



# Investigating the Standards: Iowa Core Mathematics Grade 6




**Iowa Department of  
Education in Partnership with  
AEA School Improvement**



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**Investigating the Standards:  
Iowa Core Mathematics  
Grades 6 - 8**

Iowa Department of Education  
In Partnership with  
AEA School Improvement



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**Welcome!**  
*A few logistics ...*

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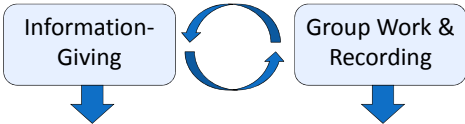
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**Ground Rules for Today**



**Information-Giving**

- Attentive listening
- Open mindset to receive new ideas and information
- Note-taking

**Group Work & Recording**

- Open mindset
- Professional conversations
- Careful note-taking (for taking back)
- Deep thinking
- Record questions – to be addressed later

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## The Message

Today is the **initial investigation** to be followed by deeper investigation.

This is an **extended process** toward full implementation.

It cannot/should not be rushed – a **marathon**, not a race.

Our focus is to learn **HOW to investigate** these standards.

We won't be aligning today – because **alignment cannot be done effectively without careful investigation.**

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## Learning Goals:

Understand the basic structure of the Iowa Core Mathematics

Understand how to investigate the Iowa Core Mathematics

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## Success Criteria:

1. I can explain at least two of the standards for mathematical practice.
2. I can describe the critical areas for my grade level.
3. I can locate my grade level content standards and explain the differences among standards, clusters, and domains.
4. I can describe “mathematical understanding” by giving an example and non-example.

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**Outcomes**

**Leadership - Community – Schools**

1. Leadership-System Capacity
2. Community-Support Implementation
3. Schools-Continuous Improvement

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**Outcomes**

**Content - Instruction – Assessment**

4. Alignment of Content, Instruction and Assessment
5. Professional Development to improve Content, Instruction, and Assessment
6. Instruction: Effective Practices in Instruction/Assessment Student Engagement

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### Journey to IC Mathematics

1. The Iowa State Board of Education adopted Common Core State Standards (CCSS) for English language arts and mathematics on July 29, 2010.
2. CCSS in English language arts and mathematics replaced the literacy and mathematics sections of the Iowa Core.
3. Additional Iowa items were adopted by the State Board on November 17, 2010.

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### Why are common standards good for teachers?

- IC Mathematics **provides** student learning standards for every grade level.
- IC Mathematics ensures a **common language** for educators.
- Students will be **assessed** based on IC Mathematics.

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### Why are common standards good for students?

- **Student Ownership.** Clearer standards will help students understand what is expected of them and allow for more self-directed learning.
- **Consistent.** Expectations will be consistent for all students and not dependent on zip code.
- **Mobility.** It will help students with transitions between states.
- **College & Career Focus.** It will help prepare students with the knowledge and skills they need to succeed in college and careers.

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Investigating the  
*Iowa Core  
Mathematics  
Grades 6 - 8*

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Standards for Mathematical Practice

*“The Standards for  
Mathematical Practice  
describe varieties of  
expertise that mathematics  
educators at all levels should  
seek to develop in their  
students.”*

*IC Mathematics page 8*

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Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Construct viable arguments & critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

Refer to Pages 8-10  
in IC Mathematics

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**Grade 8 Overview**

**The Number System**

- Know that there are numbers that are not rational, and approximate them by rational numbers.

**Expressions and Equations**

- Work with radicals and integer exponents.
- Understand the connections between proportional relationships, lines, and linear equations.
- Analyze and solve linear equations and pairs of simultaneous linear equations.

**Functions**

**Mathematical Practices**

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

*The Practices are listed at the beginning of each grade level.*

*Standards for Mathematical Practice are also provided in detail on pages 8-10.*

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**Activity 1:**  
**Investigating the Standards of Mathematical Practice**

- At your table choose two mathematical practices
- Read and discuss them
- Read the problem at the right and solve
- After completing the sample problem, think about what evidence would show a student is demonstrating the mathematical practices.
- In the chart, describe characteristics in students' thinking and actions you might observe for each practice you chose.

