TEXAS MATH SOLUTION

Grade 8

Student Edition

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LONG + LIVE + MATH

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"Mathematics is so much more than memorizing rules. It is learning to reason, to make connections, and to make sense of the world. We believe in Learning by Doing™—you need to actively engage with the content if you are to benefit from it. The lessons were designed to take you from your intuitive understanding of the world and build on your prior experiences to then learn new concepts. My hope is that these instructional materials help you build a deep understanding of math."

Sandy Bartle Finocchi, Chief Mathematics Officer

"My hope is that as you work through this course, you feel capable—capable of exploring new ideas that build upon what you already know, capable of struggling through challenging problems, capable of thinking creatively about how to fix mistakes, and capable of thinking like a mathematician."

Amy Jones Lewis, Senior Director of Instructional Design

"At Carnegie Learning we have created an organization whose mission and culture is defined by your success. Our passion is creating products that make sense of the world of mathematics and ignite a passion in you. Our hope is that you will enjoy our resources as much as we enjoyed creating them."

Barry Malkin, CEO

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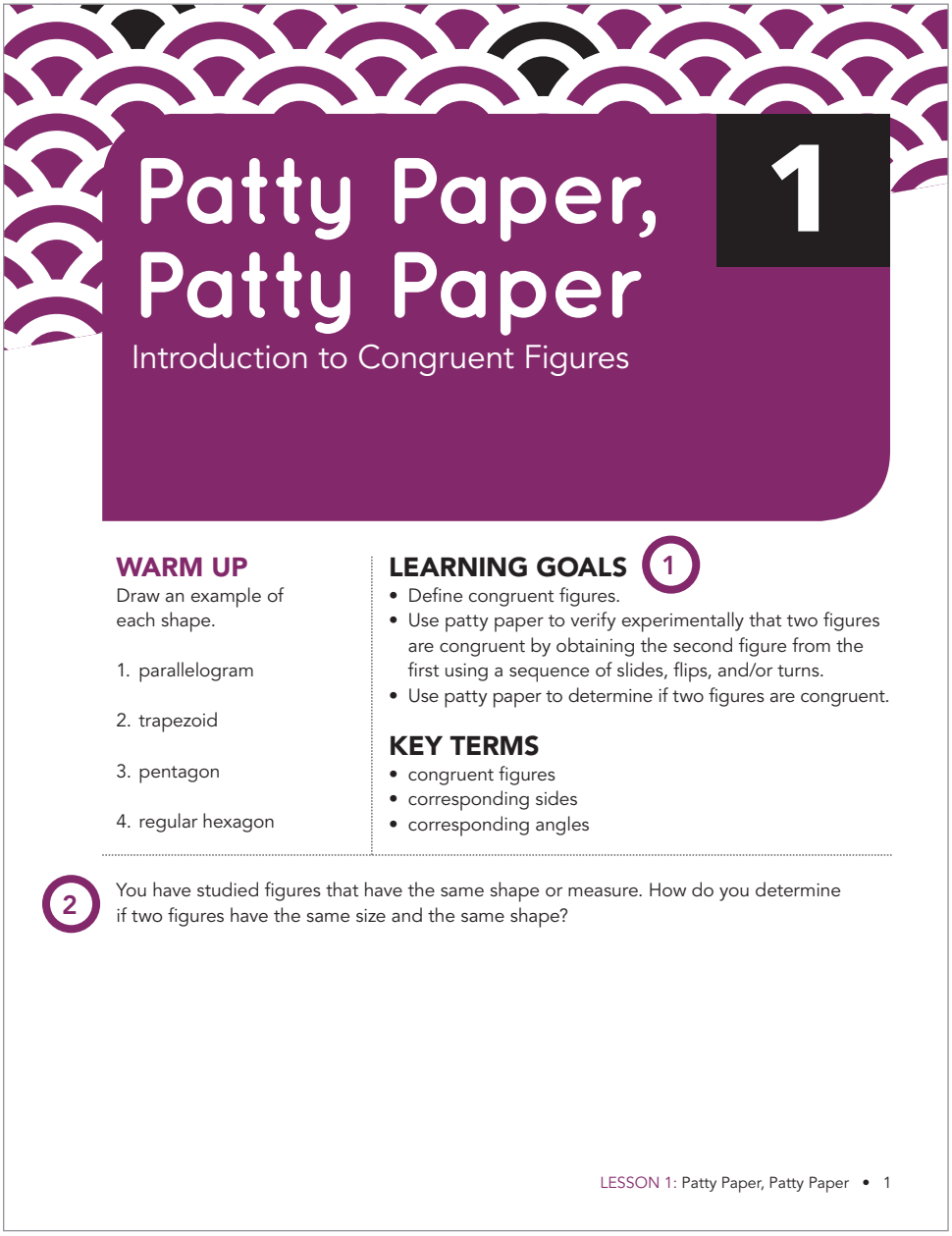


Patty Paper, Patty Paper

1

Introduction to Congruent Figures

WARM UP

Draw an example of each shape.

