5th Grade Mathematics

Curriculum Map April 28th – June 27th
New Content – Operations and Algebraic Thinking/Geometry/ Measurement & Data
Review Content - In-Depth Opportunities

ORANGE PUBLIC SCHOOLS

OFFICE OF CURRICULUM AND INSTRUCTION

OFFICE OF MATHEMATICS

Unit Overview

CCSS
New Standards
5.OA.3
5.MD.1, 5.MD.3, 5.MD.4
5.G.1, 5.G.2
Opportunity for In-Depth Focus
5.NBT.1
5.NBT.6
5.NF.2
5.NF.4
5.MD.5

Essential Concepts

5.OA

• Given a pattern you can generate a rule; given a rule you can generate a pattern.

• Ordered pairs that represent corresponding terms from two patterns can be represented on a graph, and apparent relationships between them can be described.

5.MD

Measurements can be converted into different sized standard unit measurements within a given measurement system (i.e. cm to m, or m to cm)

• Conversions can be used to solve multistep, real-world problems

Volume is an attribute of 3 dimensions; length, width, height.

• Volume of a rectangular prism is determined by multiplying its three dimensions; length times width times height OR the base x the height.

• Volume is measured by the quantity of same size units times of volume that completely fill the space.

• 1 x 1 x 1 unit cube is standard unit of measurement for volume; either customary or metric measurement can be used.

5.G

• Shapes can be described in terms of their location in a plane or in space.

• Space can be defined by an ordered pair of numbers that designate an intersection point on a grid.

• This point corresponds to a location on both a horizontal x-axis and a vertical y-axis on the coordinate plane.

• The point (0,0) is an ordered pair that marks the origin on a coordinate plane.

• Points on a coordinate plane can be used to graph real world problems to find solutions.

Essential Questions

5.OA

• How can a rule help you define a pattern?

• What can you learn about the relationship between two sequences of numbers by creating a visual representation?

• Why is it important to match corresponding terms to create a coordinate pair?

5.MD

Essential Questions

• Why does “what” we measure influence “how” we measure?

• What unit would be most appropriate for solving a given problem?

How is volume related to multiplication?

• When finding the volume of two non-overlapping right rectangular prisms what measurements do you need? Explain.

5.G

- With any two coordinate values (x,y), how can you locate the point?
- How do we apply these ideas to real-world context? Common Core Standards

Unit 5	
5.OA.3	Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. *For example, given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.*
5.MD.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.
5.MD.3	Recognize volume as an attribute of solid figures and understand concepts of volume measurement. 5.MD.3.A A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume. 5.MD.3.B A solid figure which can be packed without gaps or overlaps using *n* unit cubes is said to have a volume of *n* cubic units.
5.MD.4	Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.
5.G.1	Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., *x*-axis and *x*-coordinate, *y*-axis and *y*-coordinate).
5.G.2	Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

Connections to the Mathematical Practices

1	Make sense of problems and persevere in solving them
	Students solve problems by applying their understanding of operations with whole numbers, decimals, and fractions including mixed numbers. They solve problems related to volume and measurement conversions. Students seek the meaning of a problem and look for efficient ways to represent and solve it. They may check their thinking by asking themselves, "What is the most efficient way to solve the problem?", "Does this make sense?", and "Can I solve the problem in a different way?"
2	Reason abstractly and quantitatively
	Fifth graders should recognize that a number represents a specific quantity. They connect quantities to written symbols and create a logical representation of the problem at hand, considering both the appropriate units involved and the meaning of quantities. They extend this understanding from whole numbers to their work with fractions and decimals. Students write simple expressions that record calculations with numbers and represent or round numbers using place value concepts.
3	Construct viable arguments and critique the reasoning of others
	In **fifth** grade, students may construct arguments using concrete referents, such as objects, pictures, and drawings. They explain calculations based upon models and properties of operations and rules that generate patterns. They demonstrate and explain the relationship between volume and multiplication. They refine their mathematical communication skills as they participate in mathematical discussions involving questions like "How did you get that?" and "Why is that true?" They explain their thinking to others and respond to others' thinking.
4	Model with mathematics
	Students experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, making a chart, list, or graph, creating equations, etc. Students need opportunities to connect the different representations and explain the connections. They should be able to use all of these representations as needed. Fifth graders should evaluate their results in the context of the situation and whether the results make sense. They also evaluate the utility of models to determine which models are most useful and efficient to solve problems.
5	Use appropriate tools strategically
	Fifth graders consider the available tools (including estimation) when solving a mathematical problem and decide when certain tools might be helpful. For instance, they may use unit cubes to fill a rectangular prism and then use a ruler to measure the dimensions. They use graph paper to accurately create graphs and solve problems or make predictions from real world data.
6	Attend to precision
	Students continue to refine their mathematical communication skills by using clear and precise language in their discussions with others and in their own reasoning. Students use appropriate terminology when referring to expressions, fractions, geometric figures, and coordinate grids. They are careful about specifying units of measure and state the meaning of the symbols they choose. For instance, when figuring out the volume of a rectangular prism they record their answers in cubic units.
7	Look for and make use of structure
	In **fifth grade**, students look closely to discover a pattern or structure. For instance, students use properties of operations as strategies to add, subtract, multiply and divide with whole numbers, fractions, and decimals. They examine numerical patterns and relate them to a rule or a graphical representation.
8	Look for and express regularity in repeated reasoning
	Fifth graders use repeated reasoning to understand algorithms and make generalizations about patterns. Students connect place value and their prior work with operations to understand algorithms to fluently multiply multi-digit numbers and perform all operations with decimals to hundredths. Students explore operations with fractions with visual models and begin to formulate generalizations.

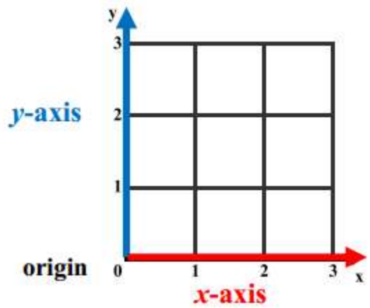
Vocabulary

Visual Definition

The terms below are for teacher reference only and are not to be memorized by students.

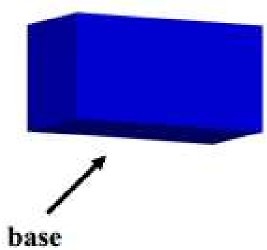
Teachers should first present these concepts to students with models and real life examples. Students should understand the concepts involved and be able to recognize and/or use them with words, models, pictures, or numbers.

axis



A reference line from which distances or angles are measured in a coordinate grid. (plural - axes)

base of a solid figure

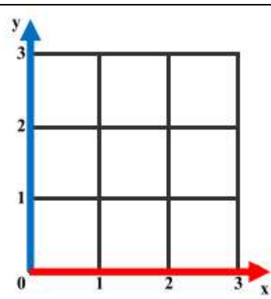


A base of a solid figure is usually thought of as a face upon which it can "sit." Most solid figures have more than one base.

