



South Carolina  
Department of Education

**Good Morning! Please sign-in and get 1 of each handout off the table by the door.**

*Digging Deep into the Major  
Work of 7<sup>th</sup> Grade Math*

Janel Johnson

April 1, 2014



# Logistics



## Questions

- Raise your hand and ask questions during the session.
- Parking Lot – questions not directly related to the session



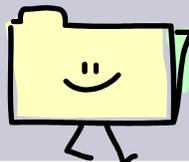
## Breaks

- Morning Break and Afternoon Break
- Lunch (30 min)



## Technology

- Feel free to take notes on your computer or tablet
- Cell phones on silent



## Session Materials

- Located in center of table
- Will be posted on SCDE website and Edmodo Group

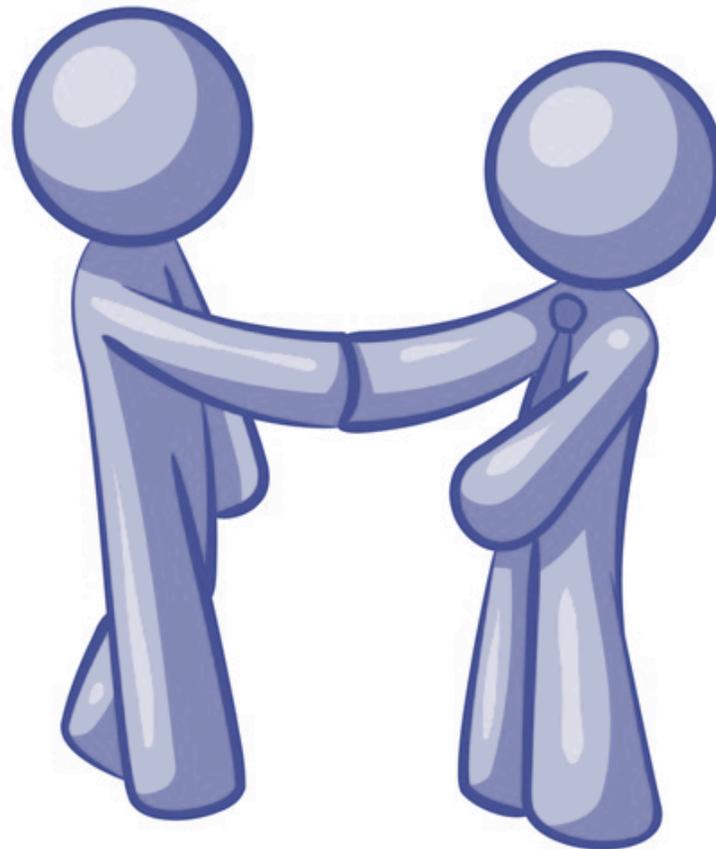


# Introductions

Good Morning!  
My name is...

My favorite math  
concept is...

I teach (grade  
level) at (school)  
in (district).



Today I hope to...



# Norms

- Listen as an Ally
- Value Differences
- Maintain Professionalism
- Actively Participate



# Agenda

- **Overview of CCSS for Math**
- **Critical Areas**
  - Ratios and Proportional Relationships
  - The Number System
  - Expression and Equations
  - Geometry
  - Statistics and Probability

## **Critical Areas**

- Learning Expectations
- Prior Knowledge
- Connections to Future Learning
- Task/Activity



# Agenda (continued)

- Student Misconceptions and Teaching Strategies
- Reflection
- Closing



# Objectives

- **IDENTIFY** the critical areas
- **DESCRIBE** the connections concepts have to prior and future courses
- **PRACTICE** tasks and activities aligned to each domain
- **ANALYZE** standards to determine student misconceptions and generate teaching strategies to address them



# Mathematical Shifts

## *Focus*

Focus strongly where the standards focus

## *Coherence*

Think across grades, and link to major topics

## *Rigor*

In major topics, pursue conceptual understanding, procedural skill and fluency, and application



# Types of Standards

## Standards for Mathematical Content

- Skills and understandings students will learn
- Identified by grade level or course

## Standards for Mathematical Practice

- Processes and proficiencies that students show when engaged in mathematics
- Identified for students across all grade levels (K–12)



# What? vs. How?

While the Content Standards describe what mathematics students should be able to **understand** and **do**, the Mathematical Practices describe **how** students should **engage** with these mathematical concepts and skills.



