

## Grade 6 Mathematics

### **Overview:**

This curriculum is aligned to the 2005 Connecticut Mathematics Curriculum Frameworks and references the CMT 4<sup>th</sup>. Generation. It consists of 8 units, 6 to be completed before the CMT administration in March.

Each unit begins with a pre-assessment. This assessment is meant to be ungraded and is formative in that it allows teachers to better plan instruction for their students. The post-assessment is both summative and formative in nature. It is graded, and provides the teacher with data as to students who have mastered concepts and skills and those who may still need work in some areas.

Grade level expectations (GLEs) are coded (see below). For each GLE, or group of GLEs, activities are listed that are specific to those expectations. It is up to the teacher to use pre-assessment data along with CMT data to plan each unit for their students. Extensions, Interventions, Technology and other support materials (including those listed in the teachers' manuals) are listed to help with differentiation of math instruction.

### **Vocabulary:**

A list of important mathematical vocabulary can be found at the end of each unit. Students need to become fluent with vocabulary so that they can communicate effectively in mathematics. It is suggested that math vocabulary be posted for each unit, and that students have opportunities to “define” terms using words, numbers, pictures, examples and by making connections to their lives or other areas of mathematics.

Appendix A contains a list of grade specific vocabulary that will be found on the CMT.

### **Connections to Connecticut Mastery Test:**

Connecticut Mastery Test Content is listed at the end of each unit. These are specific to your grade level test. It should be noted that students were introduced to and provided instruction to these topics in previous grades. Sample items can be found in the Connecticut CMT Handbook for Mathematics, CMT Coach (as referenced throughout the unit) and in Ledyard Grade 6 CMT Fourth Generation Sample Items Review (see Appendix A).

## Grade 6 Mathematics

### Key to Coding:

This curriculum is based on the 2005 Mathematics Curriculum Framework and the 2007 Grade Level Expectations (which were written to further clarify what students should know and be able to do at each grade level.)

There are 4 content standards. Each includes two or three component statements.

#### Algebraic Reasoning: Patterns and Functions

- 1.1 Students should understand and describe patterns and functional relationships
- 1.2 Students should represent and analyze quantitative relationships in a variety of ways
- 1.3 Students should use operations, properties and algebraic symbols to determine equivalence and solve problems

#### Numerical and Proportional Reasoning

- 2.1 Students should understand that a variety of numerical representations can be used to describe quantitative relationships
- 2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities

#### Geometry and Measurement

- 3.1 Students should use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems
- 3.2 Students should use spatial reasoning, location and geometric relationships to solve problems
- 3.3 Students should develop and apply units, systems, formulas and appropriate tools to estimate and measure

#### Working with Data: Probability and Statistics.

- 4.1 Students should collect, organize and display data using appropriate statistical and graphical methods
- 4.2 Students should analyze data sets to form hypotheses and make predications
- 4.3 Students should understand and apply basic concepts of probability

These component statements are further delineated in the Grade Level Expectations document. (See Appendix A).

Therefore, a statement coded 4.1.2 refers to collecting, organizing and displaying data. The .2 refers to the grade level expectation and will describe specific graphs that will be used.

## Grade 6 Mathematics

### Unit 1: Data and Graphing

**Pacing: 2 weeks**

This unit begins with a review of different types of graphical representations. Students graph data using the appropriate representation. Students analyze data using measures of central tendency. Note: This unit will be extended in Unit 8.

**Teacher note:** check students' knowledge of basic multiplication and division facts by a pre-assessment. Create an individual plan for learning those not yet mastered – see appendix Helping Children Master Basic Facts.

#### Pre-Assessment for Unit 1

**Grade level expectations:** The student will be able to:

- 4.1.2 **Select, create and use appropriate graphical representations of data including bar graphs, line graphs, line plots, and stem and leaf plots.**
- 4.2.3 **Describe the shape of numerical data sets using measures of spread (range) and central tendency (mean, median, mode) and outliers.**
- 4.2.4 Determine how the mean, median, mode and range change as a result of changes in the data set and describe in writing.
- 4.1.1 Compare sets of data between two populations, e.g., heights of two classes of students, or within a population, e.g., height vs. arm length of sixth-grade students, using a variety of graphical representations.
- 1.2.3 **Examine tables, graphs and equations to determine patterns of change in linear relationships**

#### **Activities:**

a. Students display and analyze data using bar and line graphs. MC pgs. 81-85

*Technology:* You may extend this lesson by using Microsoft Excel to make a spreadsheet and create a line or bar graph. See MC pgs. 86-87

b. Students interpret line graphs. MC pgs. 88-91

c. Students display and analyze data using a stem-and-leaf plot. MC pgs. 92-95

d. Students display and analyze data using line plots. MC pgs. 96-100

e. Students find the mean of a set of data. MC pgs. 102-106.

f. Students find and interpret the mean, median, mode and range of a set of data. MC pgs. 108-113

g. Students select an appropriate display for a set of data. MC pgs. 114-118

## Grade 6 Mathematics

**Teacher note:** the following activities provide applications of the above skills.

- Students analyze data about their class to find mode and range using a line plot (frequency graph). MS Class Survey pgs. 6-7
- Students learn about means and medians by finding out “what’s typical.” MS Name Exchange pgs. 8-9
- Students use a broken line graph to match a journal entry to a graph. MS Investigate Mixed-up Data pg. 25
- Students match graphs to written descriptions. MS Stories and Graphs pg. 26

**Teacher note:** Have students explore the effectiveness of different graphical representations of data and examine the measures of central tendency and determine when one is a better representation of the data than another. (See appendix for Exploring Data lesson.)

**Assessment:** Post Assessment Unit 1

*Technology:* students use interactive software to compare and contrast properties of measures of center, specifically these tasks illustrate how changes in data values influence the mean and median.

<http://standards.nctm.org/document/eexamples/chap6/6.6/index.htm>.

*Extend:* Graphic Novels “Riding the Line” pg. 29

*Support with CMT COACH* pgs. 218-232

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### UNIT I VOCABULARY

Average

Axis

Bar graph

Broken line graph

Circle graph

Data set

Frequency

Line graph

Line plot

Mean

Median

Mode

Outlier

Range

Scale

Stem and leaf plot

### CMT CONNECTION

4.2.3

20B. Solve problems involving means, medians and modes of sets of data

4.1.1

20A. Draw reasonable conclusions from data in tables, pictographs, line graphs, circle graphs, stem-and-leaf plots and charts.