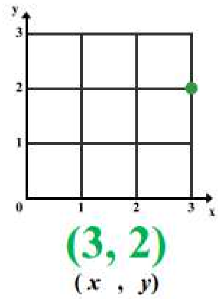
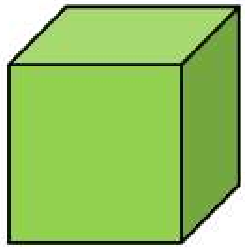
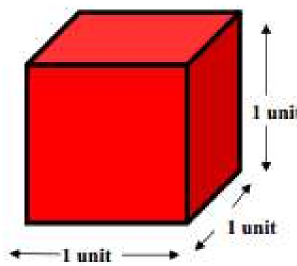
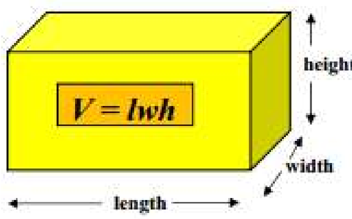
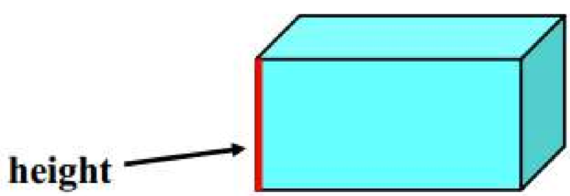
capacity

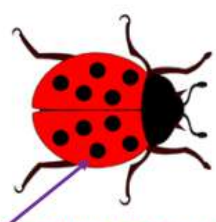
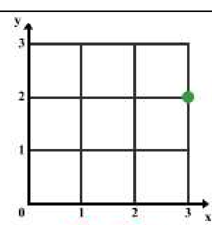
Capacity refers to the amount of liquid a container can hold.

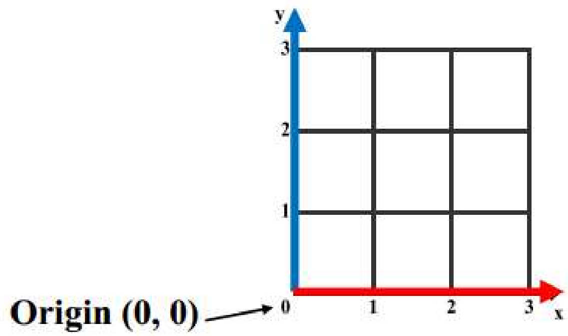
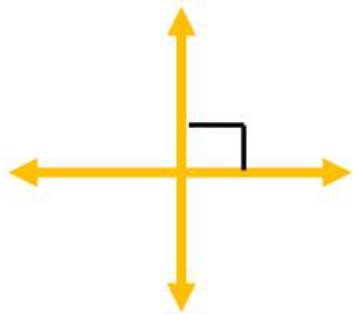
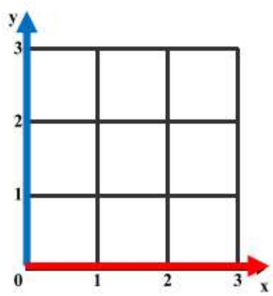
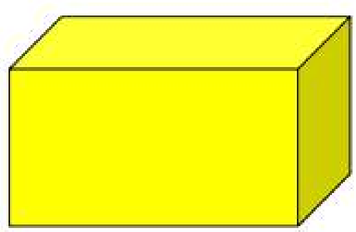
coordinate grid

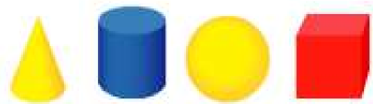
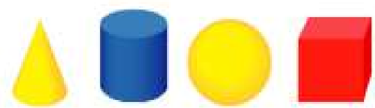
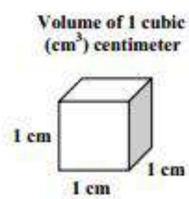
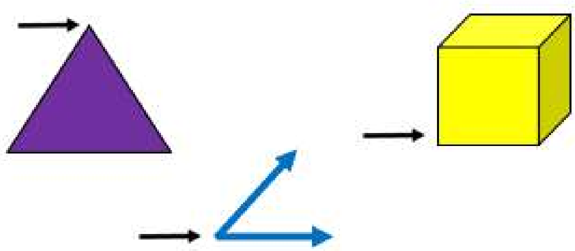
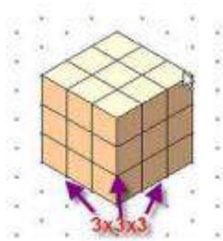


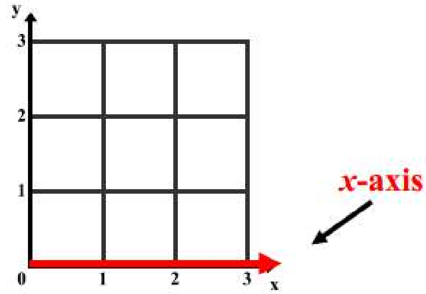
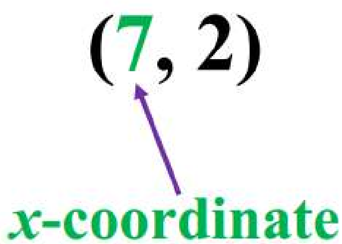
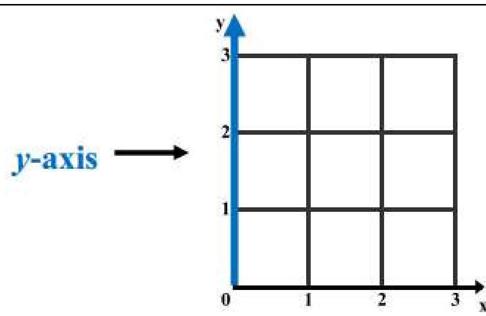
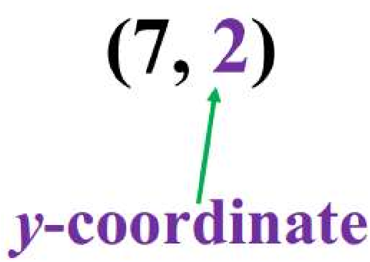
A two-dimensional system in which the coordinates of a point are its distances from two intersecting, usually perpendicular, straight lines called axes. (also known as coordinate plane or coordinate system)

coordinates		An ordered pair of numbers that identify a point on a coordinate plane.
cube		A rectangular solid having 6 congruent square faces.
cubic unit		A unit such as a cubic meter to measure volume or capacity.
formula		A general mathematical rule that is written as an equation.
height		A perpendicular line segment from the base to the top of the figure.

liter (L)	large bottle of soda or bottle of water  1,000 mL = 1 L	The basic unit of capacity in the metric system. 1 liter = 1,000 milliliters
meter (m)	 A baseball bat is *about* 1 meter long.	A standard unit of length in the metric system.
milliliter (mL)	This holds about 10 drops or 1 milliliter. 	A metric unit of capacity. 1,000 milliliters = 1 liter
millimeter (mm)	 The dot on a ladybug is *about* 1 millimeter wide.	A metric unit of length. 1,000 millimeters = 1 meter
ordered pair	 (3, 2) (x, y)	A pair of numbers that gives the coordinates of a point on a grid in this order (horizontal coordinate, vertical coordinate).

origin		
perpendicular lines		Two lines that form right angles.
quadrant	 Quadrant I	A section of a coordinate grid that is separated by the *x*-axis and *y*-axis..
right rectangular prism		A prism with 6 rectangular faces where the lateral edge is perpendicular to the plane of the base.

solid figure		Three-dimensional figure that has length, width, and height.
three-dimensional figure		A solid figure that has length, width, and height.
unit cube	 	A precisely fixed quantity used to measure volume.
vertex		The point at which two line segments, lines, or rays meet to form an angle. (plural - vertices)
volume	 Volume = 27 cubic units	The number of cubic units it takes to fill a figure.