# Structure of the Standards

Standards

Domain

**Ratios and Proportional Relationships** 7.RP

**Analyze proportional relationships and use them to solve real-world and mathematical problems.**

1. Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks  $1/2$  mile in each  $1/4$  hour, compute the unit rate as the complex fraction  $^{1/2}/_{1/4}$  miles per hour, equivalently 2 miles per hour.*
2. Recognize and represent proportional relationships between quantities.
  - a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
  - b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

Cluster



# Critical Areas

COMMON CORE STATE STANDARDS for MATHEMATICS

## Mathematics | Grade 7

In Grade 7, instructional time should focus on four critical areas: (1) developing understanding of and applying proportional relationships; (2) developing understanding of operations with rational numbers and working with expressions and linear equations; (3) solving problems involving scale drawings and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume; and (4) drawing inferences about populations based on samples.

(1) Students extend their understanding of ratios and develop understanding of proportionality to solve single- and multi-step problems.

A yellow callout box with a pointer pointing towards the text on the left. The text inside the box is "Critical Areas" in white, bold, sans-serif font.

**Critical  
Areas**



# Critical Areas

**In Grade 7, instructional time should focus on four critical areas:**

- (1) developing understanding of and applying proportional relationships.
- (2) developing understanding of operations with rational numbers and working with expressions and linear equations;
- (3) solving problems involving scale drawings and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume; and
- (4) drawing inferences about populations based on samples



# Grades 6-8 Domains

6 <sup>th</sup> Grade	7 <sup>th</sup> Grade	8 <sup>th</sup> Grade
Ratios and Proportional Relationships		Functions
Expressions and Equations		
The Number System		
Statistics and Probability		
Geometry		



# Ratios and Proportional Relationships

<b>Critical Area</b>	<b>Standards</b>	<b>Concepts</b> (What do students need to know?)	<b>Skills and Procedures</b> (What do students need to know and be able to do?)
Developing understanding of and applying proportional relationships.	7.RP.1 7.RP.2 7.RP.3	<b>Ratio</b> <ul style="list-style-type: none"><li>• Part to part</li><li>• Part to whole</li></ul> <b>Unit Rate</b> <b>Proportion</b> <b>Percent</b> <ul style="list-style-type: none"><li>• Simple Interest</li><li>• Tax/Discount</li><li>• Markups/Markdowns</li><li>• Gratuity</li><li>• Commission</li><li>• Percent error</li></ul>	<ul style="list-style-type: none"><li>• Compute unit rates involving ratios with fractions.</li><li>• Determine proportionality using tables, graphs, equations, diagrams or verbal descriptions.</li><li>• Represent proportional relationships using equations.</li><li>• Describe how an ordered pair shows a proportional relationship in terms of a given situation.</li><li>• Solve multistep ratio and percent problems using proportional relationships.</li></ul>



# Ratios and Proportional Relationships

## What do students need to learn prior to these concepts?

- Understand the concept of a unit rate
- Solve unit rate problems
- Simplify a complex fraction
- Make tables and plot points generated from equivalent ratios
- Find a percent of a quantity as a rate per 100
- Solve problems involving finding the whole given a part and the percent
- Work fluently among fractions, decimals, and percent

## How do these concepts support learning in later grades?

- 8<sup>th</sup>: Linear equations and functions



# Tic-Tac-Toe Activity

1. With a partner, determine who will go first based on whose birthday comes first.
2. The first person selects a problem and both people solve the problem.
  - If the person who selected the problem is correct, they place their X or O in that square.
  - If the other player gets the problem correct and they place their X or O in that square.
  - If neither gets the problem correct, the problem is still available for either to select again.
3. The first person with a straight row wins.



# The Number System

<b>Critical Area</b>	<b>Standards</b>	<b>Concepts</b> (What do students need to know?)	<b>Skills and Procedures</b> (What do students need to know and be able to do?)
Developing understanding of operations with rational numbers and working with expressions and linear equations	7.NS.1 7.NS.2 7.NS.3	<b>Rational Number</b> <b>Integers</b> <ul style="list-style-type: none"><li>• Positive</li><li>• Negative</li><li>• Zero pair</li></ul> <b>Absolute Value</b> <b>Additive Inverse</b> <b>Decimal</b>	<ul style="list-style-type: none"><li>• Add, subtract, divide, and multiply rational numbers and apply to real-world contexts.</li><li>• Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number.</li><li>• Understand that a number and its opposite have a sum of zero (additive inverse).</li><li>• Understand subtraction of rational numbers as adding the additive inverse.</li><li>• Convert a rational number to a decimal using long division.</li><li>• Represent addition and subtraction on a horizontal or vertical number line diagram.</li></ul>