24B. Sort or classify objects, and draw logical conclusions from data including Venn diagrams and transitive reasoning questions.

1.2.3

25A. Solve extended numerical, statistical and spatial problems.

**Bold face indicates Ledyard POWER GLEs**

Ledyard Public Schools

MC – Math Connects

MS - MathScape

Approved by IC 5/19/08

Grade 6

## Grade 6 Mathematics

### Unit 2: Number Representation

Pacing: 3 weeks

This unit builds on students' number sense to compose and decompose numbers in a variety of ways to compare and compute flexibility.

#### Pre-assessment for Unit 2

**Grade level expectations:** The student will be able to:

2.1.3 **Represent and compare whole numbers (to a billion) in expanded notation**, e.g.,  $75,654 = (7 \times 10,000) + (5 \times 1,000) + (6 \times 100) + (5 \times 10) + (4 \times 1)$  **and by using regrouping**, e.g. 2 thousands + 18 hundreds = 3,800

**Activities:**

- Students investigate representation of numbers in Egyptian hieroglyphics and the similarities and differences to our place value system. (See appendix "Using Egyptian Hieroglyphics")
- Students work in pairs or threes to solve Mystery Number problems. See appendix for sample Mystery Number Problems, or use the game format I Have, Who Has

*Differentiate:* by including both basic and challenging numbers

- Students use knowledge of place value, expanded notation and regrouping to solve problems.

*Support with CMT COACH* pgs. 42-49

2.1.4 Represent chain multiplication, including powers of 10 in exponential and standard form, e.g.,  $5 \times 5 \times 5 = 5^3 = 125$ .

**Activities:**

- Students develop stories that can be represented using chain multiplication, such as: A man had seven dogs. Each dog had seven puppies. Each puppy had seven toys. How many puppy toys are there in all?

**Teacher note:** for samples, see MC pg. 35 #38-39

- Students develop a powers of ten chart, e.g.,  $10^2 = 10 \times 10 = 100 =$  one hundred,  $10^3 = 10 \times 10 \times 10 = 1,000 =$  one thousand, etc.

2.1.5 Factor composite numbers and express them as a product of primes using exponents, e.g.,  $24 = 3 \times 2^3$

**Activities:**

- Students review rectangular arrays to identify factor pairs and classify numbers as prime, composite and perfect squares. MS Shapes and Factors pgs. 96-97 (manipulatives needed – color tiles, cubes)
- Students find prime and composite factors. MS The Great Factor Hunt pgs. 98-99
- Students find common multiples. MS Multiple Approaches pgs. 100-101.
- Students find prime factorizations and create a factor tree. MC pgs. 28-31

## Grade 6 Mathematics

e. Students write prime factorizations using exponents. See Mini-lab MC pg.32-36

*Technology:* After students fill in table and discuss, use the calculator lesson Calculating Powers Activity, (see Appendix.)

f. Students practice by playing the Factor Game, an interactive game that exercises factoring ability.

Have students discuss strategies for best moves (see appendix)

<http://illuminations.nctm.org/ActivityDetail.aspx?ID=12>

*Differentiate:* model with 30 choices, change to 49 or 100 choices depending on student level.

2.2.20 Understand and use divisibility rules, factors of composite numbers and powers of 10 to find products and quotients.

**Activities:**

a. Give students examples of numbers that fit a certain divisibility rule and those that don't. Ask students to deduce the rule.

*Support with MC pg. 28a, pg. 736-737 (Table of divisibility rules)*

b. Students use Venn diagrams to sort common multiples, factors, primes, etc. Samples may be found in MC teachers manual pg.196 and in *GroundWorks: Reasoning with Numbers Grade 6* pgs.56-63

2.2.21 **Apply the order of operations and algebraic properties;** i.e., commutative, associative, distributive, inverse operations, and the additive and multiplicative identities; **to compute and solve multistep problems and explain solutions in writing.**

**Activities:**

a. Students learn about and apply order of operations. MS First Things First pgs. 102-103

b. Students solve problems with whole numbers. MS Putting it all Together pg. 104

c. Students play a number game using factors and multiples. MS Guess My Number pg. 105

**Teacher note:** You may wish to use a Daily Order of Operations calendar for practice (see appendix for model)

d. Students apply the order of operations. MC pgs. 37-40

e. Students review commutative (order), associative (grouping), distributive properties, inverse operations and Identity properties of addition and multiplication and discuss how they help in computation.

MC: distributive pg. 630, 632 commutative/associative pg. 636, identity and inverse pg. 748

f. Students practice mental math strategies such as grouping compatible numbers together when adding; using the distributive property to break numbers into smaller numbers, calculate the products and add them together; or using compensation (to add  $39 + 28$  add  $40 + 28$  and then take 1 away from the answer).

g. Students practice solving computational problems in two ways: 1. applying properties 2. traditional algorithm

e.g.,  $92 \times 4 = (90 \times 4) + (2 \times 4) = 368$ , then using traditional multiplication algorithm

## Grade 6 Mathematics

### 2.2.17 Determine when an estimate is sufficient or when an exact answer is needed.

**Activities:**

a. Students explore real life scenarios to determine which require an estimate and which require exact answers, find the appropriate answer, and explain their reasoning in writing. (see appendix for examples)

### 2.1.2 Compare and order whole numbers, positive and negative integers in context using number lines, scales and the coordinate plane.

**Activities:**

a. Students relate negative numbers to real situations. MS The Other End of the Number Line pgs. 244-245

b. Students use integers to represent real-world data. MC pgs. 121-125

c. Students compare and order integers. MC pgs. 572-575

**Teacher note:** students should be at a developing state with operations of integers.

### 2.2.22 Use concrete models to develop strategies to add and subtract integers.

**Activities:**

a. Students use models to understand zero pairs. MC pgs. 576

b. Students add integers using models and number lines. MC pgs. 577-581

c. Students subtract integers using models and number lines. MC pgs. 582-586

### 2.1.1 Locate and label whole numbers, positive and negative integers on number lines and on coordinate grids (all four quadrants)

**Activities:**

a. Students locate and graph ordered pairs on a coordinate plane. MC pgs. 599-603

*Technology:* Students plot points on a grid to get a robot to safety.