***x*-axis**		The horizontal axis in a coordinate plane.
***x*-coordinate**		In an ordered pair, the value that is always written first.
***y*-axis**		The vertical axis in a coordinate plane.
***y*-coordinate**		In an ordered pair, the value that is always written second.

NEW CONTENT

Suggested Lessons, Task and Projects

Lesson Suggestion from Current Resources	CCSS	Teacher Notes
EDM 9-1	5.G.1-2	Part 1 and Part 2 Readiness
EDM 9-2	5.G.1-2	Part 1 and Extra Practice
EDM 9-3	5.G.1-2	Part 2
EDM 10-3	5.OA.3	Part 3 Readiness (Exploring What's my Rule? Tables)
EDM 10-4	5.OA.3	Part 1 & Extra Practice
EDM 10-6	5.OA.3	Part 1

Tasks

5.G.1

Battle Ship Using Grid Paper

Materials

The students will need grid paper and colored pencils; some color for the ships and (for example) red for explosions on their ships and their enemy's ships. This is how they will keep track of what ordered pairs have been called.

Setup

Students begin by folding the grid paper in half. They need to draw coordinate axes on both the top half and the bottom half and label the *x* and *y* axes with the numbers 1–10 on each axis. The students will need to draw in 5 ships on ordered pairs and label the ordered pairs. They should draw:

- Two ships that are sitting on 2 ordered pairs,
- One ship that is sitting on 3 ordered pairs,
- One ship that is sitting on 4 ordered pairs, and
- One ship sitting on 5 ordered pairs.

Remind them the bottom half has their boats or (Navy) and the top half has their opponent's boats.

Actions

Students play in pairs sitting opposite each other and take turns calling out ordered pairs. Players should keep a list of the ordered pairs they call out written in (*x*,*y*) form on a piece of paper that both players can see so there is no disagreement later on about what has been called (it is common for students to transpose the coordinates). Then they are to mark the ordered pair they call out on the top coordinate plane. They should mark in black if they missed and red if they hit their opponent's boat. On the bottom half of the grid paper they are to color black for the ordered pairs their opponent calls out and color red for the ordered pairs that hit their ship.

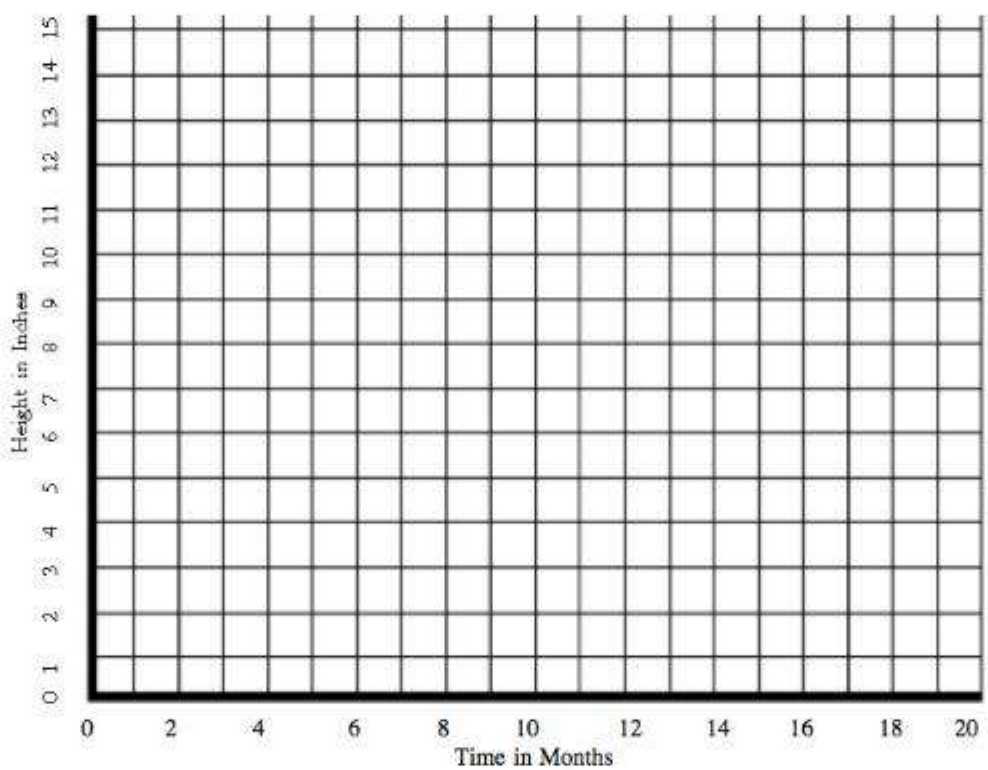
5.G.2 – Meerkat Coordinate Plane Task

Greetings from the Kalahari Desert in South Africa! In this activity, you will learn a lot about the Kalahari's most playful residents: meerkats.

a. The following ordered pairs show the height of a typical meerkat at different times during the first 20 months of life. Graph the corresponding points and see what you can discover about meerkats. Once you have graphed them all, connect the points in the order they are given to form a line graph.

See if you can graph these ordered pairs:
(0 months, 3 inches)
(2 months, 5 inches)
(4 months, 6 inches)
(6 months, 7 inches)
(8 months, 8 inches)
(10 months, 9 inches)
(12 months, 10 inches)
(14 months, 12 inches)
(16 months, 12 inches)
(18 months, 12 inches)
(20 months, 12 inches)

Title: Meerkat Height in Inches Over First 20 Months



b. What does the point (0 months, 3 inches) mean for a typical meerkat's height?

c. How tall do you think a typical meerkat gets? Why?

d. At what age do meerkats reach their full height? How do you know from this graph?

