATA & PROBABILITY

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*Professional organization whose members have contributed to the development of Michigan's K-8 Grade Level Content Expectations through their work on committees:*



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Units and Systems of Measurement								
K	1	2	3	4	5	6	7	8
	<b>M.UN.01.01</b> Measure the lengths of objects in non-standard units, e.g., pencil lengths, shoe lengths, to the nearest whole unit.	<b>M.UN.02.01</b> Measure lengths in meters, centimeters, inches, feet, and yards approximating to the nearest whole unit and using abbreviations: cm, m, in, ft, yd.  <b>M.UN.02.03</b> Measure area using non-standard units to the nearest whole unit.	<b>M.UN.03.02</b> Measure in mixed units within the same measurement system for length, weight, and time: feet and inches, meters and centimeters, kilograms and grams, pounds and ounces, liters and milliliters, hours and minutes, minutes and seconds, years and months.	<b>M.UN.04.01</b> Measure using common tools and select appropriate units of measure.				
<b>M.UN.00.04</b> Compare two or more objects by length, weight and capacity, e.g., which is shorter, longer, taller?	<b>M.UN.01.02</b> Compare measured lengths using the words shorter, shortest, longer, longest, taller, tallest, etc.		<b>M.UN.03.03</b> Understand relationships between sizes of standard units, e.g., feet and inches, meters and centimeters.  <b>M.UN.03.08</b> Visualize and describe the relative sizes of one square inch and one square centimeter.  <b>M.UN.03.07</b> Distinguish between units of length and area and choose a unit appropriate in the context.		<b>M.UN.05.03</b> Compare the relative sizes of one cubic inch to one cubic foot, and one cubic centimeter to one cubic meter.  <b>M.UN.05.01</b> Recognize the equivalence of 1 liter, 1,000 ml and 1,000 cm <sup>3</sup> and include conversions among liters, milliliters, and cubic centimeters.			
<b>M.UN.00.01</b> Know and use the common words for the parts of the day (morning, afternoon, evening, night) and relative time (yesterday, today, tomorrow, last week, next year).			<b>M.UN.03.01</b> Know and use common units of measurements in length, weight, and time.  <b>M.UN.03.05</b> Know the definition of area and perimeter and calculate the perimeter of a square and rectangle given whole number side lengths.  <b>M.UN.03.06</b> Use square units in calculating area by covering the region and counting the number of square units.		<b>M.UN.05.02</b> Know the units of measure of volume: cubic centimeter, cubic meter, cubic inches, cubic feet, cubic yards, and use their abbreviations (cm <sup>3</sup> , m <sup>3</sup> , in <sup>3</sup> , ft <sup>3</sup> , yd <sup>3</sup> ).			
<b>M.UN.00.03</b> Identify daily landmark times to the nearest hour (lunchtime is 12 o'clock; bedtime is 8 o'clock).	<b>M.UN.01.03</b> Tell time on a twelve-hour clock face to the hour and half-hour.	<b>M.UN.02.05</b> Using both A.M. and P.M., tell and write time from the clock face in 5 minute intervals and from digital clocks to the minute; include reading time: 9:15 as nine-fifteen and 9:50 as nine-fifty. Interpret time both as minutes after the hour and minutes before the next hour, e.g., 8:50 as eight-fifty and ten to nine. Show times by drawing hands on clock face.  <b>M.UN.02.06</b> Use the concept of duration of time, e.g., determine what time it will be half an hour from 10:15.						
	<b>M.UN.01.04</b> Identify the different denominations of coins and bills.  <b>M.UN.01.05</b> Match one coin or bill of one denomination to an equivalent set of coins/bills of other denominations, e.g., 1 quarter = 2 dimes and 1 nickel.  <b>M.UN.01.06</b> Tell the amount of money: in cents up to \$1, in dollars up to \$100. Use the symbols \$ and ¢.	<b>M.UN.02.07</b> Read and write amounts of money using decimal notations, e.g., \$1.15.						
		<b>M.UN.02.09</b> Read temperature using the scale on a thermometer in degrees Fahrenheit.	<b>M.UN.03.04</b> Know benchmark temperatures such as freezing (32°F, 0°C); boiling (212°F, 100°C); and compare temperatures to these, e.g., cooler, warmer.	<b>M.UN.04.03</b> Measure and compare integer temperatures in degrees.	<b>M.UN.05.04</b> Convert measurements of length, weight, area, volume, and time within a given system using easily manipulated numbers.	<b>M.UN.06.01</b> Convert between basic units of measurement within a single measurement system, e.g., square inches to square feet.		



