NEW MILFORD PUBLIC SCHOOLS

New Milford, Connecticut

Practical Math-Applications of Measurement

November 2021

BOE Approved May 2022

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Authors of Course Guide

Oligerta Gjoka-Hughes, Kaitlyn Pierce

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New Milford's Mission Statement

The mission of the New Milford Public Schools, a collaborative partnership of students, educators, family and community, is to prepare each and every student to compete and excel in an ever-changing world, embrace challenges with vigor, respect and appreciate the worth of every human being, and contribute to society by providing effective instruction and dynamic curriculum, offering a wide range of valuable experiences, and inspiring students to pursue their dreams and aspirations.

Practical Math: Applications of Measurement Overview

Grade 9 -12

The goal of this ½ year (one semester) course is to provide a review of foundational skills and concepts related to measurement, including indirect measurement, before exploring how the concept is used in a variety of fields, designed to give students exposure to real-world applications of measurement and measurement systems. Skills to be reviewed will include but are not limited to measuring using rulers, protractors, and other devices; arithmetic, including with fractions and decimals; solving equations; using formulas to find area, volume. Applications that will be discussed include but are not limited to surveying and construction, how indirect measurement can be used to measure items that are very large (ex. height of the flag pole), and how math is used in the culinary field. Because this is a course in practical math; standards will focus on the Standards for Mathematical Practice and assessments will often be practical in nature.

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Pacing Guide

Unit Title	# of Weeks
Measurement and Measurement Systems	4 Weeks
Units of Measure (Standard and Non-Standard)	5 Weeks
Applications of Direct Measurement	4 weeks
Applications of Indirect Measurement	5 weeks
Review and Exams	2 Weeks

Unit 1: Measurement and Measurement Systems

# of weeks: 4

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr><td rowspan="3">ESTABLISHED GOALS
Common Core State Standards.

CCSS.Math.Content.5.MD.A.1
Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.

CCSS.Math.Content.5.MD.B.2
Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots.
CCSS.Math.Content.4.MD.A.1
Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit.</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to independently use their learning to…

Students will be able to identify and recognize different units of measurements and use them to communicate with each other. They will be able to reason and model using different systems of measurement in order to improve their lifestyle.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>UNDERSTANDINGS
Students will understand that…
● People have been using measurement through history to communicate.

-</td><td>ESSENTIAL QUESTIONS
Students will keep considering
● Why do we measure?
● Are there different ways to measure the same quantity?
● Is there a better measurement system?
● How accurate does this need to be?
● When is estimation better than counting?</td></tr>
</table>

	Acquisition	
	Students will know… ● Units of measure from various systems such as the Metric System (km,m, cm,mm etc) and the Customary System (mi, yd,in, etc) and their relationships. ● Math operations and fractions of a unit. ● Which units are used to measure certain quantities. ● Relative sizes of measurement units within one System including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec.	*Students will be skilled at…* ● Converting among different units. ● Applying conversions in solving multi-step Real-World problems. ● Applying the correct unit to a situation ● Measuring a quantity correctly ● Demonstrating proficiency with a ruler ● Creating a Line plot. ● Using operations on fractions for this grade to solve problems involving information presented in line plots. ● Expressing measurements in a larger unit in terms of a smaller unit and vica versa.

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T,M,A	Evaluative Criteria will look for: ● Accurate analysis of the systems of measurement ● A chart/diagram that highlights features of the new system ● Visually neat, organized. ● Communication Rubric for NMH	PERFORMANCE TASK(S): Students will show that they really understand evidence of… Goal: Research different units of measurement and Create a Measurement System Role: Designer Audience: Self/Classmates. Situation: Student wants to research the need for different systems of measure and create a new system of measure to communicate units of measure. Product or Performance: Students will create a presentation (Google Doc, Poster, Video, Google Slides) justifying their description of the system.

T,M,A T,M,A	Evaluative criteria consists of: ● Is all the work shown when converting between units of measurement. ● Are applications related to different units of measurement clearly presented.	OTHER EVIDENCE: Students will show they have achieved Stage 1 goals by… ● Alternative assessment projects such as posters, drawings, pictures and real world applications. ● Review of standardized test questions to prep students for the challenge of the SAT and ACT exams. ● Unit Test - to include a variety of DOK level problems. ● Practical Quiz on Ruler Reading ● Quiz on Units of Measures. ● Research Paper on Units of Measure.