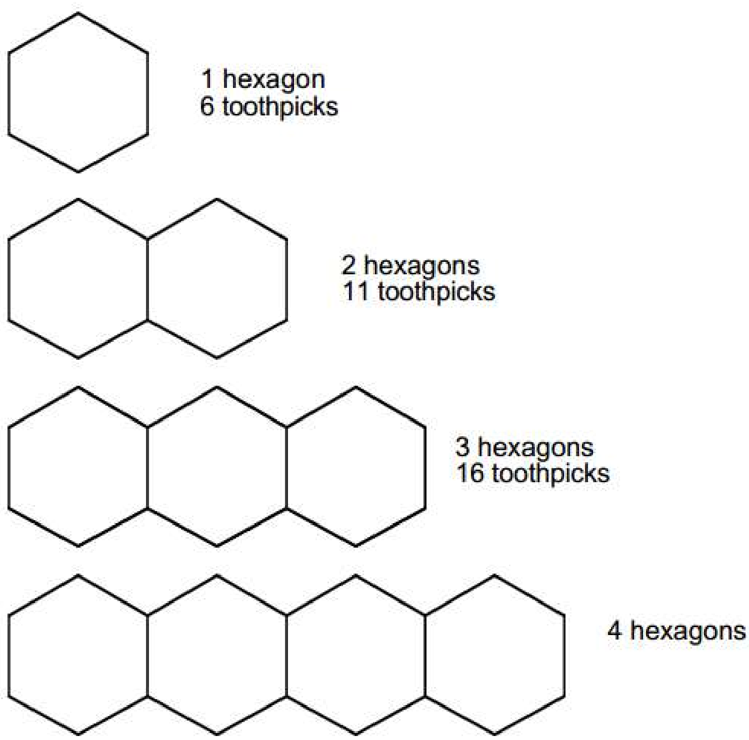
e. If this graph were about a human instead of a meerkat, at what age do you think the height would stop getting larger?

5.OA.3 – Hexagons in a Row

This problem gives you the chance to:

- find a pattern in a sequence of diagrams
- use the pattern to make a prediction

Joe uses toothpicks to make hexagons in a row.



Joe begins to make a table to show his results.

Number of hexagons in a row	1	2	3	4
Number of Toothpicks	6	11		

1. Fill in the empty spaces in Joe's table of results.

2. How many toothpicks does Joe need to make 5 hexagons? _______________

   Explain how you figured it out.

3. How many toothpicks does Joe need to make 12 hexagons? ______________

   Explain how you figured it out.

4. Joe has 76 toothpicks.

   How many hexagons in a row can he make? __________________

   Explain how you figured it out.

5.MD.1 – Converting Fraction of a unit into a Smaller unit

a. Five brothers are going to take turns watching their family's new puppy. How much time will each brother spend watching the puppy in a single day if they all watch him for an equal length of time? Write your answer

I. Using only hours,

II. Using a whole number of hours and a whole number of minutes, and

III. Using only minutes.

b. Mrs. Hinojosa had 75 feet of ribbon. If each of the 18 students in her class gets an equal length of ribbon, how long will each piece be? Write your answer

i. Using only feet,

ii. Using a whole number of feet and a whole number of inches, and

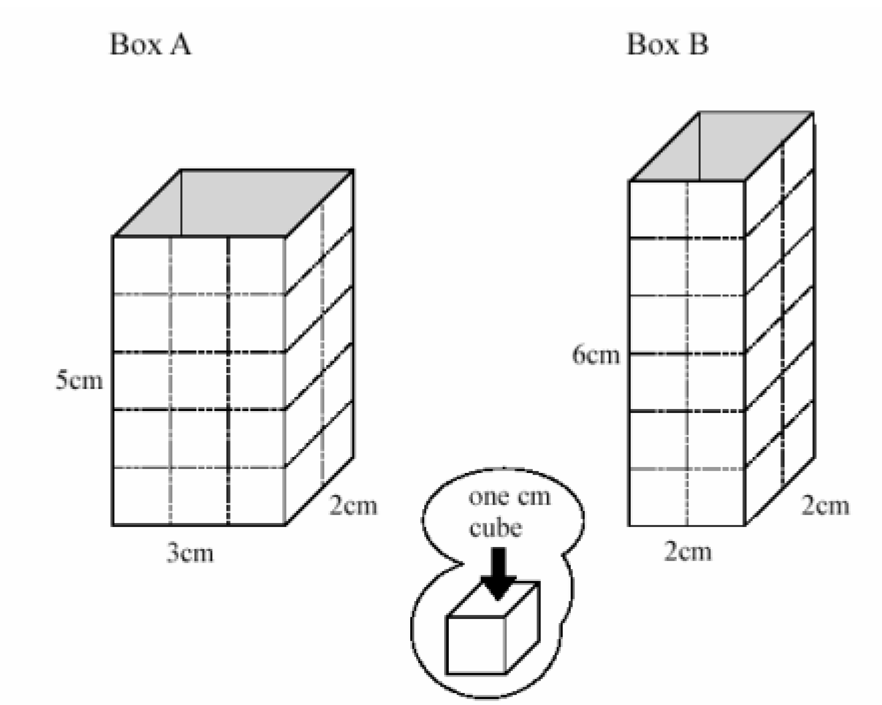
iii. Using only inches.

5.MD.3, 4, 5 – How many Cubes?

The Problem gives you the chance to:

- Work with volume

Steve fills Box A and Box B with one centimeter cubes.



1. How many cubes can Steve fit into Box A? ____________________________

   Explain how you figured it out.

2. How many cubes can Steve fit into box B?

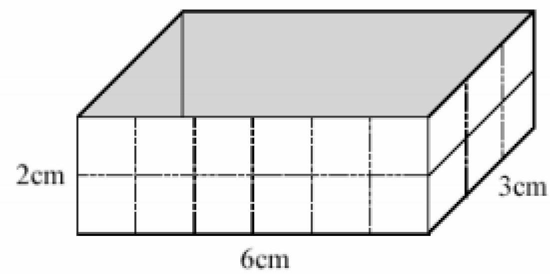
   Show your calculations.

3. Which of the two boxes can hold more cubes? ___________________________

4. Here is another box.

   How many centimeters cubes can this box hold?

   ____



5. Find the measurement of a different box that holds the same number of cubes as this box.

________________ cm long ______________cm wide _______________cm high

CUMULATIVE REVIEW

Standards for In-Depth Opportunities

The Common Core Standards with opportunities for in-depth focus are identified in the PARCC Model Content Frameworks. These standards highlight some individual standards that play an important role in the content at each grade. The indicated mathematics might be given an especially in-depth treatment, as measured, for example, by the type of assessment items; the number of days; the quality of classroom activities to support varied methods, reasoning, and explanation; the amount of student practice; and the rigor of expectations for depth of understanding or mastery of skills.

Description of Unit Materials

The curriculum guide in this section of the unit consists primarily of projects and tasks. Students should work in groups or pairs with teacher facilitation and a strong focus on problem solving skills and logical reasoning. Since these standards have already been formally taught in previous units, the teacher should release responsibility to students and allow for student exploration, growth, and critique of their own work and the work of classmates.

The teacher should collect all student tasks in a portfolio for the items to move on with the student in future mathematics classes.