# The Number System

## What do students need to learn prior to these concepts?

- Fluency with addition and subtraction of positive fractions and decimals
- Fluency with multiplication and division of positive fractions and decimals
- Set up a number sentence to model a real-life situation
- Order of operations
- Compute fluently the four operations using rational numbers

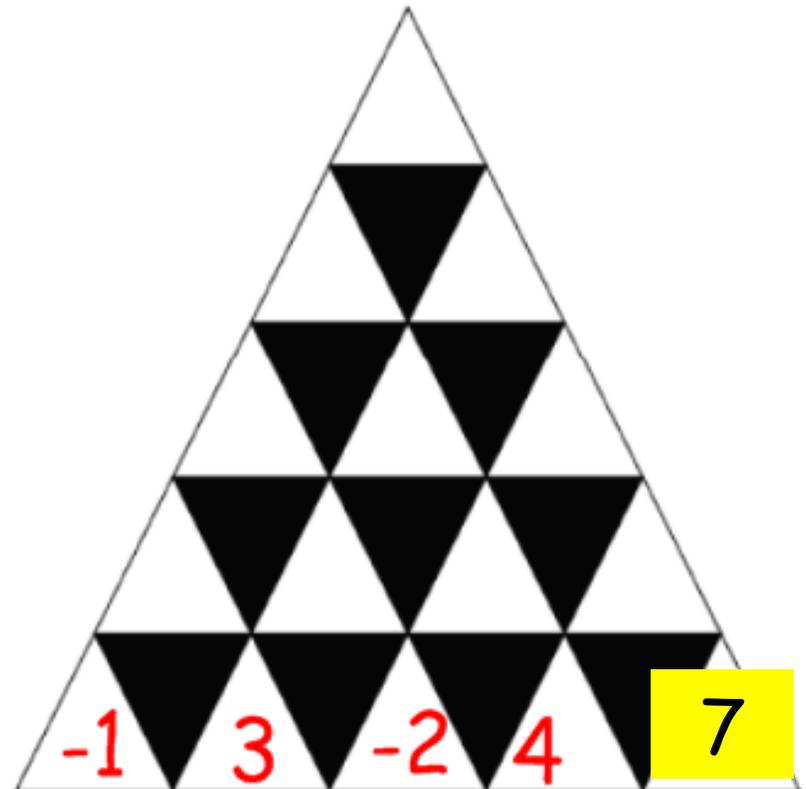
## How do these concepts support learning in later grades?

- 8<sup>th</sup>: Irrational numbers and square roots



# Beat Me to the Top Activity

1. Place the answers in the triangles in the row ABOVE the bottom row by **adding** the two numbers adjacent (beside each other) below the triangle.
2. Continue this process up the triangle until you get the FINAL answer at the TOP of the triangle.





# Scavenger Hunt



1. At your first letter, read the problem.
2. Write the numerical problem on your sheet.
3. Solve the problem and write the answer on your sheet.
4. Look for the answer on the sheets around the classroom.
5. Move to that letter and repeat the process.