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**MORE FOCUSED:**  
**Increased Clarity and Specificity**

*"It is important to recognize that "fewer standards" are no substitute for focused standards. Achieving "fewer standards" would be easy to do by resorting to broad, general statements. Instead, these Standards aim for **clarity and specificity**."*

*IC Mathematics page 4.*

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**Critical Area Narratives** 

- Important **descriptions** at the beginning of each grade level
- Provide the **intent** of the mathematics at each grade
- Provide 3-4 **critical areas** for the grade level
- Provide a sense of ...
  - the sophistication for mathematical understanding at the grade level
  - the learning progressions for the grade
  - extensions from prior standards
  - what's important at the grade level

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**Grade Level Critical Areas** 

**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. Students use their understanding of ratios and proportionality to solve a wide variety of percent problems, including those involving discounts, interest, taxes, tips, and percent increase or decrease. Students solve problems about scale drawings by relating corresponding lengths between the objects or by using the fact that relationships of lengths within an object are preserved in similar objects. Students graph proportional relationships and understand the unit rate informally as a measure of the steepness of the related line, called the slope. They distinguish proportional relationships from other relationships.

**Grade 6 Narrative, IC Mathematics p. 41**

**Grade 7 Narrative, IC Mathematics p. 47**

**Grade 8 Narrative, IC Mathematics p.53**

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**Activity 2:**  
**Investigating Grade Level Critical Areas** 

- Note the narrative of the critical areas for your grade level in the first paragraph of the IC.
- Divide the critical areas among table partners and read the descriptions.
- Use the organizers to note what you discover and think about the critical areas.
- Discuss your thinking with your table partners about all of the critical areas.

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## K-12 Standards for Mathematical Content

- K-8 standards presented by grade level
- Organized into domains that progress over several grades
- High school standards presented by conceptual theme (Number & Quantity, Algebra, Functions, Modeling, Geometry, Statistics & Probability)

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## Structure of the Standards

- **Content standards** define what students should understand and be able to do.
- **Clusters** are groups of related standards.
- **Domains** are larger groups that progress across grades.

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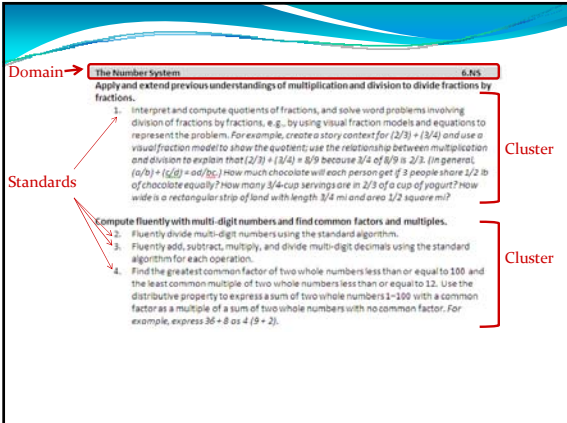
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**Domain** → **The Number System** 6.NS

**Standards** →

- Apply and extend previous understandings of multiplication and division to divide fractions by fractions.
  - Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. For example, create a story context for  $(2/3) \div (3/4)$  and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that  $(2/3) \div (3/4) = 8/9$  because  $3/4$  of  $8/9$  is  $2/3$ . (In general,  $(a/b) \div (c/d) = ad/bc$ .) How much chocolate will each person get if 3 people share  $1/2$  lb of chocolate equally? How many  $3/4$ -cup servings are in  $2/3$  of a cup of yogurt? How wide is a rectangular strip of land with length  $3/4$  mi and area  $1/2$  square mi?
- Compute fluently with multi-digit numbers and find common factors and multiples.
  - Fluently divide multi-digit numbers using the standard algorithm.
  - Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.
  - Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express  $36 + 8$  as  $4(9 + 2)$ .

**Cluster** (bracketed around the first standard)

**Cluster** (bracketed around the second standard)

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**Grade Level Standards**

“...grade placements for specific topics have been made on the basis of state and international comparisons and the collective experience and collective professional judgment of educators, researchers and mathematicians.”

-IC Mathematics, page 7

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**Activity 3:**  
**Investigating the Structure of the IC Mathematics Content**



- Go to page 7 of the IC to review the components of the content standards structure.
- See the standards provided below.
- Scavenger Hunt for each standard, find all the elements (Standard #, Cluster Title, and Domain), and note them in the table below each standard.