Techniques and Formulas for Measurement

Techniques and Formulas for Measurement								
K	1	2	3	4	5	6	7	8
		<p><b>M.TE.02.04</b> Find the area of a rectangle with whole number side lengths by covering with unit squares and counting, or by using a grid of unit squares; write the area as a product.</p> <p><i>M.TE.02.11 Determine perimeters of rectangles and triangles by adding lengths of sides, recognizing the meaning of perimeter.</i></p>	<p><b>M.TE.03.09</b> Estimate the perimeter of a square and rectangle in inches and centimeters; estimate the area of a square and rectangle in square inches and square centimeters.</p>	<p><b>M.TE.04.06</b> Know and understand the formulas for perimeter and area of a square and a rectangle; calculate the perimeters and areas of these shapes and combinations of these shapes using the formulas.</p> <p><b>M.TE.04.07</b> Find one dimension of a rectangle given the other dimension and its perimeter or area.</p> <p><b>M.TE.04.08</b> Find the side of a square given its perimeter or area.</p> <p><b>M.TE.04.04</b> Measure surface area of cubes and rectangular prisms by covering and counting area of the faces.</p>	<p><b>M.TE.05.06</b> Understand and know how to use the area formula of a triangle: <math>A = \frac{1}{2}bh</math> (where b is length of the base and h is the height), and represent using models and manipulatives.</p> <p><b>M.TE.05.07</b> Understand and know how to use the area formula for a parallelogram: <math>A = bh</math>, and represent using models and manipulatives.</p>	<p><b>M.TE.06.03</b> Compute the volume and surface area of cubes and rectangular prisms given the lengths of their sides, using formulas.</p>		
						<p><b>M.TE.05.08</b> Build solids with unit cubes and state their volumes.</p> <p><b>M.TE.05.09</b> Use filling (unit cubes or liquid), and counting or measuring to find the volume of a cube and rectangular prism.</p>		
<p><b>M.TE.00.02</b> Identify tools that measure time (clocks measure hours and minutes; calendars measure days, weeks, and months).</p>				<p><b>M.TE.04.10</b> Identify right angles and compare angles to right angles.</p> <p><b>M.TE.04.05</b> Carry out the following conversions from one unit of measure to a larger or smaller unit of measure: meters to centimeters, kilograms to grams, liters to milliliters, hours to minutes, minutes to seconds, years to months, weeks to days, feet to inches, ounces to pounds (using numbers that involve only simple calculations).</p>		<p><b>G.GS.05.02</b> Measure angles with a protractor and classify them as acute, right, obtuse or straight.</p>		

Problem Solving

Problem Solving								
<p><b>M.PS.00.05</b> Compare length and weight of objects by comparing to reference objects, and use terms such as shorter, longer, taller, lighter, heavier.</p>		<p><b>M.PS.02.02</b> Compare lengths; add and subtract lengths (no conversion of units).</p>	<p><b>M.PS.03.10</b> Add and subtract lengths, weights, and times using mixed units within the same measurement system.</p>					
	<p><b>M.PS.01.07</b> Add and subtract money in dollars only or in cents only.</p>	<p><b>M.PS.02.08</b> Add and subtract money in mixed units, e.g., \$2.50 + 60 cents and \$5.75 - \$3, but not \$2.50 + \$3.10.</p>	<p><b>M.PS.03.11</b> Add and subtract money in dollars and cents.</p>					
			<p><b>M.PS.03.13</b> Solve contextual problems about perimeters of rectangles and areas of rectangular regions.</p>	<p><b>M.PS.04.09</b> Solve contextual problems about perimeter and area of squares and rectangles in compound shapes.</p>	<p><b>M.PS.05.05</b> Represent relationships between areas of rectangles, triangles, and parallelograms using models.</p>	<p><b>M.PS.06.02</b> Draw patterns (of faces) for a cube and rectangular prism that, when cut, will cover the solid exactly (nets).</p>		
	<p><b>M.PS.01.08</b> Solve one-step word problems using addition and subtraction of length, money and time, including “how much more/less”, without mixing units.</p>	<p><b>M.PS.02.10</b> Solve simple word problems involving length and money.</p>	<p><b>M.PS.03.12</b> Solve applied problems involving money, length, and time.</p>	<p><b>M.PS.04.11</b> Solve contextual problems about surface area.</p> <p><b>M.PS.04.02</b> Give answers to a reasonable degree of precision in the context of a given problem.</p>	<p><b>M.PS.05.10</b> Solve applied problems about the volumes of rectangular prisms using multiplication and division and using the appropriate units.</p>			

\* revised expectations in italics