Stage 3 – Learning Plan		
Code	***Pre-Assessment***	
T,M	● Teacher checks for prerequisite skills and prior knowledge via warm-up and questioning activities, such as basic problems on order of operations and the associative, commutative and distributive properties.	
T,M, A	● Prerequisite knowledge will be reviewed as it is incorporated into multi-step problems both in class and on review assignments.	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
T,M	● Teacher will introduce the to systems of measurement and examples for each, methods of measuring for length.	● Warm up questions ● Summative assessments Quizzes Unit test.
T,M,A	● Students will participate in a measuring activity where they will measure using both a ruler and a protractor.	● Monitoring class work through board work, group work, questioning, and walk-arounds.
T,M,A	● Teacher will lead a discussion on the differences between the customary and metric systems of measurement.	● Check for understanding via going over homework, whiteboard activities, and medium such as reflections and journals.
T,M,A	● Students will practice converting between each unit in each System.	● Kahoot as a practice and review activities.
T,M,A	● Teacher will lead students to discover the difference between each unit of measurement.	● Exit tickets and reflective questions at the end of each lesson.
T,M,A	● Students will use kahoots, peardeck slide shows, matching activities and crossword puzzles as ways to review and practice different units of measurement.	● Differentiate through purposeful or flexible grouping, use of diagrams and explanations to demonstrate understanding and active lessons involving discovery, scaffolding, jigsaw activities and use of hands-on

		manipulatives.

Unit 2: Units of Measure (Standard and Non-Standard)

# of weeks : 5

Stage 1 Desired Results

ESTABLISHED GOALS
Common Core State Standards.

CCSS.Math.Content.4.MD.A.2
Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.
CCSS.Math.Content.4.MD.A.1
Know relative sizes of measurement units within one system of units

Transfer

Students will be able to independently use their learning to…

Students will be able to identify and recognize different units of measurements and use them to solve real life situations. They will be able to reason and model using different systems of measurement in order to improve their lifestyle.

Meaning

UNDERSTANDINGS
Students will understand that…

The most popular systems of measure are essential for industry and proper communication.

ESSENTIAL QUESTIONS

- Can my arm length be a unit of measure?
- What units are used to measure various properties?
- How do we know a pound is a pound?

including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. CCSS.Math.Content.5.MD.A.1 Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.		
	Acquisition	
	Students will know… ● The four operations. ● Problems that require expressing measurements given in a larger unit in terms of a smaller unit. ● Various units of measure in the customary and metric systems. ● Which units are used to measure certain quantities. ● Relative sizes of measurement units within one System.	*Students will be skilled at…* ● Using the four operations to solve problems. ● Converting between two different-sized units of measure. ● Expresings measurements in a larger unit in terms of a smaller unit ● Describing the similarities and differences between two measurement systems. ● Using conversions in solving multi-step Real-World problems. ● Applying the correct unit to a situation. ● Representing measurement quantities using diagrams.

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T,M,A	Evaluative Criteria will look for: ● Accurate analysis of their findings about systems of measurement in History. ● A chart/diagram that highlights features of each system. ● Visually neat, organized. ● Communication Rubric for NMH.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* Goal: Present measurement in a historical context. Role: Researcher Audience: Peer (Student) Situation: Present a fellow student with information about a measurement system. Product or Performance: Research paper on the customary and metric systems, highlighting the challenges of the 1970's and the failure of the U.S. to switch to the metric system. Standards for Success: - accurate analysis of the systems of measurement - Assessment specific rubric.