[http://www.shodor.org/interactivate/activities/MazeGame/?version=1.6.0\\_01browser=MSIE&vendor=SunMicrosystem\\_Inc](http://www.shodor.org/interactivate/activities/MazeGame/?version=1.6.0_01browser=MSIE&vendor=SunMicrosystem_Inc)

*Extend:* Graphic Novels “Meet me There” pg. 16

*Support* with CMT COACH pgs. 195-199

**Assessment:** Post Assessment Unit 2

## Grade 6 Mathematics

### UNIT 2 VOCABULARY

Array  
Associative property of addition  
Associative property of multiplication  
Commutative property of addition  
Commutative property of multiplication  
Composite number  
Distributive property  
Divisible  
Estimate  
Exact answer  
Expanded notation  
Exponent  
Factor  
Grid  
Identity property of addition  
Identity property of multiplication  
Integer  
Negative number  
Ordered pair  
Order of operations  
Positive number  
Prime factorization  
Prime number  
Product  
Quadrant  
Quotient

### CMT CONNECTION

2.1.3

1A. Solve problems involving 100, 1,000 or 10,000 more/less and 0.1 more/less than a given number.

1B. Identify alternative forms of expressing whole numbers less than 10,000 using expanded notation and regrouping. (Decimals expressed in expanded notation is tested in Grade 7.)

1C. Use place value concepts to identify and compare the magnitude and value of digits in numbers.

2.2.20

6A. Multiply and divide facts.

2.2.17

10A. Identify the best expression to find an estimate.

2.1.1

4F. Identify points on number lines and scales, including fractions, decimals and integers.

4G. Locate points number lines and scales, including fractions, decimals and integers.

18E. Locate and draw points on grids.

2.1.2

4A. Order whole numbers up to six digits and decimals (tenths and hundredths).

4B. Order mixed numbers, fractions and decimals.

4C. Describe magnitude of whole numbers up to six digits and decimals (tenths and hundredths).

4D. Describe magnitude of fractions and mixed numbers.

## Grade 6 Mathematics

### Unit 3: Connecting Fractions, Decimals and Percentages

Pacing: 4 weeks

This unit focuses on developing an understanding of these different representations of numbers, how they relate to each other and their uses.

#### Pre-assessment for Unit 3

**Grade level expectations:** The student will be able to:

**2.1.1 Locate and label whole numbers, fractions and decimals on number lines, scales and measurement tools.**

**2.1.2 Compare and order whole numbers, fractions and decimals in context using number lines and scales.**

**2.1.3 Represent and compare decimals (to thousandths) in expanded notation.**

e.g.,  $75.654 = (7 \times 10) + (5 \times 1) + (6 \times 0.1) + (5 \times 0.01) + (4 \times 0.001)$

**2.2.10 Estimate and find percentages of a number in context using benchmarks and number patterns and ratios to 100.**

**2.1.6 Determine equivalent fractions, decimals, and percent representations and choose among these forms to solve problems.**

#### **Activities:**

**Teacher note:** These activities deal with fractions only.

- a. Students divide whole areas into fractional parts using an area model. MS Designer Fractions, pgs. 108-109
- b. Students use an area model to compare fractions. MS Area Models and Equivalent Fractions, pgs. 110-111
- c. Students locate fractions on the number line. MS pgs. 112-113
- d. Students compare fractions using common denominators, MS pgs. 114-115
- e. Students find GCF of two or more numbers. MC pgs. 197-201
- f. Students express fractions in simplest form. MC pgs. 204-208
- g. Students write mixed numbers as improper fractions and vice versa. MC pgs. 209-212
- h. Students find the LCM of two or more numbers. MC pgs. 216-219
- i. Students compare and order fractions. MC pgs. 220-224

**Teacher note:** You may choose to have your students create a human number line using string. Pass out cards with numbers and have students stand in the appropriate place, explaining reasons for their placement. You may repeat this activity using decimals and percents later in this unit.

**Extension:** Students can compare and order fractions by solving a logic problem, e.g., Sally, Ben, Alan and Jill all competed in a ball throwing contest. The distances they threw the ball were  $2\frac{1}{2}$  yards,  $2\frac{2}{3}$  yards,  $1\frac{5}{6}$  yards and  $2\frac{3}{8}$  yards. Sally did not throw the ball the shortest or the longest distance. Ben threw it further than Sally but less than Jill. Alan threw it the shortest distance. Find the distance each person threw the ball.

## Grade 6 Mathematics

j. Students investigate decimals by looking at rectangular arrays of pennies and express them as fractions of one dollar and as decimals.  
MS The Fraction-Decimal Connection pgs. 210-211

k. Students use place value to write fractions as decimals. MS What's the Point pgs. 212-213

**Teacher note:** have students write decimal numbers using expanded form e.g.,  $75.654 = (7 \times 10) + (5 \times 1) + (6 \times 0.1) + (5 \times 0.01) + (4 \times 0.001)$

l. Students compare and order decimals. MS. Put Them in Order. Pgs. 214-215

**Teacher note:** When comparing decimals have students use a 100 grid and color 0.3 vs. 0.30 to show equivalence.

m. Students use number lines to round decimals. MS. Get It Close Enough pgs. 216-217

n. Students write decimals as fractions or mixed numbers in simplest form. MC pgs. 225-228

o. Students write fractions as decimals. MC pgs. 229-232

p. Students are introduced to percents by using models. MS Moving to Percents pgs. 232-233. (see MC pg. 364, Modeling Percents)

*Technology:* Students focus on the basic concept of percent, that of "parts per hundred" using a 100 grid.

grid. <http://illuminations.nctm.org/LessonDetail.aspx?ID=L249>

q. Students relate common fractions and decimals to percents. MS Working with Common Percents pgs. 234-235

r. Students estimate, then find the actual percent of a number. MS Percent Power pgs. 236-237

*Technology:* The following website lets students focus on the basic concept of percent, that of parts per hundred, using a 100 grid.