Opportunity for In-Depth Focus
5.NBT.1
5.NBT.6
5.NF.2
5.NF.4
5.MD.5

NEW CONTENT PROJECTS

Resource Title: The Basketball Court	
CCSS: 5.MD.1,3,5	**Time Frame:** 1-2 class periods
Brief Description of Lesson/Task/Activity: Students apply their understanding of calculating volume of right rectangular prisms to find the volumes and various costs of building a neighborhood basketball court.	
Students who have made the connection between multiplication and finding the volume of rectangular prisms should complete this task in order to apply their understanding in a real world context.	
Needed Resources/Materials • Grid paper • Task sheet 11 • Student access to computers for presentation creation and writing of proposal	
Sources: Various paving companies (triangle area)	
STAGE ONE: ENGAGE	
Have students read the information regarding the task (task sheet 11) independently before facilitating a group discussion about the information provided. Encourage students to ask questions about any aspects of the situation with which they are unfamiliar (homeowner's association, concrete, asphalt, four-square, proposal, scale, proportion, etc.). Allow for adequate discussion time in order to set students up for success with the task. Pose the following questions… **1. In what format might a proposal to the homeowner's association be? Why would you choose this format? What are other acceptable formats? What formats may not be acceptable, and why?** **2. Why is creating a proposal that includes precise calculations an important skill to have?** **3. Notice that concrete and asphalt are sold in yards. Yards are linear, and concrete and asphalt have depth. One yard (as referred to when discussing concrete and asphalt) is a section that is 10 ft. by 10 ft. by 4 in. How might this language confuse people who are purchasing these materials?** **4. Both the four-square court(s) and the basketball court will be the standard 4 inches deep. How will you make the courts safe for players who run out of bounds? (possible responses….pave an area that is larger than the actual court size so players don't step off a 4-in. step to the ground, provide a border of mulch of some material that is level with the court, etc.)** **5. Anna realizes that her court will not be full size (84' x 50') because she wants to add at least one full size (16' x 16') four-square court. If she plans to keep the side lengths proportional to those of a full size high school basketball court, what are some possible dimensions for Anna's court? How do you know they are proportional?** **6. The proposals will be presented to adults on the homeowner's association. What will you include in the proposals to help persuade your adult audience to choose your proposal? What factors will adults consider most? (cost, aesthetics, benefits to community, etc.)**	
STAGE TWO: ELABORATE	

Have students choose their proposal and begin work using the information provided. Teachers may choose to provide graph paper in order to help students organize their thoughts and drawings. Students should work in pairs or independently on the proposal. Clear expectations should be set before beginning regarding accessibility to the teacher for any unanswered questions and quality of finished work.
STAGE THREE: EVALUATE
Proposals must include all of the following information… • **A detailed description of the proposed addition and how it will benefit the neighborhood.** • **A drawing, including measurements, of the proposed addition.** • **A list of equipment needed for the addition to the playground.** • **Total cost for the addition from at least 2 contractors.**
TEACHER NOTES: **Extension Questions…** **Suppose the homeowner's association decided that the court(s) should be 6 inches in depth. How would you determine the number of concrete or asphalt yards needed? Explain your strategy and provide the total number of yards needed.**

The Basketball Court

The neighborhood homeowner's association is planning to use a portion of their savings to make additions to the neighborhood playground. They are accepting proposals from any neighborhood resident. The proposals will be reviewed by the homeowner's association and voted on at the July meeting. Only one proposal will be accepted, as space for additions to the playground is limited. Any additions to the playground must fit in a small rectangular field, 30 yards by 23 yards.

Jalyn, a rising sixth grader, felt that the kids her age had outgrown most of the playground equipment in their neighborhood and wanted a basketball court. Her parents encouraged her to create her own proposal. She rounded up some friends and set to work.

Anna, one of Jalyn's friends, liked the idea of having a basketball court, but wanted an additional space for games like four-square so she gathered some friends and started working on her own proposal. Anna recognizes that with the available space, she will need to scale her proposed basketball court down (make it smaller than regulation size) in order to have room for four-square courts. However, she plans to keep the side lengths proportional to the dimensions of a regulation high school basketball court (See proportional rectangles example below.). Her proposed four-square courts will be to scale (16 ft. by 16 ft.).

The Task…

Your challenge is to create a proposal for the homeowner's association. First, you must choose the proposal you plan to support (Jalyn's or Anna's) and write about. The proposal must include all the specified criteria. The information should be presented in a way that is easy to understand and appealing to the adult members of the homeowner's association. Remember, only one proposal will be chosen!

Proposals must include all of the following information…

- A detailed description of the proposed addition and how it will benefit the neighborhood.
- A drawing, including measurements, of the proposed addition.
- A list of equipment needed for the addition to the playground.
- Total cost for the addition from at least 2 contractors.

The girls found that the dimensions of a high school basketball court are 84 ft. by 50 ft., and a foursquare court is 16 ft. by 16 ft. They also found that concrete and asphalt are priced by the yard. A yard of concrete refers to the amount poured in 10 ft. x 10 ft. x 4 in. (deep). Both girls figure the cost for asphalt and concrete in order to present the voters with more options.

Anna and Jalyn found two local contractors that charged the following…

CONTRACTOR 1	
material	**price per yard**
asphalt	$115
concrete	$125
basketball goal	$79

CONTRACTOR 2	
material	**price per yard**
asphalt	$112
concrete	$119
basketball goal	$85

Proportional Rectangles…

Rectangle A is proportional to rectangle B.

rectangle A…

length = 10 ft. width = 5 ft.

rectangle B…

length = 20 ft. width = 10 ft.

Rectangle A is **NOT** proportional to rectangle C.

rectangle A…

length = 10 ft. width = 5 ft.

rectangle C…

length = 15 ft. width = 10 ft.

Resource Title: Sophie's Surprise

CCSS: 5.OA.3 | **Time Frame:** 1 class period

Brief Description of Lesson/Task/Activity: Students explore linear relationships in the context of helping Sophie determine the best option (back yard celebration or dinner at a restaurant) for her parents' surprise anniversary celebration.

This task provides an opportunity for students to explore linear relationships in a meaningful context. By helping Sophie determine which venue (back yard with caterer and rental chairs and tables or restaurant) is most cost effective, students explore the relationships between the two growing patterns (cost per guest) and the visual representations in which they are required to present them (table and graph). By graphing the two data sets, students can make connections between the data presented in the table and their locations on the graph. Discussions should arise around the concepts of slope and intersection, which are concepts students will need to master in later grades.

Needed Resources/Materials:

- **graph paper and or access to Excel or other graph creating programs**
- **table format (optional)**

STAGE ONE: ENGAGE

Pose the task…
Sophie and her Aunt Jamie want to surprise her parents with a celebration for their 15th wedding anniversary. Aunt Jamie put Sophie in charge of all the planning and offered to pay for the party. Sophie isn't sure if she should have the celebration at her parents' favorite restaurant or in their back yard. She realizes that if the party is in the back yard she will need to rent tables and chairs and have a catering company prepare the food.

Sophie needs your help. Her Aunt Jamie wants to have a nice party for the lowest cost, and Sophie is having a hard time deciding where to have the party so that they spend the least amount of money. Based on the information provided by the caterers, rental company, and restaurant, determine the best location for the celebration. Present your findings in such a way that is easy to understand.

Convenient Caterers	Reliable Rentals	Café 4707
Dinner per guest $11	**Delivery fee $40** **Cost per chair $3** **Tables $30 flat rate** ***(Number of tables delivered based on number of chairs rented)***	**Dinner per guest $19**

Facilitate a discussion regarding any terms about which students need clarification. Ask students what factors they should consider when creating their proposal.