Stage 3 – Learning Plan		
Code	***Pre-Assessment***	
T,M	● Teacher checks for prerequisite skills and prior knowledge via warm-up and questioning activities, such as basic problems conversions on order of operations and the associative, commutative and distributive properties.	
T,M, A	● Prerequisite knowledge will be reviewed as it is incorporated into multi-step problems both in class and on review assignments.	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
T,M,A	● Teacher will lead a discussion between the various systems of measure.	● Warm up questions
T,M,A	● Students will compare and contrast the units of measure in various systems using indirect conversions.	● Summative assessments Quizzes Unit test.
T,M,A	● Teacher will provide guidance in research about various systems. ● Students will show examples of each.	● Monitoring class work through board work, group work, questioning, and walk-arounds.
	● Teacher will lead students to discover the difference between each unit.	● Check for understanding via going over homework, whiteboard activities, and medium such as reflections and journals.
	● Students will express measurements in a lager unit in terms of a smaller unit.	● Kahoot as a practice and review activities.
	● Teacher will demonstrate examples of real world problems involving different units. ●	● Exit tickets and reflective questions at the end of each lesson.
	● Students will complete practice problems.	● Differentiate through purposeful or flexible grouping, use of diagrams and explanations to demonstrate understanding and active lessons involving discovery, scaffolding, jigsaw activities and use of hands-on
	● Teacher will emphasize that observing patterns can be useful in problem solving.	

		manipulatives

Unit 3: Applications of Direct Measurement

# of weeks: 4

Stage 1 Desired Results

ESTABLISHED GOALS
Common Core State Standards.

CCSS.Math.Content.4.MD.A.2
Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

CCSS.Math.Content.5.MD.A.1
Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these

Transfer

Students will be able to independently use their learning to…

Students will be able to make sense of problems and persevere in solving them without teacher guidance in order to analyze Area and Space in real life situations.

Meaning

UNDERSTANDINGS
Students will understand that…

- Area measures units in two dimensions.
- Surface Area measures two dimensional area on a three-dimensional surface.
- Volume measures the amount of space something occupies in three dimensions

ESSENTIAL QUESTIONS
Students will keep considering…

- How do I measure the area of the room to carpet/tile/etc
- How do I find the surface area of this house to paint?
- What is the volume of asphalt I need for this driveway?

conversions in solving multi-step, real world problems.		
	Acquisition	
	Students will know… ● The four operations. ● Problems that require expressing measurements given in a larger unit in terms of a smaller unit. ● Different-sized standard measurement units. ● Area and Surface Area are two dimensional measurements ● Volume is a three-dimensional measurement	*Students will be skilled at…* ● Using the four operations to solve real-world problems. ● Converting between two different-sized units of measure. ● Expressing measurements in a larger unit in terms of a smaller unit. ● Using conversions in solving multi-step Real-World problems. ● Applying the correct unit to a situation. ● Representing measurement quantities using diagrams. ● Calculating the Area and Surface Area of a figure ● Calculating the Volume of a figure ● Correctly choosing between Surface Area and Volume based on a specific application.

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T, M, A	Further information: Evaluative Criteria will look for: ● Accurate measurements of Surface area and Volume of the objects. ● A chart/diagram that highlights the measurements taken. ● Visually neat, organized. ● Communication Rubric for NMH.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* Goal: Take correct measurements of surface area and volume. Role: Scientist. Audience: Self/Peers. Situation: You must take correct measurements of surface area and volume on a variety of three-dimensional objects. Product or Performance: A completed Lab Report Standards for Success: Assessment specific rubric.

T, M, A		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* ● Alternative assessment projects such as posters, drawings, pictures and real world applications. ● Review of standardized test questions to prep students for the challenge of the SAT and ACT exams. ● Area Scavenger-Hunt. ● Group Measurement Activity in School. ● Classification quiz. ● Quiz on basic area calculations. ● Quiz on basic Volume calculations.