[http://illuminations.nctm.org/LessonDetail\\_20.aspx?id=L249](http://illuminations.nctm.org/LessonDetail_20.aspx?id=L249)

s. Students express percents as fractions and vice versa. MC pgs. 365-369

t. Students express percents as decimals and vice versa. MC pgs. 377-380.

u. Students estimate the percent of a number. MC pgs. 401-405

*Technology:* The following site lets students explore several representations for fractions and gives equivalent decimals and percents.

<http://illuminations.nctm.org/ActivityDetail.aspx?ID=45>

## Grade 6 Mathematics

2.1.7 Use ratios and rates (involving different units) to compare quantities.

**Activities:**

a. Students write about ratios and rates. MC pgs. 314-319

**Teacher note:** Have students compare how far they can go on a tank of gas for a variety of cars using estimated mpg.

Have students compare two or more different quantities of the same item to determine the better buy. Include problems involving whole numbers, fractions and decimals within the rates.

4.3.7 Express probabilities as fractions, ratios, decimals and percentages.

**Activities:**

a. Students determine the probability of an event and express it as a fraction (ratio), decimal and percent. MC pgs. 381-386

**Teacher note:** Students will study probability more fully in Unit 7. This is just a preview to further demonstrate the connections between the three forms of numbers

Support with CMT COACH pages 50-91

**Assessment: Post-assessment for Unit 3**

## Grade 6 Mathematics

### UNIT 3 and UNIT 4 VOCABULARY

Fraction  
Decimal  
Denominator  
Estimate  
Equivalence  
Greatest Common Factor  
Least common multiple  
Like fraction  
Improper fraction  
Mixed number  
numerator  
Percent  
Probability  
Proper fraction  
proportion  
Rate  
Ratio  
Rational number  
Reciprocal  
Simplest form  
Unit rate  
Unlike fraction

### CMT CONNECTION

2.1.1

4F. Identify points on number lines and scales, including fractions, decimals and integers.

4G. Locate points on number lines and scales, including fractions, decimals and integers

2.1.2

4A. Order whole numbers up to six digits and decimals (tenths and hundredths).

4B. Order mixed numbers, fractions and decimals.

4C. Describe magnitude of whole numbers up to six digits and decimals (tenths and hundredths).

4D. Describe magnitude of fractions and mixed numbers.

2.1.6

2A. Relate fractions, mixed numbers, decimals and percents to their pictorial representations and vice versa.

2B. Identify and/or shade fractional parts of regions or sets, decimals (tenths and hundredths) and mixed numbers in pictures.

3A. Rename equivalent fractions and mixed numbers.

3B. Rename improper fractions and mixed numbers as equivalent decimals and vice versa. (Equivalent percentages are tested in grade 7)

2.1.7

12A. Solve problems involving simple ratios.

## Grade 6 Mathematics

### Unit 4: Understanding and Using Fractions - Understanding and Using Decimals

Pacing: 4 weeks

This unit builds on students' prior knowledge of adding and subtracting fractions and extends to a conceptual understanding of multiplication and division. It also builds upon students' prior knowledge of fractions and decimals and develops strategies for multiplying and dividing decimals.

#### Pre-assessment for Unit 4

*Instructional Note:* Adding and subtracting fractions should be reviewed from previous grades using more complex fractions and should be at a procedural level, whereas multiplying and dividing fractions is being conceptually developed at this grade. (Division of fractions is not tested on the CMT at this grade level.)

**Grade level expectations:** The student will be able to:

**2.2.12 Add and subtract by fractions in context.**

**2.2.18 Estimate solutions to problems and justify the reasonableness of estimates in writing.**

**Activities:**

- a. Students use models to round fractions to the nearest half. MC pg. 248
- b. Students round fractions and mixed numbers. MC pgs. 249-253
- c. Students add and subtract fractions with like denominators. MC pgs. 256-260.
- d. Students add and subtract fractions with unlike denominators. MC pgs. 261-269
- e. Students add and subtract mixed numbers. MC pgs. 270-274  
*Extension:* Graphic Novels: "Going the Distance" pg. 5  
*Extension:* Students solve a magic square using fractions. MS Solve the Magic Square pg. 121

**Assessment:** Students describe the rules in writing for adding and subtracting fractions. MS Calc and the Numbers pg. 126  
Students solve application problems involving addition and subtraction of fractions. MS Use Fractions pg. 127  
(see assessment rubric provided in MS module pg. A15)

*Support with CMT COACH pgs. 109-112*

**Teacher note:** students should be instructed on how to use a calculator with fraction capabilities (TI-15) and be allowed to use a calculator when problem solving is the focus.

## Grade 6 Mathematics

### 2.2.12 Multiply and divide by fractions in context.

2.2.14 Examine the relationships between multiplication by a unit fraction (unit fractions have a numerator of 1) and dividing by the fraction's denominator

**Teacher note:** see MC teacher manual pg. 276a for an example. Also, have students use 12 counters. Find  $\frac{1}{2}$  of 12. Students should divide the twelve into 2 groups. Record by writing  $\frac{1}{2}$  OF 12 = 6,  $\frac{1}{2}$  X 12 = 6 and make the connection that  $\frac{1}{2}$  of 12 is the same as  $12 \div 2$ . Repeat by finding  $\frac{1}{3}$  of 12,  $\frac{1}{4}$  of 12,  $\frac{1}{6}$  of 12,  $\frac{1}{12}$  of 12.

2.2.13 Describe situations in writing that connect multiplying fractions to determining the fractional part of a set .

**Teacher note:** see MC pg. 284 #25-28 and pg.285 #37-40 to use as models. Also, have students solve problems such as: What fraction of a month is six days or what fraction of the word **Probability** is vowels? Have them search for words with a particular fraction. For example: Find a word that is  $\frac{1}{2}$  O's or  $\frac{1}{4}$  T's. Students can also make up their own problems like these and share with a classmate.