# Vocabulary Posters

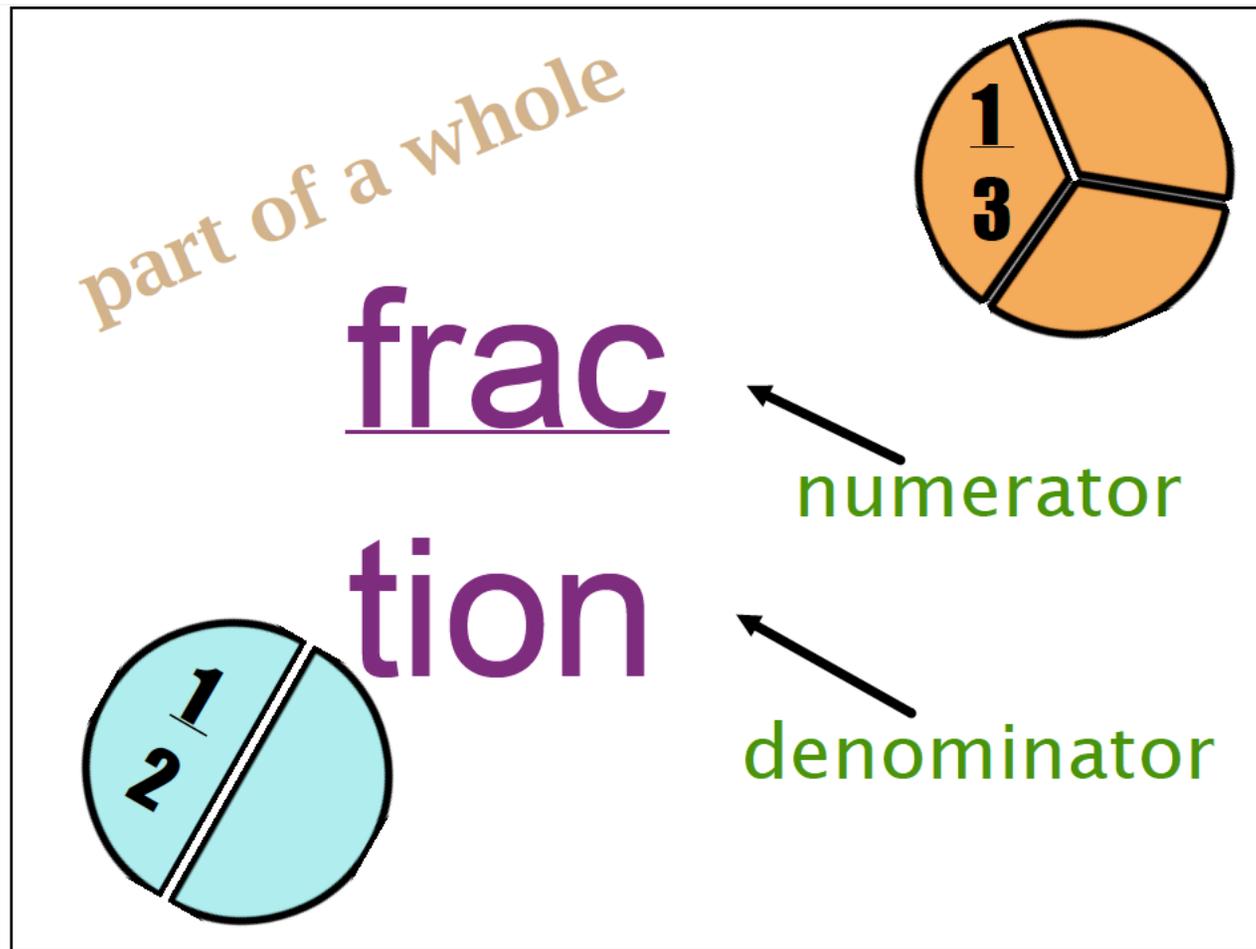
Potential Discussion Points for Helping Students Think About the Role of Zero in Real-World Contexts

SITUATION	NEGATIVE	ZERO	POSITIVE
Game/Sports: Golf/ Football	Below par / loss of yards	Par/line of scrimmage	Above par / gain of yards
Business	Loss (In the red)	Holding own	Profit (In the black)
Bank Accounts: Checkbooks	Charge- credit card Loans- interest paid / negative balance	Zero balance	Savings / Interest earned / Positive balance
Time and Time Zones	Past / Yesterday	Present / Midnight	Future / Tomorrow
Daylight Savings	Fall behind	Standard time	Spring ahead
Geologic or Historic Time	Before Common Era (B.C.)	Theoretical, but nonexistent year "0"	Common Era (C.E.)
Gauges/Dipsticks for Oil	Oil is low	Correct amount	Over filled
Tires	Flat	Correct pressure	Over inflated
Blood Pressure	Low blood pressure	Correct Pressure	High blood pressure
Eyes-Vision	-3.75	20/20	+3.75
Temperature-Vertical Time Line	Below Zero	Zero	Above zero
Elevation-Altitude	Below sea level	Sea level	Above sea level
Buildings	Basement / Lower levels	Ground floor	Attic / Upper floor