Stage 3 – Learning Plan		
Code **M** **T, M, A**	***Pre-Assessment*** ● Teacher checks for prerequisite skills and prior knowledge via warm-up and questioning activities, such as basic problems on conversions of units of measurements. ● Prerequisite knowledge will be reviewed as it is incorporated into multi-step problems both in class and on review assignments.	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
T,M,A T,M,A T,M,A T,M,A	● Teacher will lead students through a discussion of surface area vs. volume applications. ● Students will classify a specific situation as Area, Surface Area or Volume. ● Teacher and students will compare and contrast various methods of measurement. ● Students work in groups to take large direct measurements around the school. ● Teacher will lead students through the measurement of surface Area and Volume Measurement Lab. ● Students will take direct measurements for surface area and volume in a lab activity. ● Students will explore Area and volume units by using a calculator and spreadsheets, when appropriate.	● Warm up questions ● Summative assessments Quizzes Unit test. ● Monitoring class work through board work, group work, questioning, and walk-arounds. ● Check for understanding via going over homework, whiteboard activities, reflections and journals. ● Kahoot as a practice and review activity. ● Exit tickets and reflective questions at the end of each lesson. ● Differentiate through purposeful or flexible grouping, use of diagrams and explanations to demonstrate understanding and active lessons involving discovery, scaffolding, jigsaw activities and use of hands-on activities.

Unit 4: Applications of Indirect Measurement

# of weeks : 5

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr><td rowspan="4">ESTABLISHED GOALS
Common Core State Standards.

CCSS.Math.Content.4.MD.A.2
Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

CCSS.Math.Content.5.MD.A.1
Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to independently use their learning to…

Make sense of problems and persevere in solving them without teacher guidance in order to analyze how to apply Indirect measurements in real life situations.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>UNDERSTANDINGS
Students will understand that…

● There are methods for taking large measurements if they cannot be taken directly.
● Angles and proportions can help us to take measurements.
● Methods can be used to mark large areas like sports fields.</td><td>ESSENTIAL QUESTIONS
Students will keep considering…
● When is estimation better than counting?
● How do I estimate a large distance?
● Is there a method to take measurements if I cannot use a tool directly?
● How accurate are indirect measurements?
● How could I make taking large measurements easier?</td></tr>
</table>

	Acquisition	
	Students will know… ● The four operations. ● Problems that require expressing measurements given in a larger unit in terms of a smaller unit. ● Different-sized standard measurement units. ● Proportions and angles are used to take various indirect measurements. ● Alternate Methods can be used to mark large areas like sports fields.	*Students will be skilled at…* ● Using the four operations to solve real-world problems. ● Converting between two different-sized units of measure. ● Expressing measurements in a larger unit in terms of a smaller unit. ● Using conversions in solving multi-step Real-World problems. ● Applying the correct unit to a situation. ● Represent measurement quantities using diagrams. ● Using conversions and take indirect measurements across large spans and of objects which are elevated. ● Understanding the processes used in marking sports fields.

STAGE 2

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T, M, A	Further information: Evaluative Criteria will look for: ● Understanding of using indirect measurements to determine the height of an object. ● A chart/diagram that highlights the conversions done. ● Proposal and Invoice is visually neat, organized. ● Communication Rubric for NMH.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* Goal: Determine height of flagpole Role: Concerned Student Audience: Mr.Manka and the BOE Situation: As a student, you are concerned that the flagpole has become unsafe and we should order a new one. You must justify your calculations for the height of the pole that should be ordered. Product or Performance: Mathematical findings, proposal and invoice Standards for Success: Correct height within two feet using two different methods.

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* ● Alternative assessment projects such as posters, drawings, pictures and real world applications. ● Review of standardized test questions to prep students for the challenge of the SAT and ACT exams. ● Activity on sports field markings ● Various measurements inside of NMHS ● Accurate estimations for height.

Stage 3 – Learning Plan		
Code **M**	***Pre-Assessment*** ● Teacher checks for prerequisite skills and prior knowledge via warm-up and questioning activities, such as basic problems on conversions of units of measurements.	
T, M, A	● Prerequisite knowledge will be reviewed as it is incorporated into multi-step problems both in class and on review assignments	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
T, M, A T, M, A T, M, A	● Teacher will guide students in the creation of proportions which help to measure the height of the flagpole. ● Students will work in groups to measure the height of the flagpole indirectly. ● Teacher will lead a discussion where students brainstorm how a sports field and its markings are constructed. ● Students will estimate and measure various other objects on campus indirectly. ● Students will apply estimation skills to indirect measurement around the NMHS campus.	● Warm up questions ● Summative assessments Quizzes Unit test. ● Monitoring class work through board work, group work, questioning, and walk-arounds. ● Check for understanding via going over homework, whiteboard activities, reflections and journals. ● Kahoot as a practice and review activity. ● Exit tickets and reflective questions at the end of each lesson. ● Differentiate through purposeful or flexible grouping, use of diagrams and explanations to demonstrate understanding and active lessons involving discovery, scaffolding, jigsaw activities and use of hands-on

		activities.