STAGE TWO: ELABORATE

Have students work independently or in pairs to determine the best plan for Sophie. Explain that all proposals

for Sophie should include the following… 1. **A table comparing the costs of having the surprise anniversary celebration at the two locations** 2. **A graph displaying the information in the table (important points should be highlighted and explained)** 3. **A written explanation of which location Sophie and her aunt should choose (Accurate costs should be included in the explanation, and the explanation should match the data presented in both the table and the graph.)**
STAGE THREE: EVALUATE
Students should be able to correctly answer the following questions… 1. **Should the celebration be held at the restaurant or in the back yard? Why?** 2. **How does the number of guests impact your choice of location?** 3. **When should Sophie choose to have the celebration in her back yard? When should she choose the restaurant?** 4. **How does the graph show a clear solution to Sophie's dilemma? How does the table help make clear which location to choose?** 5. **Which representation (graph or table) would you present to Sophie? Why?** 6. **Without extending the table or the graph, how could you determine the total cost of each location for any number of guests?**

Resource Title: **Summer Kickball League**	
CCSS: 5.G.1, 5.G.2, 5.NBT.7, 5.OA.3	**Time Frame:** 3-4 class periods
Brief Description of Lesson/Task/Activity: This activity requires students to design a set of kickball fields to accommodate 153 players in a summer league, determine the number of teams, create a schedule that allows each team to play each other team once, create umpire schedules, determine the number of kickballs needed, choose the company from which tee shirts should be purchased, and then determine if the boys charged an appropriate registration fee based on their findings.	
This set of tasks is appropriate for students who are proficient in identifying points on the coordinate plane (first quadrant) and need an additional challenge in problem solving. This set of tasks presents a situation in a context to which many fifth grade students can relate (kickball) and provides the opportunity for students to solve problems in a meaningful context.	
Needed Resources/Materials • Task sheet • Grid paper • Resources providing information on kickball (optional)	
TEACHER NOTES: The set of tasks may be assigned to a group of students or an individual. The tasks may be modified to stand alone in order to shorten the assignment or to focus on specific concepts. For example, if students need an additional challenge in **5.OA.3** you may choose for them to complete only task 3, number 1. Additional questions may be included to further students' understanding of that particular concept.	
STAGE ONE: ENGAGE	
Facilitate a group discussion about the game of kickball in order to ensure that students have an understanding of the game. Provide information about kickball as needed. Explain to students that they will be helping some students create a summer kickball league. Ask students what types of summer sports they play. What equipment and supplies are necessary? Who pays for the supplies? How are games scheduled fairly? Once students have an understanding of the idea of a league sport, chose the task/tasks (on task sheet) you expect them to complete. A discussion about vocabulary specific to the sport of kickball should ensure that students have an understanding of the task. Grid paper should be provided. Students may choose to use a scale greater than 1 square = 1 foot in order to fit multiple kickball fields on the soccer field, or they may suggest the idea of using the grid paper for one field and applying their understanding of the coordinate plane to determine the locations of the remaining fields' corners and bases (5. Use appropriate tools strategically.)	
STAGE TWO: ELABORATE	
Students work on assigned tasks, asking questions as needed. The teacher monitors progress and asks probing, scaffolding questions as needed. Example: How did you decide to how many player would be on each team? etc.…	

STAGE THREE: EVALUATE
Mathematical accuracy should be assessed on all parts. Answers will vary, as students are allowed options based on their judgment, kickball field design, and proposed game schedule. The expectation is that students are helping to develop an organized league sport should be clear, so calculations should be accurate (6. Attend to precision.) and presented in an organized way.

Summer Kickball League

Ben and his friends wanted to start a summer kickball league. Since they were avid players at recess, they knew the rules well and thought it would be a great way to keep the kids in their neighborhood in contact over the summer and active during their vacation. They got the ball rolling by creating a detailed list of rules, securing the neighborhood soccer fields for 7 consecutive Wednesday nights, determining a registration fee (to purchase team tee shirts and supplies), emailing all their friends, and advertising around the neighborhood.

The response they received was overwhelming. Within a week of sending out the emails, 153 kids responded and were ready to register. The boys' anticipated summer fun quickly turned into a summer job!

Your task is to help Ben and his friends organize the registrants into teams, create a schedule for games using a set of criteria, plan the setup of the soccer fields to accommodate multiple kickball games at one time, determine the best rate for tee shirts and other supplies, and create a schedule and payment plan for the umpires.

Task 1

Design the layout of the kickball fields using a grid (first quadrant) for accurate placement of bases, foul lines, and sidelines. The entire soccer field is 250 ft. by 250 ft. The design must meet all of the requirements below and accommodate the most possible games simultaneously. Create a list of the location of each base marker (home plate will be considered a corner of a field) and field corner. Each point should be represented by the appropriate ordered pair (x, y). Let (0, 0) represent one corner of the entire soccer field.

1. The distance between each base (home plate, first, second, third) is 60 ft. Each base marker measures 1 square foot and should be placed at the intersections in the coordinate plane[1].
2. An imaginary line drawn from first base to second base would be perpendicular to the first base line.
3. The rules state that if a kicked ball goes beyond the outfield, it is considered a dead ball and therefore a strike. The distance from the center of home plate (traveling down the first and third base lines) to the edge of the playing field is 110 ft.

4. Each kickball field must be at least 2 yards from another kickball field and the edges of the soccer field.

[1] Use the coordinate plane provided by your teacher to design the fields. In the case that the coordinate plane does not have the number of squares needed to represent the entire soccer field with 1 square equal to 1 foot, you must determine the scale in which to use (example…1 square = 1 yard). See your teacher if you have other ideas!

Task 2

The rules state that the maximum number of players on the field at any time is 11 while the minimum is 8. Ben and his friends decided there should be 17 players on each team in order to have enough players at each game. The boys reserved the fields from 6:30 to 9:30 each Wednesday evening for the season. Games are 7 innings ***or*** 1 hour in duration. They have 4 umpires (Umpire 1, Umpire 2, Umpire 3, and Umpire 4) who have agreed to work for $9 per hour for the season.

1. Determine the number of teams that can be created.
2. Create a game schedule based on the number of teams. Make sure each team plays every other team at least once. A team may play up to 2 games in one night.
3. Once you have created the game schedule, create a schedule for the umpires, and determine the total cost of umpires for the season (Assume taxes are already included in the $9.). Each game requires 1 umpire.

Task 3

The registration fee allows for each player to get a team tee shirt. The boys got prices from 2 companies. Company 1 charges $8.25 per shirt with no screen print fee, and Company 2 charges a screen print fee (one time fee) of $75 and $5.75 for each tee shirt.

In order to provide consistency among games, the boys will provide the kickball for each game. They will need to purchase enough kickballs to have one per game being played simultaneously, extras for teams warming up, and several additional kickballs for backup during games. The best price they were able to find per kickball is $10.79.