- Vocabulary word
- Definition
- Synonyms
- Picture
- Example



# Vocabulary Posters Example





# BREAK

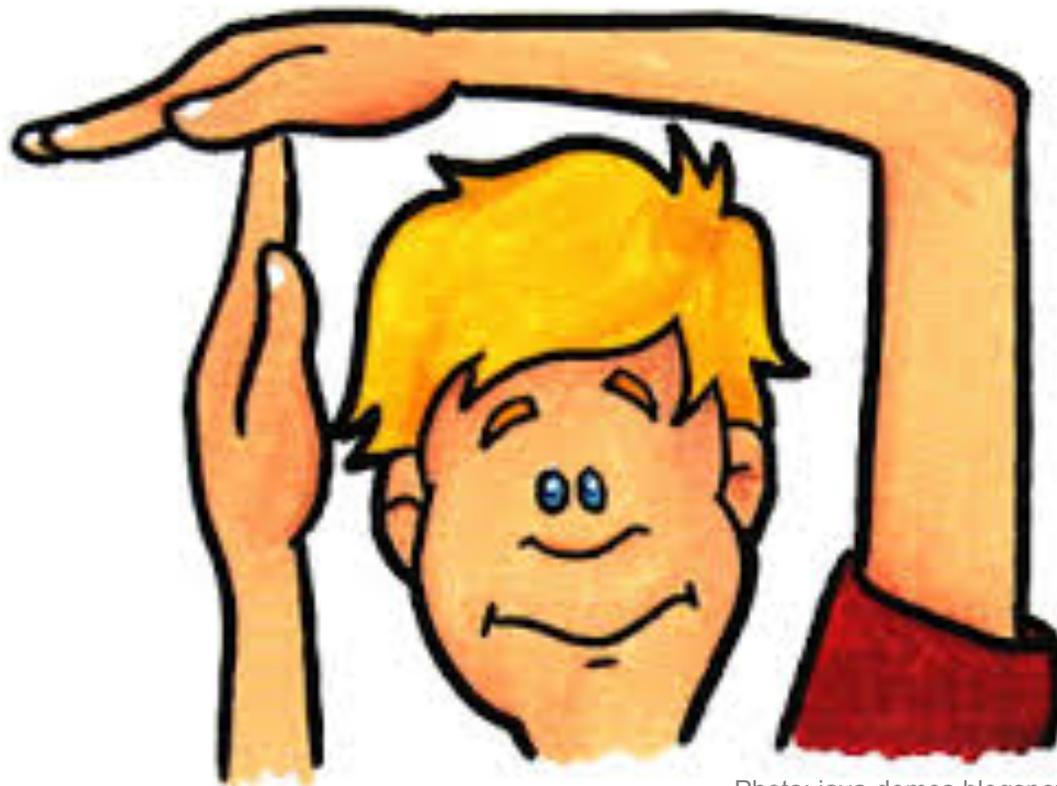


Photo: [java-demos.blogspot.com](http://java-demos.blogspot.com)



# Expressions and Equations

<b>Critical Area</b>	<b>Standards</b>	<b>Concepts</b> (What do students need to know?)	<b>Skills and Procedures</b> (What do students need to know and be able to do?)
Developing understanding of operations with rational numbers and working with expressions and linear equations	7.EE.1 7.EE.2	<b>Equation</b> <ul style="list-style-type: none"><li>• Variable</li><li>• Coefficient</li><li>• Term</li><li>• Operational vocabulary</li></ul> <b>Distributive Property</b> <b>Factor</b> <b>Equivalent</b> <b>Simplify</b> <b>Evaluate</b>	<ul style="list-style-type: none"><li>• Apply the distributive property to generate equivalent expressions.</li><li>• Create and solve multi-step linear equations based on real-life situations.</li><li>• Create algebraic expressions from word expressions.</li><li>• Create algebraic expressions from context.</li><li>• Simplify algebraic expressions.</li><li>• Recognize equivalent expressions.</li></ul>



# Expressions and Equations

<b>Critical Area</b>	<b>Standards</b>	<b>Concepts</b> (What do students need to know?)	<b>Skills and Procedures</b> (What do students need to know and be able to do?)
Developing understanding of operations with rational numbers and working with expressions and linear equations	7.EE.3 7.EE.4	<b>Equation</b> <ul style="list-style-type: none"><li>• Variable</li><li>• Coefficient</li><li>• Term</li><li>• Operational vocabulary</li></ul> <b>Inequality</b> <ul style="list-style-type: none"><li>• Solution</li><li>• Operational vocabulary</li></ul>	<ul style="list-style-type: none"><li>• Create and solve multi-step linear equations and inequalities based on real-life situations.</li><li>• Represent solutions of inequalities on number line diagrams.</li></ul>



# Expressions and Equations

## What do students need to learn prior to these concepts?

- Commutative Property, Associative Property, Distributive Property
- Order of Operations
- Generate equivalent expressions (e.g. simplify) involving whole numbers
- Solve one-step linear equations involving non-negative rational numbers
- Convert between fractions, decimals, and percent
- Represent solutions of inequalities such as  $x < c$  or  $x > c$  on a number line.
- Solve 1-step equations and inequalities

## How do these concepts support learning in later grades?

- 8<sup>th</sup>: Functions, linear equations, systems of equations, and functions



# Steps to Solving an Equation

1. Spend 10 minutes writing an equation for each of the stories.
2. In each case, let  $x$  represent the number you are trying to find.