1. parallelogram
2. trapezoid
3. pentagon
4. regular hexagon

LEARNING GOALS

1

- Define congruent figures.
- Use patty paper to verify experimentally that two figures are congruent by obtaining the second figure from the first using a sequence of slides, flips, and/or turns.
- Use patty paper to determine if two figures are congruent.

KEY TERMS

- congruent figures
- corresponding sides
- corresponding angles

2 You have studied figures that have the same shape or measure. How do you determine if two figures have the same size and the same shape?

1. Learning Goals

Learning goals are stated for each lesson to help you take ownership of the learning objectives.

2. Connection

Each lesson begins with a statement connecting what you have learned with a question to ponder.

Return to this question at the end of this lesson to gauge your understanding.

3. Getting Started

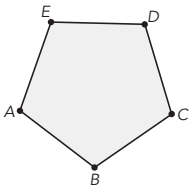
Each lesson begins with a Getting Started. When working on the Getting Started, use what you know about the world, what you have learned previously, or your intuition. The goal is just to get you thinking and ready for what's to come.

3 Getting Started

It's Transparent!

Let's use patty paper to investigate the figure shown.

1. List everything you know about the shape.



Patty paper is great paper to investigate geometric properties. You can write on it, trace with it, and see creases when you fold it.

2. Use patty paper to compare the sizes of the sides and angles in the figure.

a. What do you notice about the side lengths?

b. What do you notice about the angle measures?

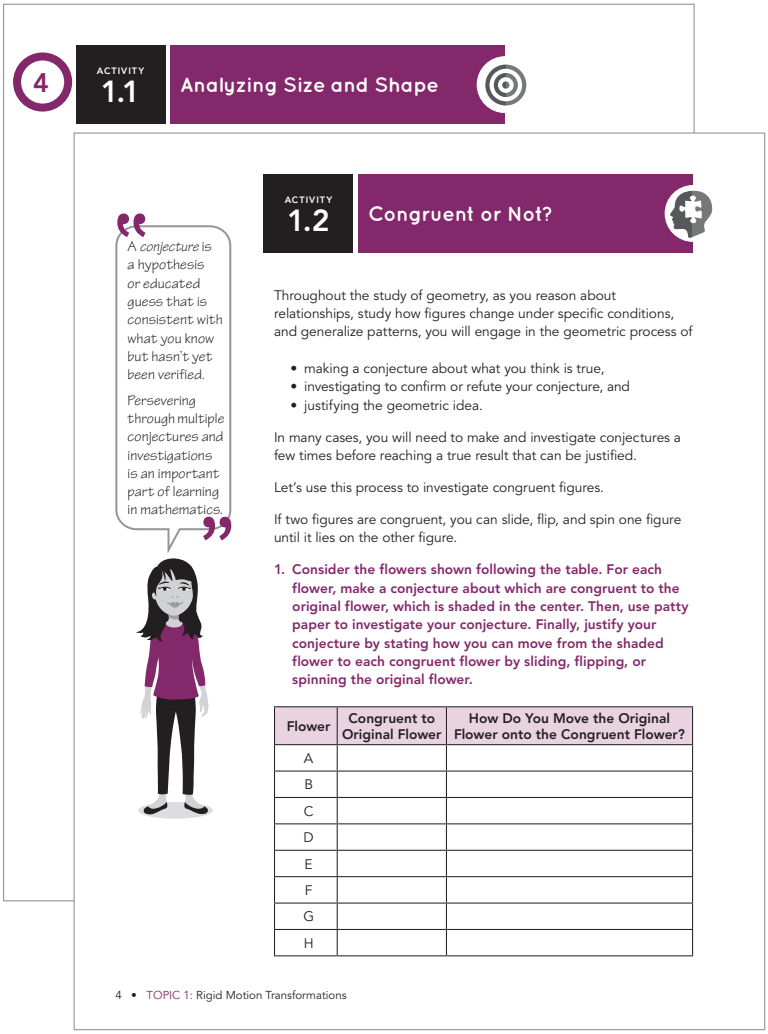
c. What can you say about the figure based on this investigation?

"Patty paper was originally created for separating patties of meat! Little did the inventors know that it could also serve as a powerful geometric tool."

Trace the polygon onto a sheet of patty paper.

3. Use five folds of your patty paper to determine the center of each side of the shape. What do you notice about where the folds intersect?

2 • TOPIC 1: Rigid Motion Transformations



4

ACTIVITY 1.1

Analyzing Size and Shape

ACTIVITY 1.2

Congruent or Not?

A *conjecture* is a hypothesis or educated guess that is consistent with what you know but hasn't yet been verified.

Persevering through multiple conjectures and investigations is an important part of learning in mathematics.

Throughout the study of geometry, as you reason about relationships, study how figures change under specific conditions, and generalize patterns, you will engage in the geometric process of

- making a conjecture about what you think is true,
- investigating to confirm or refute your conjecture, and
- justifying the geometric idea.

In many cases, you will need to make and investigate conjectures a few times before reaching a true result that can be justified.

Let's use this process to investigate congruent figures.