The base markers are pretty inexpensive. The boys found them for $2.35 each.

1. If the boys plan to buy shirts for each registered player, each umpire, and an additional 4 shirts for themselves, from which company should they purchase the tee shirts? Assume that both companies make shirts of equal quality. Explain your choice.
2. Based on the game schedule, determine the number of kickballs that the boys should purchase. Determine the total cost of the balls. Support your recommendation with facts from the schedule and the information given regarding kickball needs.
3. Based on the number of games being played simultaneously, determine the number of base markers needed and the total cost (tax is included in the price given).

Task 4

The boys charged a registration fee of $10. Each player paid the entire fee.

1. Based on the resources you recommend the boys purchase and the umpires' salaries, was the $10 registration fee enough to cover the costs?
2. Support your thinking by creating a document that presents all recommended purchases and expenses.

Opportunity for In-Depth Focus
5.NBT.1
5.NBT.6
5.NF.2
5.NF.4
5.MD.5

Resource Title: Grayville: Exploring an Alternative Number System	
5.NBT.1	**Time Frame:** Mini Project/2-3 days
Brief Description of Lesson/Task/Activity: Students will develop a deeper understanding and possibly a greater appreciation for the Hindu-Arabic (base ten) number system through exploration of a base five number system. Students will write numbers, compute within the number system, and compare the number system of Grayville to our base-ten number system.	
This task is appropriate for students who have an understanding of the standard 5.NBT.1 (Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.). This task allows students to explore an alternative number system and, in the process, develop a deeper understanding of the base-ten number system they are required to operate within. In order to assess students' understanding of 5.NBT.1 students should have an opportunity to explain, in writing, how the place value positions relate to one another.	
Needed Resources/Materials • Grayville Task Sheet • Base Five place value manipulatives (optional, based on student need)	
STAGE ONE: ENGAGE	
Prior to introducing the task, have students describe the properties of our number system. Possible points that should be discussed in order to confirm understanding… 10 digits (0-9), 9 is the largest digit that may be used in any place value position, the ones, tens, hundreds pattern repeats for the thousands, millions, billions…, as you move to the left the place values increase exponentially (x10), so as you move to the right, place values decrease exponentially (÷10) Ask students for examples of other real number systems that have been used throughout the world (Roman Numerals, Egyptian number system, etc.). Videos and other resources regarding number systems can be easily found on the internet. Explain that the number system we use is the Hindu-Arabic	

number system. Ask the students to list the symbols used to represent quantities in our number system (digits, 0-9). Introduce the students to the fictitious community of Grayville, where community members use the Grayville number system consisting of the symbols/digits 0, g, r, a, and y. Have the students write the symbols for the quantities 0-4 in the Grayville number system (0, g, r, a, y). Pose the question, "How would the citizens of Grayville represent 5 objects?" Have students work independently or in pairs to find a way to represent the quantity 5 (g0). Have students share their thoughts before posing the question, "Why does representing the quantity five require the addition of another place value?" Then ask, "When will a third place value position be needed in the Grayville number system?" Have students complete the first task, writing the numbers 1-25 in the Grayville number system. Discuss the following questions…
What patterns do you notice?

How would the quantity 30 be represented in the Grayville system? (gg0)
At what point in the Hindu-Arabic number system is a new place value position needed? (10) At what point does this occur in the Grayville number system? (5) (When do we add a new digit in each system?)
At what point do you think we will add a fourth place value in the Grayville number system? Why? (125)

STAGE TWO: ELABORATE

Have students complete the second task on the task sheet (determining the values of each place). Once students can correctly identify the place values, have them complete the remaining task and possibly the extension task. This will allow them the opportunity to develop a deeper understanding of the Grayville number system and form an opinion of the level of usability of the unfamiliar number system.

STAGE THREE: EVALUATE

The final task allows students to choose their product in order to share their understanding and opinion of the Grayville number system (see task sheet).

A problem-solving rubric or a mathematics notebook entry rubric should work for evaluating student understanding. Students should be able to discuss the workings of both systems (when a new place value is needed) and share their opinion regarding the ease of use of each system.

TEACHER NOTES: NA

Resource Title: **Collapse Zone**	
CCSS: 5.NF.4	**Time Frame:** 45 minutes-1 hour
Brief Description of Lesson/Task/Activity: Students construct various buildings using centimeter cubes or inch cubes. Students cause the build to collapse in order to determine the appropriate collapse zone firefighters should mark off for any building in danger of collapse during a fire.	
Students will use their understanding of multiplication of fractions and whole numbers, finding regularity in repeated reasoning and experimenting in order to determine a standard collapse zone for firefighters to use when fighting fire on any building. Using the collapse zone they determined to be safe, students will find the area of collapse zones of various buildings given the length and width of the base and the height of the building. They will compare the areas they deemed safe to the areas of the standard collapse zone (1 ½ x height of the building).	
Needed Resources/Materials: • inch or centimeter cubes • grid paper • measuring tools (flexible meter sticks recommended)	
STAGE ONE: ENGAGE	
Pose the task… Today you will be firefighters. Your job is to determine a standard collapse zone for all members of your fire department to use when fighting fire on a building in danger of collapse. A collapse zone is the area around the base of a building that should not be occupied by any firefighting personnel, equipment, or civilians. There are many factors to consider when determining the size of the area that is unsafe around the base of the building. The collapse zones you create will be rectangular and will extend the same distance from the base of the building on all four sides. You will begin the task by creating buildings (right rectangular prisms) of varying sizes, using centimeter or inch cubes, and causing them to collapse (The group should come to an agreement on how to cause the buildings to collapse, and this method should be used by all groups throughout the activity.). You will collect data (Grid paper, string for measuring distance, or meter sticks may be used.) on the location (distance from the base of the building) of the debris farthest from the building. Once you feel that you have adequate data, you will determine a standard way to find the collapse zone of any building. Using grid paper provided by your teacher[1], draw the collapse zone of a building with base dimensions 40 ft. by 22 ft. and a height of 45 ft. based on the collapse zone you chose for your fire department. Once the task has been posed, facilitate a discussion about the task, making sure all students understand their goal. A video of a building collapsing may be shared in order to distinguish between collapsing and exploding or falling over. Come to an agreement on a method for causing their model buildings to collapse in the classroom. One method for causing buildings to collapse is to pull a cube from the bottom of the building. The following discussion questions may be asked throughout the class period to focus and deepen	

students' thinking about the task at hand.

Discussion questions…

1. What should be considered when determining the area that is unsafe for use?
2. What are some consequences of making the collapse zone too small?
3. If the base of the building and the collapse zone are both rectangular what points of the collapse zone will be equidistant from the building? What points will be farthest from the base of the building? Explain your thinking.
4. Your fire department has tasked you and your team with determining a standard collapse zone to use on all fire scenes. This standard collapse zone will be recorded as a standard operating procedure, so precision is important for the safety of all personnel. How will you determine a standard collapse zone with the tools provided (cubes, measuring tools, grid paper)?
5. How does your collapse zone compare to the collapse zones of other groups in the class? Why aren't they identical?