# Steps to Solving an Equation

3. Match each story with an equation.
4. Check to see whether any of the equations you have written down match the equations on the cards.



# Steps to Solving an Equation

5. Put the cards **E5 and E6** and the story cards you've matched with them to one side.
6. Match the steps to solving these four equations. Repeat this until you finally reach a solution.
  - If you find there is more than one method for solving an equation, stick the two solutions side-by side.



# Steps to Solving an Equation

The image shows four examples of solving linear equations, each with handwritten steps and annotations:

- Example 1:**  $6(x-2) = 54$   
clear parentheses →  $6x - 12 = 54$   
add 12 to both sides →  $6x = 66$   
divide both sides by 6 →  $x = 11$   
Annotations: "divide both sides by 6", "add 2 to both sides", "Chew = 11¢", "x = price of chew", "x - 3 = price of lollipop", "2x + 4(x - 3) = 54", "2x + 4x - 12 = 54", "6x - 12 = 54", "6(x - 2) = 54".
- Example 2:**  $2x + 6 = 54$   
Subtract 6 from both sides →  $2x = 48$   
Divide both sides by 2 →  $x = 24$   
Annotations: "Paper 2 score = 24", "Paper 1 score = x + 6", "x + x + 6 = 54".
- Example 3:**  $2(x + 6) = 54$   
OR  
÷ both sides by 2 →  $x + 6 = 27$   
Subtract 6 from both sides →  $x = 21$   
Annotations: "clear parentheses", "2x + 12 = 54", "Subtract 12 from both sides", "2x = 42", "Divide both sides by 2", "x = 21", "The number was 21", "Call the number x", "2x + 12 = 54 Factorising gives 2(x + 6) = 54".
- Example 4:**  $6x - 54 = 6$   
Add 54 to both sides →  $6x = 60$   
Divide both sides by 6 →  $x = 10$   
Annotations: "She pays for 10 weeks", "Starts with \$54", "x = No. of weeks", "After x weeks she pays back 6x dollars", "She has 6x - 54 dollars".



# Inequality Scramble

1. Find an inequality and color in the rectangle.
2. Then, find the rectangle with the first step to solve the inequality and color it in.
3. Then, find the rectangle with the second step to solve the inequality and color it in.
4. Finish solving the inequality and find the answer and color it in.
5. When you are done, graph each answer.



# Lunch – 30 minutes



Photo: 123rf.com



# Geometry

<b>Critical Area</b>	<b>Standards</b>	<b>Concepts</b> (What do students need to know?)	<b>Skills and Procedures</b> (What do students need to know and be able to do?)
Solving problems involving scale drawings and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume	7.G.1 7.G.2 7.G.3	<b>Scale</b> <b>Scale Factor</b> <ul style="list-style-type: none"><li>• Geometric conditions</li><li>• Points</li><li>• Line Segments</li><li>• Angles</li><li>• Parallel</li><li>• Congruence</li><li>• Perpendicular</li></ul> <b>2D Figures</b> <b>3D Figures</b>	<ul style="list-style-type: none"><li>• Find actual lengths and areas from a scale drawing, using a scale factor.</li><li>• Create multiple scale drawings from the original model or drawing, using different scales.</li><li>• Draw and interpret precise geometric figures based on given conditions.</li><li>• Describe the different ways to slice a 3D figure</li><li>• Describe the different 2D cross-sections that will result depending on how you slice a 3D figure.</li></ul>



# Geometry

<b>Critical Area</b>	<b>Standards</b>	<b>Concepts</b> (What do students need to know?)	<b>Skills and Procedures</b> (What do students need to know and be able to do?)
Solving problems involving scale drawings and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume	7.G.4	<b>Formulas</b> <ul style="list-style-type: none"><li>• Area of circle</li><li>• Circumference of circle</li></ul> <b>Relationship between circumference and area of a circle</b> <b>Area</b> <ul style="list-style-type: none"><li>• Triangles</li><li>• Quadrilaterals</li><li>• Polygons</li></ul>	<ul style="list-style-type: none"><li>• Use the formulas for area and circumference of a circle to solve problems.</li><li>• Know the relationship between diameter, circumference, and pi.</li><li>• Show and explain how the circumference and area of a circle are related.</li></ul>