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**Investigating the Content Standards**  
**A closer look ...**



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**Activity 4:**  
**Investigating Content Standards**

- Recall the earlier problem.
- Identify the important mathematics necessary for this problem.
- Identify the Content Standard(s) involved in this problem.

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**Investigating the Domains**

- Domains are **common learning progressions** that can progress across grade levels.
- Domains do not dictate **curriculum** or **teaching methods**.
- Standards within domains are not meant to be **taught in the order presented**.
- Teachers must present the standards in a manner that is consistent with decisions that are made in **collaboration** with their K-12 mathematics team.

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**Activity 5:**  
**Investigating the Domains**

- Divide the Domains as directed.
- Read the Domain and note the important mathematical content
- Circle or highlight what is new to your grade level.
- Share out as directed.

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## Vertical Connections



All Standards in mathematics have a connection to earlier and subsequent concepts and skills.



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## K-8 Domains

Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Counting & Cardinality						The Number System		
Operations & Algebraic Thinking						Ratios & Proportional Relationships	Functions	
Number & Operations in Base 10								
			Number Operations – Fractions			Expressions & Equations		
Measurement & Data						Statistics & Probability		
Geometry								

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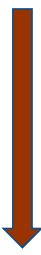
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### Vertical Connections example

## Fractions, Grades 3–6





**Grade 3:** Develop an understanding of fractions as numbers.

**Grade 4:**  
Extend understanding of fraction equivalence and ordering.  
Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.  
Understand decimal notation for fractions, and compare decimal fractions.

**Grade 5:**  
Use equivalent fractions as a strategy to add and subtract fractions.  
Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

**Grade 6:** Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

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## Coherence



William Schmidt and Richard Houang (2002) have said

*“...a set of content standards must evolve from particulars to **deeper structures** inherent in the discipline. These deeper structures then serve as a means for **connecting** the particulars.”*

IC Mathematics page 4

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## 6-8 Connection: Statistics and Probability



6 <sup>th</sup>	7 <sup>th</sup>	8 <sup>th</sup>
<p>2. Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.</p> <p>3. Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.</p>	<p>4. Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. <i>For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.</i></p>	<p>4. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.</p>

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## H.S. Connections: Geometry



8 <sup>th</sup> Grade	High School
<p>1. Verify experimentally the properties of rotations, reflections, and translations:</p> <p>a. Lines are taken to lines, and line segments to line segments of the same length.</p> <p>b. Angles are taken to angles of the same measure.</p> <p>c. Parallel lines are taken to parallel lines.</p>	<p><b>Experiment with transformations in the plane</b></p> <p>2. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).</p> <p>3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.</p> <p>4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.</p> <p>5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.</p>

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Watch this clip....

Planning and results----how does learning progress?

<http://www.youtube.com/watch?v=bggFBWn7YoI>

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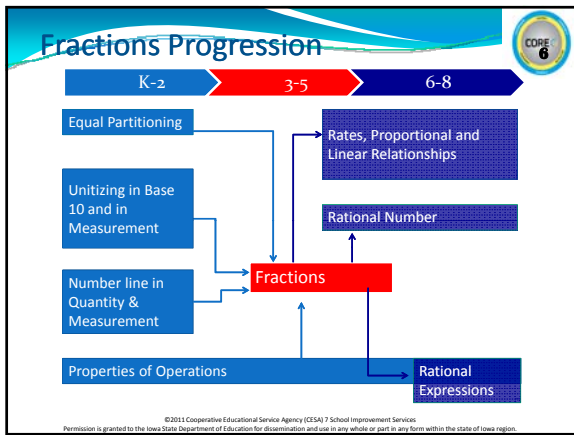
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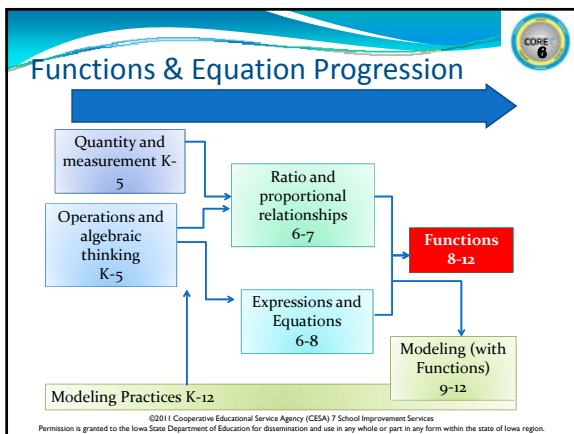
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**Activity 6:**  
**Investigating Vertical Connections**



- Given the standards in the chart, find corresponding prior and future standards (if they exist) that focus on the learning progressions. Go only **one level above** and **one level below** the given standard.
- Discuss and note these connected standards in the chart.