#### **Activities:**

- a. Students use an area model to multiply a fraction by a fraction. MC. Pgs. 280-281 Also see MS Fraction of Fractions pg. 132 and Math at Hand pg. 169 for samples.
- b. Students estimate products of fractions by using strategies of compatible numbers and rounding. MC pgs. 276-279
- c. Students are introduced to the algorithm for multiplying fractions and apply estimation strategies before each computation. MC pgs. 282-286.
- d. Students use an area model to multiply mixed numbers. See Math at Hand pg. 170 for samples.
- e. Students are introduced to the algorithm for multiplying mixed numbers. MC pgs. 287-290
- f. Students use area models and number lines to divide fractions.  
MS Fraction Groups within Fractions. pg. 136  
Math at Hand for models pgs. 171-176.  
Math Lab MC pg. 291-292
- g. Students are introduced to the algorithm for dividing fractions. MC pgs. 293-297
- h. Students are introduced to the algorithm for dividing mixed numbers. MC pgs. 298-301  
**Teacher note:** students should have opportunities to use a calculator with fraction capability.

Support with CMT COACH pgs. 113-115

## Grade 6 Mathematics

2.2.15 Use the inverse relationship between multiplication and division to make sense of procedures for multiplying and dividing fractions.

**Activities:**

a. Students use recipes to halve, double, quarter, quadruple, etc. (see appendix for sample)

**2.1.3 Represent and compare whole numbers (to a billion) and decimals (to thousandths) in expanded notation, e.g.,  $75.654 = (7 \times 10) + (5 \times 1) + (6 \times 0.1) + (5 \times 0.01) + (4 \times 0.001)$ .**

**Activities:**

a. Students review place value to write whole numbers in expanded notation. MC pgs. 138-139  
*Support with CMT COACH pgs. 56-59*

**2.2.12 Add and subtract using decimals in context.**

**Activities:**

a. Students relate fractions to decimals to add and subtract. MS Place the Point pgs. 220-221

b. Students round decimals. MC pgs. 146-149

c. Students estimate sums and differences using decimals in context. MC pgs. 150-154

d. Students use models to add and subtract decimals. MC pg. 155

e. Students add and subtract decimals in context. MC pgs. 156-160

*Support with CMT COACH pgs. 101-103, 120-124*

## Grade 6 Mathematics

**2.2.12 Multiply and divide by decimals in context.**

**2.2.8 Understand place value and patterns in place value when multiplying and dividing decimals by powers of 10.**

2.2.9 Develop, describe and use strategies for solving, simplifying and estimating multiplication and division problems involving large numbers, decimals and powers of 10, e.g.,  $4.25 \times 100 = 425$  and  $365,000 \div 6,000 = 365 \div 6$  ;  $365 \div 6 \approx 360 \div 6 \approx 60$ .

2.2.16 Understand and defend in writing the magnitude of the result of multiplication or division problems involving fractions (or decimals.)

**Activities:**

**Teacher note:** Have students use units to solve problems and analyze quotients. For example: You order five pizzas for your birthday party. You figure each person can eat 0.25 of a pizza. How many people can you feed? Have students write their own problems for division by decimals.

- a. Students look for patterns when using a calculator to multiply decimals and write where to place the decimal point in writing. MS More to the Point pgs. 222-223
- b. Students use estimation to place the decimal point correctly in multiplication. MS Decimal Pinpoint pgs. 224-225
- c. Students multiply decimal by whole numbers. MC pgs. 162-172
- d. Students use a model to divide decimals. MC pgs. 177-178
- e. Students divide by decimals. MC pgs. 179-183

*Support with CMT COACH pgs. 104-108, 116-118*

**2.2.18 Estimate solutions to problems and justify the reasonableness of estimates in writing.**

**Activities:**

- a. Students determine a reasonable estimate in problem solving. MC pgs. 184-185

*Support with CMT COACH pgs. 134-140*

## Grade 6 Mathematics

### 2.2.11 **Solve practical problems involving rates, ratios, percentages and proportionality.**

**Teacher note:** Explore and compare methods for taking a percentage of a number and its meaning including estimation, multiplying by a decimal and using ratios and ratio tables. Calculations with percentages will be further developed in Grade 7.

- a. Students express ratios and rates using fractions. MC pgs. 314-319
- b. Students use tangrams to look for a relationship between ratio and area. MC pgs. 320-321
- c. Students use ratio tables to solve problems. MC pgs. 322-327
- d. Students determine if two quantities are proportional. MC pgs. 329-333  
*Extension:* Graphic Novels “Hoops” pg. 4  
*Support with CMT COACH* pgs. 125-127

### 2.2.19 Write and solve multistep problems in context involving addition, subtraction, multiplication and division with whole numbers, fractions, (decimals) money and simple percentages.

- a. Students write and solve their own multistep problems with at least one fractional value.  
*Extension:* Students use more than one fractional values and a percentage.

### **Assessment: Post-assessment for Unit 4**

## Grade 6 Mathematics

### VOCABULARY

(see Unit 3)

### CMT CONNECTIONS

2.1.3

1A. Solve problems involving 100, 1,000 or 10,000 more/less and 0.1 more/less than a given number.

1B. Identify alternative forms of expressing whole numbers less than 10,000 using expanded notation and regrouping. (Decimals expressed in expanded notation is tested in Grade 7.)

2.2.8

7B. Multiply and divide whole numbers and decimals by 10, 100 and 1,000.

7D. Identify the correct placement of the decimal point in multiplication and division of decimals by one-digit numbers.

2.2.9

7C. Multiply and divide two- and three-digit whole numbers and money amounts by one-digit numbers and one-digit decimals

2.2.12

8A. Add and subtract fractions and mixed numbers with reasonable and appropriate denominators.

8B. Multiply whole numbers and fractions by fractions and mixed numbers.

2.2.18

4E. Round whole numbers up to 6 digits, fractions and decimals in context.

10A. Identify the best expression to find an estimate.

10B. Identify whether and why a particular strategy will result in an overestimate or an underestimate.

11A. Identify a reasonable estimate to a problem, including estimating change.

11B. Determine a reasonable estimate, and describe the strategy used to arrive at the estimate.

11C. Given an estimate as a solution, judge its reasonableness and justify the decision.

2.2.19

25A. Solve extended numerical and statistical problems

## Grade 6 Mathematics

### Unit 5: Geometry and Measurement

Pacing: 5 weeks

This unit begins with a review of measurement conversions and develops concepts in one-, two-, and three-dimensional measurements. Students use the idea of measurements to determine and describe relationships of polygons and their transformations.