# Geometry

<b>Critical Area</b>	<b>Standards</b>	<b>Concepts</b> (What do students need to know?)	<b>Skills and Procedures</b> (What do students need to know and be able to do?)
Solving problems involving scale drawings and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume	7.G.5 7.G.6	<b>Angle relationships</b> <ul style="list-style-type: none"><li>• Supplementary</li><li>• Complementary</li><li>• Vertical</li><li>• Adjacent</li></ul> <b>Volume</b> <ul style="list-style-type: none"><li>• Cubes</li><li>• Right prisms</li></ul> <b>Surface Area</b> <ul style="list-style-type: none"><li>• Cubes</li><li>• Right prisms</li></ul>	<ul style="list-style-type: none"><li>• Use properties of supplementary, complementary, vertical and adjacent angles to solve for unknown angles in a figure.</li><li>• Find the areas of triangles, quadrilaterals, polygons, and composite figures, including those found in real-world contexts.</li><li>• Find the surface area and volumes of cubes, right prisms, and right pyramids including those found in real-world contexts.</li></ul>



# Geometry

## What do students need to learn prior to these concepts?

- Find areas of geometric figures.
- Drawing precise angles using a protractor and ruler
- Identify polygons
- Parts of a circle (radius, diameter, center)
- Solve multi-step equations
- Find area of rectangles, special quadrilaterals, and triangles
- Find the volume of rectangular prisms
- Find surface area using nets

## How do these concepts support learning in later grades?

- 8<sup>th</sup>: Pythagorean theorem and transformations



# Scale Map Activity

1. Measure the scale on the map of South Carolina. Round to the nearest inch and record that information.
2. Determine the distance from the starting location to the ending location in miles.



# BREAK

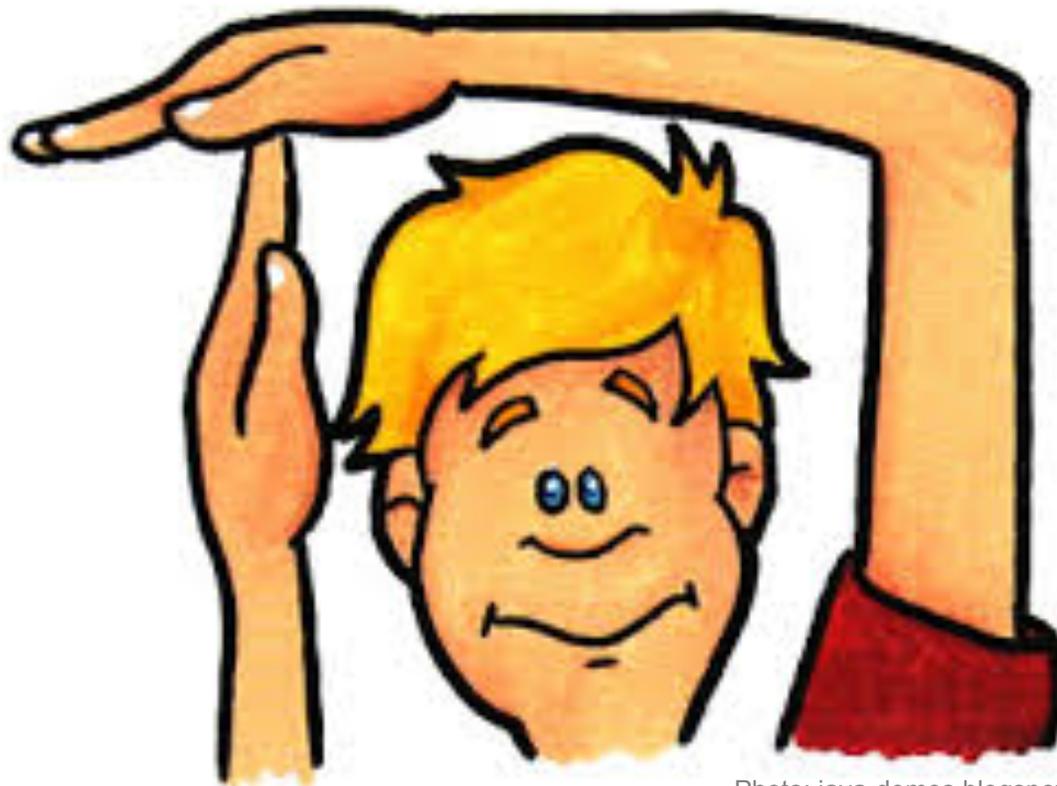


Photo: [java-demos.blogspot.com](http://java-demos.blogspot.com)