Unit 5: Course Review and Exam

# of Weeks : 2

Stage 1 Desired Results

ESTABLISHED GOALS
Common Core State Standards.

CCSS.Math.Content.5.MD.A.1
Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.

CCSS.Math.Content.5.MD.B.2
Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots.
CCSS.Math.Content.4.MD.A.1
Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit.

Transfer

Students will be able to independently use their learning to…

Students will be able to identify and recognize different units of measurements and use them to communicate with each other. They will be able to reason and model using different systems of measurement in order to improve their lifestyle.

Meaning

UNDERSTANDINGS
Students will understand that…

- There are systems of measure
- Systems of measure provide standards of communication
- Measurement can be taken directly or indirectly.

ESSENTIAL QUESTIONS
Students will keep considering…

- How do we measure?
- Why do we measure?
- How do we measure directly?
- How do we measure indirectly?
- When is estimation better than counting?

	Acquisition	
	Students will know… ● The four operations. ● Problems that require expressing measurements given in a larger unit in terms of a smaller unit. ● Various units of measure in the customary and metric systems. ● Which units are used to measure certain quantities. ● Relative sizes of measurement units within one System.	*Students will be skilled at…* ● Using the four operations to solve real-world problems. ● Converting among different units. ● Applying the correct unit to a situation ● Measuring a quantity correctly ● Demonstrating proficiency with a ruler ● Making a Line plot. ● Converting between two different-sized units of measure. ● Expressing measurements in a larger unit in terms of a smaller unit. ● Representing measurement quantities using diagrams. ● Using conversions and take indirect measurements across large spans and of objects which are elevated. ● Understanding the processes used in marking sports fields.

STAGE 2

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T, M, A	Further information: Evaluative Criteria will look for: ● Understanding of using direct and indirect measurements to convert units. ● A chart/diagram that highlights the conversions done. ● Communication Rubric for NMH.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* Goal: Demonstrate ability to measure both directly and indirectly Role: Student Audience: Teacher Situation: You must complete a portfolio of work which demonstrates ability as well as a lab practical for this course Product or Performance: Portfolio and a Practical Lab Standards for Success: Assessment specific rubric
T, M, A		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* ● Alternative assessment projects such as posters, drawings, pictures and real world applications. ● Review of standardized test questions to prep students for the challenge of the SAT and ACT exams. ● Check-in review of portfolio. ● Practical assessment of measurement skills.

<table>
<tr><th colspan="3">Stage 3 – Learning Plan</th></tr>
<tr><td>Code
M

T, M, A</td><td colspan="2">Pre-Assessment
● Teacher checks for prerequisite skills and prior knowledge via warm-up and questioning activities, such as basic problems on conversions of units of measurements.

● Prerequisite knowledge will be reviewed as it is incorporated into multi-step problems both in class and on review assignments</td></tr>
<tr><td>T, M, A</td><td>Summary of Key Learning Events and Instruction
Student success at transfer meaning and acquisition depends on…

● Teacher will guide students through a review of core concepts for this course.

● Students will actively review concepts using practice worksheets.
● Teacher will guide students on review concepts for the final.
● Students will complete a practical final exam for this course.</td><td>Progress Monitoring

● Warm up questions

● Monitoring class work through board work, group work, questioning, and walk-arounds.

● Check for understanding via going over homework, whiteboard activities, and medium such as reflections and journals.

● Kahoot as a practice and review activities.

● Exit tickets and reflective questions at the end of each lesson.

● Differentiate through purposeful or flexible grouping, use of diagrams and explanations to demonstrate understanding and active lessons involving discovery, scaffolding,</td></tr>
</table>

		jigsaw activities and use of hands-on manipulatives.