#### Pre-assessment for Unit 5

**Teacher note:** All references to MathScape (MS) from this unit are from the Grade 7 module Getting in Shape.

**Grade level expectations:** The student will be able to

- 3.3.8 **Select and use appropriate strategies, tools and units to estimate and solve measurement problems involving length, perimeter, area, volume, angles, temperature, capacity, mass and weight**
- 3.2.6 **Use and describe concrete strategies for finding the volume of rectangular solids and cylinders.**
- 3.3.9 **Use ratios to convert between both metric and customary units of length, mass, capacity and time**
- 3.3.10 **Use ratios and powers of ten to convert between metric units.**

#### **Activities:**

- a. Students explore changes in area and perimeter of squares and rectangles. MC pgs. 520-521
- b. Students find perimeters of squares and rectangles. MC pgs. 522-526  
*Technology:* Using interactive figures, students can investigate how changing the height of a rectangle with a fixed width changes its area. <http://standards.nctm.org/document/examples/chap6/6.1/index.htm>
- c. Students use models to find areas of squares and rectangles. MC pgs. 63-67
- d. Students use cubes to develop the formula for finding the volume of rectangular solids (prisms). MC pg. 548
- e. Students solve volume problems in context. MC pgs. 549-553
- f. Students estimate and compare the volume of two cylinders.  
*Activity:* students fold two identical pieces of paper to make a tall and a short cylinder. Place the tall cylinder inside the shorter cylinder, fill it with a nonstandard unit such as popcorn, mini-marshmallows, or rice. Remove the tall one and compare the volume.  
*Technology:* The same activity can be found in the following interactive website:  
<http://www.figurethis.org/challenges/c03/challenge.htm>  
*Note:* You may have to guide students through the development of the formula for cylinder based on the work they did with prisms.

*Support with CMT COACH pgs. 168-171*

## Grade 6 Mathematics

g. Students measure and classify angles. MS The Angle on Angles. Pgs. 274-275

**Teacher note:** may use colored paper plates instead of cutting circles.

For more practice measuring angles, see MC pgs. 470-473

h. Students estimate and draw angles. MC pgs. 474-478

**Teacher note:** Give students different tools for measuring capacities of liquids and/or solids. Have students discover the equivalences of each measurement (i.e., pints, cups, quarts, etc). Do similar activities for metric system and for mass and weight. You may wish to set up stations around the room and rotate students through these hands-on measurement stations.

i. Students convert units of capacity and weight in the customary system. MC pgs. 424-429

j. Students look for patterns to convert metric measures of length. MC pgs. 430-431

k. Students use metric units of length to solve problems in context. MC pgs. 432-436

l. Students use metric units of mass and capacity to solve problems in context. MC pgs. 437-441

m. Students solve problems with elapsed time and convert between units.

*Technology:* students practice with elapsed time using the following interactive website:

[http://www.shodor.org/interactivate/activities/ElapsedTime/?version=1.5.0\\_06&browser=MSIE&vendor=Sun\\_Microsystems\\_Inc.](http://www.shodor.org/interactivate/activities/ElapsedTime/?version=1.5.0_06&browser=MSIE&vendor=Sun_Microsystems_Inc.)

n. Students use powers of ten to convert between metric units. MC pgs. 445-449

o. Students choose and estimate reasonable temperatures. MC pgs. 455-458

p. Students select appropriate strategies, tools and units to measure items and write measurement problems. MC pgs. 459-460

## Grade 6 Mathematics

### 3.1.5 Recognize the relationships among radius, diameter, circumference and area of circles and develop formulas for finding circumference and area based on these relationships.

#### **Activities:**

- a. Students look for a relationship between the diameter and circumference of a circle. MS Going Around in Circles pgs. 294-295 note: on page 295, do not make a scatterplot OR use Measurement Lab on MC pg. 527
- b. Students estimate and find circumferences of circles. MC pgs. 528-533
- c. Students use a paper plate model to develop the formula for the area of a circle MS Around the Area pgs. 298-299 OR MC pgs. LA 15-19 ( note: LA pages are located after page 669 in the text)

**Teacher note:** This is only an introduction to area of a circle. More work will follow in grade 7.

**Technology:** Students use knowledge of circles to see if certain trees listed are wide enough to drive a car through.

<http://www.figurethis.org/challenges/c15/challenge.htm>.

**Extension:** Graphic Novels “Circle the Earth” p. 13 and “Tired Out” pg. 19

### 3.1.4 Use rectangles as basic shapes to model and develop formulas for finding the area of triangles, parallelograms and trapezoids.

#### **Activities:**

- a. Students use graph paper to find the relationship between a rectangle and parallelogram and determine its area. MC pgs. 534-538
- b. Students use graph paper to develop the formula for finding the area of a triangle. MC. Pgs. 539-544
- c. Students find the area of a trapezoid. (see appendix Gr. 7 MC pgs. 578-579)

**Technology:** Students relate the areas of triangles and parallelograms to finding the area of rectangles using the following applets:

- o <http://illuminations.nctm.org/ActivityDetail.aspx?ID=21>
- o <http://illuminations.nctm.org/ActivityDetail.aspx?ID=106>
- o <http://illuminations.nctm.org/ActivityDetail.aspx?ID=108>
- o <http://illuminations.nctm.org/ActivityDetail.aspx?ID=109>
- o <http://illuminations.nctm.org/LessonDetail.aspx?ID=L574>.

**Support with CMT COACH** pgs. 160-165

## Grade 6 Mathematics

**3.1.1 Classify sets and subsets of polygons using the relationship of the sides (length, parallel and perpendicular) and angles (types and measure).**

**3.2.7 Use measurements to examine the ratios between corresponding side lengths of scale models and similar figures.**

**Activities:**

a. Students investigate the angles and sides of triangles. MS The Truth About Triangles pgs. 276-277

**Teacher note:** you may choose to use Cuisenaire rods to explore the sides of a triangle if they are available. You may also use Geometry Lab on MC pg. 485

b. Students classify triangles by their sides and angles and investigate lines of symmetry.