# Statistics and Probability

<b>Critical Area</b>	<b>Standards</b>	<b>Concepts</b> (What do students need to know?)	<b>Skills and Procedures</b> (What do students need to know and be able to do?)
Drawing inferences about populations based on samples	7.SP.1 7.SP.2	<b>Statistics</b> <b>Population</b> <ul style="list-style-type: none"><li>• Representative Sample</li><li>• Representative/Valid</li><li>• Random</li></ul> <b>Inferences</b> <ul style="list-style-type: none"><li>• Informal Comparative</li></ul>	<ul style="list-style-type: none"><li>• Understand that representative samples can be used to make valid inferences about a population.</li><li>• Understand that a random sample increases the likelihood of obtaining a representative sample of a population.</li><li>• Make inferences about a population based on a sample.</li><li>• Explore the variation in estimates or predictions based on multiple samples of the same data.</li></ul>



# Statistics and Probability

<b>Critical Area</b>	<b>Standards</b>	<b>Concepts</b> (What do students need to know?)	<b>Skills and Procedures</b> (What do students need to know and be able to do?)
Drawing inferences about populations based on samples	7.SP.3 7.SP.4	<b>Data</b> <b>Variation</b> <b>Data Distribution</b> <ul style="list-style-type: none"><li>• Variability</li><li>• Center</li><li>• Mean Absolute Deviation</li></ul> <b>Measures Of Center</b> <b>Measures Of Variability</b>	<ul style="list-style-type: none"><li>• The measure of mean is independent of the measure of variability.</li><li>• Use visual representations to compare and contrast numerical data from two populations using measures of variability and center.</li><li>• Make comparative inferences about two populations using measures of center and variability.</li></ul>



# Statistics and Probability

## What do students need to learn prior to these concepts?

- How to obtain a random sample
- Dot plots, histograms, and box plots
- Calculate the measures of center (median and/or mean)
- Calculate measures of variability (interquartile range and/or mean absolute deviation)
- The measure of mean is independent of the measure of variability.
- Use visual representations to compare and contrast numerical data from two populations using measures of variability and center

## How do these concepts support learning in later grades?

- 8<sup>th</sup>: Scatter plots



# Temperatures Task

1. Read each question.
2. Use the graphs indicated in each problem to answer each question.
3. Be sure to respond in complete sentences where indicated.



# Student Misconceptions and Teaching Strategies

Analyze the standards in your assigned domain.  
Create the chart below for your group's assigned domain.  
Post on the wall when finished.

## Student Misconceptions

- What are some common misconceptions students have?
- What areas do students struggle?

## Teaching Strategies

- List teaching strategies and a brief summary of how to address this misconception.
- List teaching strategies used to address the domain.



# Student Misconceptions and Teaching Strategies

1. Grab a few stick notes.
2. Review each chart posted around the room.
3. On your sticky note, record and post any additional student misconceptions and teaching strategies.



# Reflection

**How will your knowledge of the  
Critical Areas help to inform and  
guide your instruction?**





# Putting It All Together

The critical areas highlight standards that play an important role in the content at a grade level. They frame important considerations such as time devoted to the standard, amount of student practice, assessment questions, etc.



# Suggestions

- Develop long range plans for course content
  - Give focus to the critical areas
- Determine if current instructional materials (unit/lesson plans, books, etc.) meet the demands of CCSS



# Objectives

- **IDENTIFY** the critical areas
- **DESCRIBE** the connections concepts have to prior and future courses
- **PRACTICE** tasks and activities aligned to each domain
- **ANALYZE** standards to determine student misconceptions and generate teaching strategies to address them



# Resources

- [Illustrative Mathematics](#)
- [Mathematics Assessment Resource Services](#)
- [Utah State Office of Education](#)
- [National Council for Teachers of Mathematics](#)
- [SCDE Common Core Support](#)



# Questions



Photo: microsoft.com



# Certificates of Attendance



- Survey will be sent to you via e-mail.
- Once complete, your certificate will be sent to you via e-mail.



# Exit Ticket

List **3** things you learned today.

List **2** things you will take back and use in your school or district.

List **1** thing you need more information about.



# Contact Information

**Janel Johnson**

Middle School and High School Math

E-mail: [jejohnson@ed.sc.gov](mailto:jejohnson@ed.sc.gov)

Phone: 803-734-7814