Large grid paper should be created by taping or gluing pieces of grid paper together. Chart grid paper may be used if available.

STAGE TWO: ELABORATE

Once students have had ample time to experiment, identify the collapse zone they deem appropriate for their fire department, and represent the building and collapse zone in part 2 on the grid paper, pose the following…

The standard collapse zone for firefighters is 1 ½ times the height of the building. Firefighters must determine the height of the building (exact height from a preplan or estimate based on their judgment if no building plans are available), multiply the height by 1 ½ and measure that distance away from all sides of the building. Usually they create a circular collapse zone, but we will continue to use a rectangular collapse zone.

For the building and collapse zone you have represented on your grid paper, construct the actual collapse zone using the formula given (1 ½ x height of building). Represent the actual collapse zone in a way that is easily distinguished from your fire department's collapse zone. Compare the areas of your collapse zone and the actual standard collapse zone.

Evaluate the students' work based on their numerical findings and on the logic of their reasoning when answering the questions provided.

STAGE THREE: EVALUATE

Possible follow-up questions…

1. Suppose the state of New Jersey decided that all fire departments in the state should increase the collapse zone to 2 ¼ times the height of the building. What events might cause the state to make the change? How would the new collapse zone area compare to the original collapse zone (1 ½ times the height)?
2. How might fire-fighting organizations determine when a collapse zone is needed?
3. Why do you think it's important to have a standard collapse zone?

4. How might the process of finding the actual standard collapse zone compare to the process you used in finding your fire department's collapse zone?

Potential Student Misconceptions

Measurement & Data

Students use their knowledge of renaming whole numbers when solving problems that require renaming units.
The same procedures used in renaming whole numbers should not be taught when solving problems involving measurement conversions. For example, when subtracting 5 inches from 2 feet, students may take one foot from the 2 feet and use it as 10 inches. Since there were no inches with the 2 feet, they put 1 with 0 inches and make it 10 inches. Students need to pay attention to the unit of measurement that dictates the renaming and the number to use. 1 foot = 12 inches, not 10.

Geometry

Students may think the order in plotting a coordinate point is not important when playing games with coordinates or looking at maps.
Have students create directions for others to follow so that they become aware of the importance of directions and distance. Have students plot points so that the position of the coordinate is switched.

Extensions and Sources

Online Resources

Common Core Tools
http://commoncoretools.me/
http://www.ccsstoolbox.com/
http://www.achievethecore.org/steal-these-tools

Manipulatives

http://nlvm.usu.edu/en/nav/vlibrary.html
http://www.explorelearning.com/index.cfm?method=cResource.dspBrowseCorrelations&v=s&id=USA-000
http://www.thinkingblocks.com/

Problem Solving Resources

Illustrative Math Project*
http://illustrativemathematics.org/standards/k8
http://illustrativemathematics.org/standards/hs
The site contains sets of tasks that illustrate the expectations of various CCSS in grades K–8 grade and high school. More tasks will be appearing over the coming weeks. Eventually the sets of tasks will include elaborated teaching tasks with detailed information about using them for instructional purposes, rubrics, and student work.

***Inside Mathematics**
http://www.insidemathematics.org/index.php/tools-for-teachers
Inside Mathematics showcases multiple ways for educators to begin to transform their teaching practices. On this site, educators can find materials and tasks developed by grade level and content area.

IXL
http://www.ixl.com/

Sample Balance Math Tasks
http://www.nottingham.ac.uk/~ttzedweb/MARS/tasks/

New York City Department of Education
http://schools.nyc.gov/Academics/CommonCoreLibrary/SeeStudentWork/default.htm
NYC educators and national experts developed Common Core-aligned tasks embedded in units of study to support schools in implementation of the CCSSM.

***Georgia Department of Education**
https://www.georgiastandards.org/Common-Core/Pages/Math-K-5.aspx

Georgia State Educator have created common core aligned units of study to support schools as they implement the Common Core State Standards.

Gates Foundations Tasks

http://www.gatesfoundation.org/college-ready-education/Documents/supporting-instruction-cards-math.pdf

Minnesota STEM Teachers' Center
http://www.scimathmn.org/stemtc/frameworks/721-proportional-relationships

Singapore Math Tests K-12
http://www.misskoh.com

Math Score:
Math practices and assessments online developed by MIT graduates.
http://www.mathscore.com/

Massachusetts Comprehensive Assessment System
www.doe.mass.edu/mcas/search

Performance Assessment Links in Math (PALM)

PALM is currently being developed as an on-line, standards-based, resource bank of mathematics performance assessment tasks indexed via the National Council of Teachers of Mathematics (NCTM).
http://palm.sri.com/

Mathematics Vision Project
http://www.mathematicsvisionproject.org/

***NCTM**
http://illuminations.nctm.org/

Assessment Resources

- *Illustrative Math: http://illustrativemathematics.org/
- *PARCC: http://www.parcconline.org/samples/item-task-prototypes
- NJDOE: http://www.state.nj.us/education/modelcurriculum/math/ (username: model; password: curriculum)
- DANA: http://www.ccsstoolbox.com/parcc/PARCCPrototype_main.html
- New York: http://www.p12.nysed.gov/assessment/common-core-sample-questions/
- *Delaware: http://www.doe.k12.de.us/assessment/CCSS-comparison-docs.shtml

PARCC Prototyping Project		
Elementary Tasks (ctrl+click)	Middle Level Tasks (ctrl+click)	High School Tasks (ctrl+click)
• **Flower gardens (grade 3)** • **Fractions on the number line (grade 3)** • **Mariana's fractions (grade 3)** • **School mural (grade 3)** • **Buses, vans, and cars (grade 4)** • **Deer in the park (grade 4)** • **Numbers of stadium seats (grade 4)** • **Ordering juice drinks (grade 4)**	• **Cake weighing (grade 6)** • **Gasoline consumption (grade 6)** • **Inches and centimeters (grade 6)** • **Anne's family trip (grade 7)** • **School supplies (grade 7)** • **Spicy veggies (grade 7)** • **TV sales (grade 7)**	• **Cellular growth** • **Golf balls in water** • **Isabella's credit card** • **Rabbit populations** • **Transforming graphs of quadratic functions**

Professional Development Resources

Edmodo

http://www.edmodo.com

Course: iibn34

Clark County School District Wiki Teacher

http://www.wiki-teacher.com/wikiDevelopment/unwrappedSearch.php#contentAreaId=6&courseId=474

Learner Express Modules for Teaching and Learning

http://www.learner.org/series/modules/express/videos/video_clips.html?type=1&subject=math

Additional Videos
http://www.achieve.org/achieving-common-core;
http://www.youtube.com/user/TheHuntInstitute/videos

Mathematical Practices

Inside Mathematics

http://www.insidemathematics.org/index.php/commmon-core-math-intro

Also see the ***Tools for Educators***

The Teaching Channel

https://www.teachingchannel.org

***Learnzillion**

https://www.learnzillion.com

Engage NY

http://www.engageny.org/video-library?f[0]=im_field_subject%3A19

**Adaptations of the these resources has been included in various lessons.*