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**Activity 7:**  
**Investigating Mathematical Understanding**



Begin a line of learning by responding to this question:

**What is the meaning of “mathematical understanding?”**

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**Math Class Needs a Make Over**



**Dan Meyer**  
High School Math Teacher

[http://www.ted.com/talks/dan\\_meyer\\_math\\_curriculum\\_makeover.html](http://www.ted.com/talks/dan_meyer_math_curriculum_makeover.html)

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In short, a lack of understanding effectively prevents a student from engaging in the mathematical practices.

Iowa Core Mathematics, p. 10 FreeFoto.com

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### Determining Implications and Next Steps

*We've been investigating the standards – now, what do we do?*

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### Activity 8: Reflection

In the chart, reflect on the activities completed by responding to these prompts

- New things I learned about the IC Mathematics based on Practices, Content, and Miscellaneous items.
- Next Steps for how you will take this process back to your colleagues for investigations at your School/District.

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**Success Criteria:**

1. I can explain at least two of the standards for mathematical practice.
2. I can describe the critical areas for my grade level.
3. I can locate my grade level content standards and explain the differences among standards, clusters, and domains.
4. I can describe “mathematical understanding” by giving an example and non-example.

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**Feedback** 

Please complete the **exit ticket** provided.

Thanks so much for your participation! Best of luck!

Contact:  
Your AEA Math Consultant

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## Activity 1

## Investigating the Standards for Mathematical Practice

## Task:

- At your table choose two mathematical practices and write them in the table below.
- Read and discuss them.
- Read the problem at the right and solve.
- After completing the sample problem, think about what evidence would show a student is demonstrating the mathematical practices.
- In the chart below, describe characteristics in students' thinking and actions that you might observe for each practice.

Dan wants to rent a video game. Late fees at one store are \$1 a day. Another store charges \$3 for the first late day and \$0.50 for each additional day.

If Dan returns the game three days late, which store would charge him less? One time he forgot to return a game for 9 days. Which store would charge him less? How many days late would result in the same amount of late fees for Dan?

Explain how you found your answers.

Standard for Mathematical Practice	What evidence would show a student is demonstrating the mathematical practices? (What might students be thinking and doing?)
Practice #1:	
Practice #2:	
<b>After discussing the above results, read “Connecting the Standards for Mathematical Practice to the Standards for Mathematical Content”, IC page 10.</b>	
<b>The most important idea is ...</b>	
<p><b>Roam the Room</b></p> <ul style="list-style-type: none"> <li>• When time is called, everyone “roams the room” to exchange important ideas with someone from another table.</li> <li>• When time is called, repeat.</li> <li>• Then sit down</li> </ul>	

## Activity 2

# Investigating the Grade Level Critical Areas

### Task:

- Note the narrative of the critical areas for grade 6 in the first paragraph on page 41 of the IC.
- Divide the grade level critical areas among table partners and read the descriptions.
- Use the organizers below to note what you discover and think about the 6<sup>th</sup> grade critical areas.
- Discuss your thinking with your table partners about all of the critical areas.

**6<sup>th</sup> Grade Critical Area 1:** connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems

INTENT:

**6<sup>th</sup> Grade Critical Area 2:** completing understanding of division of fractions and extending the notion of number to the system of rational numbers, which includes negative numbers

INTENT:

**6<sup>th</sup> Grade Critical Area 3:** writing, interpreting, and using expressions and equations

INTENT:

**6<sup>th</sup> Grade Critical Area 4:** developing understanding of statistical thinking

INTENT:

## Activity 3

# Investigating the Structure of the IC Mathematics Content

### Task:

- Go to page 7 of the IC to review the components of the content standards structure.
- See the standards provided below.
- Scavenger Hunt for each standard, find all the elements (Standard #, Cluster Title, and Domain), and note them in the table below each standard.

Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

Standard #	Cluster Title	Domain

Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

Standard #	Cluster Title	Domain

Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

Standard #	Cluster Title	Domain

## Activity 4

### Investigating Content Standards

Task:

- Recall the earlier problem.
- Identify the important mathematics necessary for this problem.
- Identify the 6<sup>th</sup> Grade Content Standard(s) involved in this problem.

<b>Sample 6th grade Mathematics Problem</b>	
<p>Dan wants to rent a video game. Late fees at one store are \$1 a day. Another store charges \$3 for the first late day and \$0.50 for each additional day.</p> <p>If Dan returns the game three days late, which store would charge him less? One time he forgot to return a game for 9 days. Which store would charge him less? How many days late would result in the same amount of late fees for Dan?</p> <p>Explain how you found your answers.</p>	
<p>Important Mathematics Necessary for this Problem</p>	
<p>6<sup>th</sup> Grade Content Standard(s) for this Problem</p>	

## Activity 5

### Investigating the Domains

**Task:**

- Expert Jigsaw:
  - Number off 1 – 5, 1's will be first domain, 2's will be second domain, etc.
  - Read the domain and note the important math content.
  - Circle or highlight what is new to your grade level.
  - Get into Expert groups (all the same numbers) and discuss the notes you took.
  - Go back to your table groups and share out each domain.

Domains	Important Math Content
Ratio and Proportional Relationships	
The Number System	
Expressions and Equations	
Geometry	
Statistics and Probability	

## Activity 6

### Investigating Vertical Connections

## Task:

- Given the standards in the chart below, find corresponding prior and future standards (if they exist) that focus on the learning progressions. Go only **one level above** and **one level below** the given standard.
- Discuss and note these connected standards in the chart.

Prior Standards	Standard	Future Standards
	<p><b>6<sup>th</sup> Grade, Ratios and Proportional Relationships</b></p> <p>Understand the concept of a unit rate <math>a/b</math> associated with a ratio <math>a:b</math> with <math>b \neq 0</math>, and use rate language in the context of a ratio relationship. <i>For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is <math>3/4</math> cup of flour for each cup of sugar." "We paid \$75 for 15 hamburgers, which is a rate of \$5 per hamburger."</i></p>	
	<p><b>6<sup>th</sup> Grade, Statistics and Probability</b></p> <p>Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. <i>For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.</i></p>	
	<p><b>6<sup>th</sup> Grade, Geometry</b></p> <p>Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.</p>	



Activity 7  
Investigating Mathematical Understanding

Begin a “line of learning” by responding to this question:

**What is the meaning of “mathematical understanding”?**

1) Reflect on the following problems:

**Sally has scores of 8, 9, 5, 4, and 10 on her math homework. What is her mean score?**

**Linus has scores of 75, 81, 92, and 69 on the first four math tests. If he wants his mean score for five tests to be (at least) 80, what score should he get on test five?**

- What is the difference between them? Why might solving the second problem require deeper mathematical understanding than the first? Discuss with your elbow partner.
- In your table groups, describe problems or classroom situations that portray an example and non-example of “mathematical understanding.”

Example	Non-example

- Draw a line under your response on the previous page and again reflect on

**What is the meaning of “mathematical understanding”?**

2) Read page 3 and the first paragraph on page 6 from the IC Mathematics.

- Draw a line under your response on the previous page and again reflect on

**What is the meaning of “mathematical understanding”?**

3) View the following video, “Math Class Needs a Make Over” featuring HS Math Teacher, Dan Meyer.

- Draw a line under your response on the previous page and again reflect on

**What is the meaning of “mathematical understanding”?**

4) Share your final writing with your group or partner.

## Activity 8 Reflection

Reflect on the activities completed today. How will you take this process back to your colleagues for investigations at your school/district? Jot your “next steps” in the chart below.

New Things I Learned about the IC Mathematics		
Practices	Content	Miscellaneous
Next Steps for Future Standards Investigations		
Teacher	Grade Level	School/District

## Exit Ticket

<b>3</b>	<b>New Ideas</b>	
<b>2</b>	<b>Things I Will Use</b>	
<b>1</b>	<b>Question I Still Have</b>	