MS Can a Triangle Have Four Sides: pgs. 278-279

**Teacher note:** Additional support may be found on MC pgs. 486-491

c. Students create an enlargement (scale model) and investigate similarity. MS Enlarging Triangles pgs. 280-281

**Teacher note:** Additional support may be found on MC pgs. 502-507

d. Students classify polygons and quadrilaterals. MS Polygon Power pgs. 284-285 (materials needed – polygon tiles)

**Teacher note:** Additional support may be found on MC pgs. 494-499

**Extension:** Graphic Novels “Ladder Thinking” pg. 17

**Technology:** students classify polygons according to more than one property at a time.

<http://illuminations.nctm.org/LessonDetail.aspx?ID=L270>

*Support with CMT COACH pgs. 174-185*

**3.1.3 Identify lines of symmetry and reflections, rotations and translations of geometric figures.**

**Activities:**

a. Students identify and model slides (translations), flips (reflections) and turns (rotations). See Math at Hand pgs. 375-378

**Teacher note:** Examine rotational symmetry in lowercase letters by looking at which ones can be read the same upside down and right side up.

*Support with CMT COACH pgs. 188-194, 200-206*

**Assessment: Post-assessment for Unit 5**

## Grade 6 Mathematics

### UNIT 5 VOCABULARY

Angle  
Area  
Base  
Capacity  
Circle  
Congruent  
Cube  
Cubic units  
Customary system  
Cylinder  
Degree  
Diameter  
Formula  
Height  
Length  
Line of symmetry  
Mass  
Metric system  
Parallel  
Perimeter  
Perpendicular  
Polygon  
Quadrilateral  
Radius  
Rectangular prism  
Reflection  
Rotation  
Scale model  
Side  
Similar  
Temperature  
Transformation  
Translation  
Triangle  
Vertex  
Volume  
Weight

### CMT CONNECTIONS

3.3.8

15A. Estimate lengths, areas and angle measures.

16A. Measure and determine perimeter, area and volume. Explain or show how the solution was determined.

16B. Identify appropriate customary or metric units of measure (length, temperature, capacity, mass) for a given situation.

3.3.9, 3.3.10

16C. Identify the correct solution to problems involving the conversions of measures of length, mass, capacity and time.

16D. Solve problems involving conversions of measures of length, mass, capacity and time.

25A. Solve extended numerical, statistical and spatial problems.

3.1.4

16A. Measure and determine perimeter, area and volume. Explain or show how the solution was determined.

3.2.6

16A. Measure and determine perimeter, area and volume. Explain or show how the solution was determined.

18C. Identify congruent and similar figures.

3.1.1

17A. Identify and classify two- and three-dimensional geometric shapes and figures.

17B. Draw, describe and classify 2-dimensional geometric shapes and figures

18B. Draw lines of symmetry.

18C. Identify congruent and similar figures.

18D. Identify geometric reflections, rotations and translations

25A. Solve extended numerical, statistical and spatial problems.

## Grade 6 Mathematics

### Unit 6: Algebraic Thinking

Pacing: 4 weeks

This unit focuses on representing mathematical situations in a variety of ways such as tables, graphs, expressions or equations to make connections between the representations and explore methods for generalizing patterns and finding solutions.

#### Pre-assessment for Unit 6

**Grade level expectations:** The student will be able to:

**1.1.1 Analyze, describe in writing and extend a variety of patterns (numeric, geometric and statistical) to justify predictions and identify trends.**

**Activities:**

a. Students identify rules for patterns written in a sequence. MC pgs. 343-348

*Extension:* In the activity on the following website, students work through a series of numbers to figure out a mystery operation.

<http://www.learner.org/teacherslab/math/patterns/mystery/>

b. Students explore patterns by organizing data. MS Painting Faces pgs. 326-327

c. Students use tables to describe and predict patterns. MS Crossing the River pgs. 328-329

d. Students use variables and expressions to describe patterns. MS Letter Perfect pgs. 332-333

e. Students describe patterns with multiple expressions. MS Tiling Garden Beds pgs. 334-335

f. Students compare tables, graphs and verbal descriptions of different type of patterns. Examining Patterns of Growth (see appendix)

**1.2.3 Examine tables, graphs and equations to determine patterns of change in linear relationships**

**Activities:**

a. Students work through a scenario such as: You have a summer job cutting lawns. You are going to charge \$20 per lawn. How many lawns will it take you to earn \$100? (Some students may immediately multiply  $\$20 \times 5$ ; others may count by 20s ... lead to development of a table.) Answer/Discuss other questions such as: How much will you have after cutting seven lawns? You want to buy an iPod that costs \$150. How many lawns do you have to cut? Lead to equation using variables such as L for lawn and D for dollars earned ( $20L = D$ ).

*Support* using Download Dilemma – Graphic Novels

b. Students use patterns to make a decision. They express their findings by making a table, a graph and describe the growth pattern in writing. MS The Will, pgs. 352-352

*Differentiate* by providing 2 plans instead of 3.

## Grade 6 Mathematics

1.2.4 **Write expressions, formulas, equations or inequalities using symbols or variables** to denote a pattern or represent a contextual situation. (**Solve for an unknown**)

**Teacher note:** The focus is on expressions and formulas, but you should include simple inequalities such as  $x > 5$  and then build to slightly more complex inequalities as related to contextual situations. See MC pg. 655 to use a scale to model inequalities.

1.3.5 **Evaluate algebraic expressions and formulas using substitution** (replacing a variable with a number)

1.3.6 **Write, model and solve one-step equations** using mental math, tables, substitution and concrete models **that demonstrate equivalence and justify the solution in writing.**

**Activities:**

a. Students evaluate expressions using substitution. MC pgs. 42-46

b. Students use function tables to find rules. MC pgs. 49-53

c. Students use a balance model to solve equations. MC pgs. 57-60

d. Students use tables and data to generate formulas and find areas of rectangles and squares. MC. Pgs. 61-67

**Teacher note:** Students use shapes to balance a scale and then writes the algebraic expression for the scale weights.

<http://illuminations.nctm.org/ActivityDetail.aspx?ID=131>

*Support with Groundworks: Algebra Puzzles*

*Support this unit by using CMT COACH pgs. 250-262*

### Assessment: Post-assessment for Unit 6

#### UNIT 6 VOCABULARY

Equation  
Evaluate  
Expression  
Formula  
Function  
Patterns  
Solve  
Solution  
Substitution  
Trends  
Variables

#### CMT CONNECTIONS

1.1.1

22A. Identify the missing terms in a pattern, or identify rules for a given pattern using numbers and attributes.

22B. Extend or complete patterns and state rules for given patterns using numbers and attributes.

25A. Solve extended numerical, statistical and spatial problems.

1.2.2

18E. Locate and draw points on grids.

1.3.5

23B. Evaluate equations, identify fact-family relationships and use formulas provided. 1.3.6 CMT: 23A. Solve simple one-step algebraic equations.

## Grade 6 Mathematics

### Unit 7: Probability

Pacing: 3 weeks

This unit revisits the concepts of fractions, decimals and percentages through concepts of probability and experiments.

#### Pre-assessment for Unit 7

**Grade level expectations:** The student will be able to:

**4.3.5 Investigate and describe the relationship between the number of trials in an experiment and the predicted outcomes.**

**4.3.6 Design and conduct probability experiments to test predictions about outcomes and fairness.**

4.3.7 Express probabilities as fractions, ratios, decimals and percentages.

4.3.8 Find all possible outcomes by systematic listing and counting strategies to solve problems.

- a. Students play a game of chance and analyze data to determine probability. MS What are the Chances? Pgs. 30-31
- b. Students conduct an experiment by changing the cubes in the bag to see how the probability changes.  
MS Changing the Chances pgs. 32-33
- c. Students apply probability and statistics to make predictions. MS Which Bag is Which? pgs. 34-35
- d. Students find the probability of a simple event and express the probability as a fraction, decimal and percent. MC pgs. 381-386  
*Extend* with Graphic Novels Rain or Shine pg. 28
- e. Students compare experimental probability with theoretical probability. MC pg. 387
- f. Students use tree diagrams and organized lists to solve problems. MC pgs. 389-393  
*Extend* with Graphic Novels No Tricks pgs 25-27

*Support* with CMT COACH pgs. 233-237 and 238-242

#### **Assessment: Post-assessment for Unit 7**

## Grade 6 Mathematics

### VOCABULARY UNIT 7

Equally likely  
Experimental probability  
Likely  
Not likely  
Outcome  
Positive correlation  
Theoretical probability

### CMT CONNECTIONS

4.3.6

21A. Identify correct solutions to problems involving elementary notions of probability and fairness.

21B. Solve problems involving elementary notions of probability and fairness, including justifying solutions.

4.3.8

24A. Solve logic, counting and classification problems involving the organization of data.

## Grade 6 Mathematics

### Unit 8: Data and Graphing

Pacing: 4 weeks

This unit is designed to expand students' abilities to graph data appropriately using graphs including histograms, scatterplots and circle graphs. Students graph, examine and analyze both single variable and multivariable data.

#### Pre-assessment for Unit 8

**Grade level expectations:** The student will be able to:

- 4.1.2 Select, create and use appropriate graphical representations of data including, circle graphs (and recognize the proportional representation of data) , scatter plots, and histograms .**
- 4.2.3 Describe the shape of numerical data sets using measures of spread (range) and central tendency (mean, median, mode) and outliers.**
- 4.1.1 Compare sets of data between two populations, e.g., heights of two classes of students, or within a population, e.g., height vs. arm length of sixth-grade students, using a variety of graphical representations.
- 1.2.3 Examine tables, graphs and equations to determine patterns of change in linear relationships**
- 1.2.2 Create tables of values and scatterplots from mathematical relationships and equations and vice versa to solve problems.

#### **Activities:**

a. Students sketch and analyze circle graphs. MC pgs. 370 - 375

**Teacher note:** Discuss the appropriateness of graphs based on the characteristics of data being displayed (e.g. circle graphs are used when the data describes parts of a whole). Visit <http://cstl.syr.edu/fipse/TabBar/Compare/COMPARE.HTM> for more information.

b. Students create a human circle graph to compare fractions and percentages using estimation. (see appendix for Human Circle Graph lesson).

c. Students explore the effectiveness of different graphical representations of data and examine the measures of central tendency and determine when one is a better representation of the data than another. See appendix for Exploring Data lesson.

**Technology:** Students create a customized circle graph with their own data, or display a circle graph from an included set of data using the following website: <http://illuminations.nctm.org/ActivityDetail.aspx?ID=60>.

d. Students collect, organize, analyze and display data using histograms. MC LA pgs. 25-28

e. Students construct a scatterplot to demonstrate relationships between two sets of data. (see appendix for Searching for Relationships Activity 11.11)

f. Students determine line of best fit on a scatter plot. (see appendix for Best Fit Line Activity 11.12)

g. Students graph a scatterplot and determine and extend a linear pattern. (see appendix for lesson "Constant Dimensions")

## Grade 6 Mathematics

**Teacher note:** the following websites provide students with opportunities for working with scatterplots and lines of best fit.

- Students do a bungee jumping activity using a Barbie doll (or another item). Students will be able to use a spread sheet, graph their results and find the line of best fit. <http://illuminations.nctm.org/LessonDetail.aspx?ID=L646>
  - Students plot points on a grid and then guess the best line of fit. The computer will then give the best line of best fit. <http://illuminations.nctm.org/ActivityDetail.aspx?ID=146>
  - Using a scatter plot, students compare favorite soda bought at two different stores <http://www.figurethis.org/challenges/c70/challenge.htm>
- h. Students compare sets of data between two populations using bar graphs. MS Double Data pgs. 16-17
- i. Students make comparisons and recommendations based on two sets of data. MS Across the Ages pgs. 18-19
- j. Students identify correct graphical representations and find means, medians and modes. See appendix for lesson “Exploring Data”

### Post-assessment for Unit 8

#### UNIT 8 VOCABULARY

circle graph  
histogram  
line of best fit  
and scatterplot

#### CMT CONNECTIONS

4.1.1  
20A. Draw reasonable conclusions from data in tables, pictographs, line graphs, circle graphs, stem-and-leaf plots charts.  
24B. Sort or classify objects, and draw logical conclusions from data including Venn diagrams and transitive reasoning questions.