If two figures are congruent, you can slide, flip, and spin one figure until it lies on the other figure.

1. **Consider the flowers shown following the table. For each flower, make a conjecture about which are congruent to the original flower, which is shaded in the center. Then, use patty paper to investigate your conjecture. Finally, justify your conjecture by stating how you can move from the shaded flower to each congruent flower by sliding, flipping, or spinning the original flower.**

Flower	Congruent to Original Flower	How Do You Move the Original Flower onto the Congruent Flower?
A		
B		
C		
D		
E		
F		
G		
H		

4 • TOPIC 1: Rigid Motion Transformations

4. Activities

You are going to build a deep understanding of mathematics through a variety of activities in an environment where collaboration and conversations are important and expected.

You will learn how to solve new problems, but you will also learn why those strategies work and how they are connected to other strategies you already know.

Remember:

- It's not just about answer-getting. The process is important.
- Making mistakes is a critical part of learning, so take risks.
- There is often more than one way to solve a problem.

Activities may include real-world problems, sorting activities, Worked Examples, or analyzing sample student work.

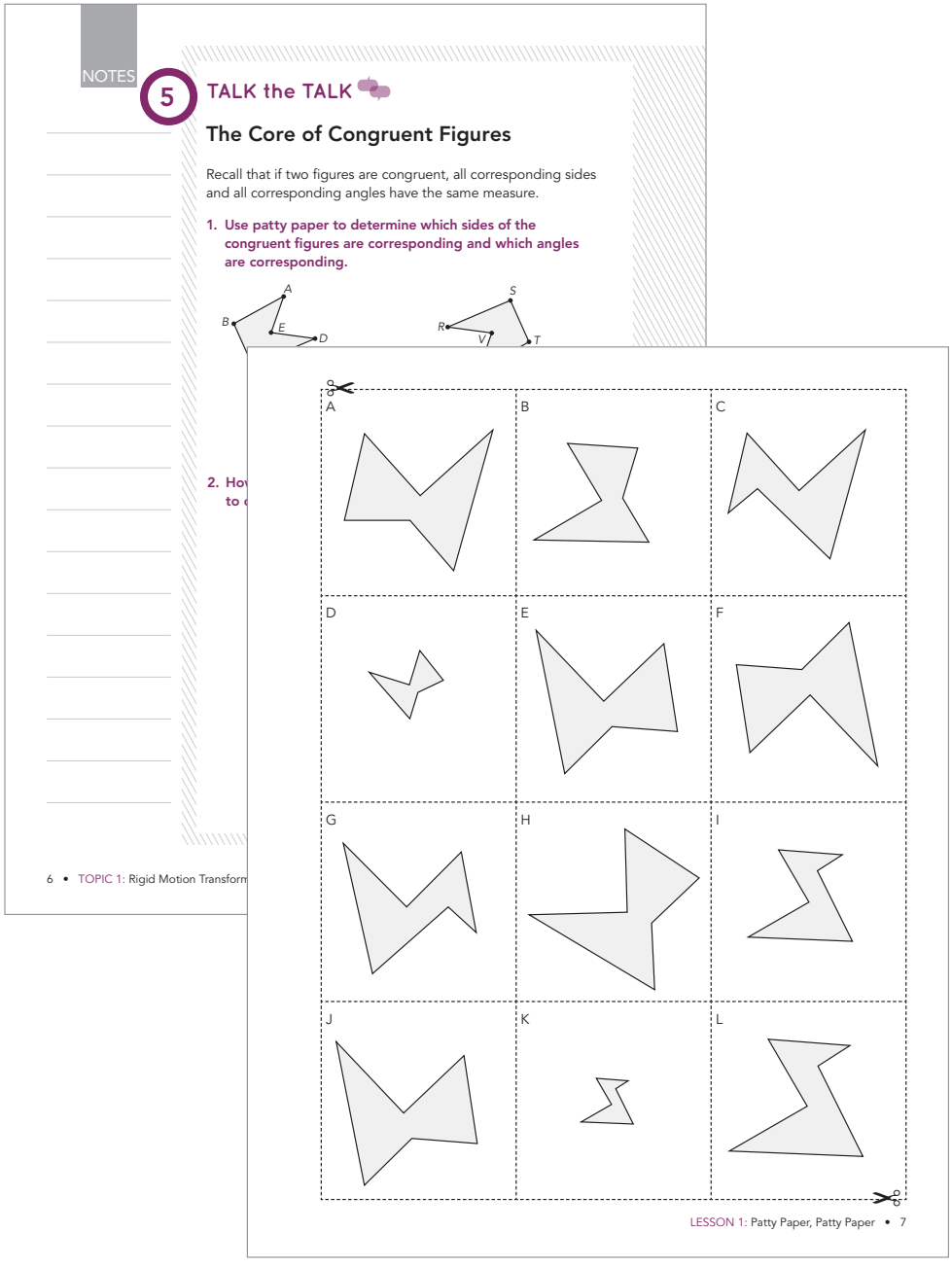
Be prepared to share your solutions and methods with your classmates.

5. Talk the Talk

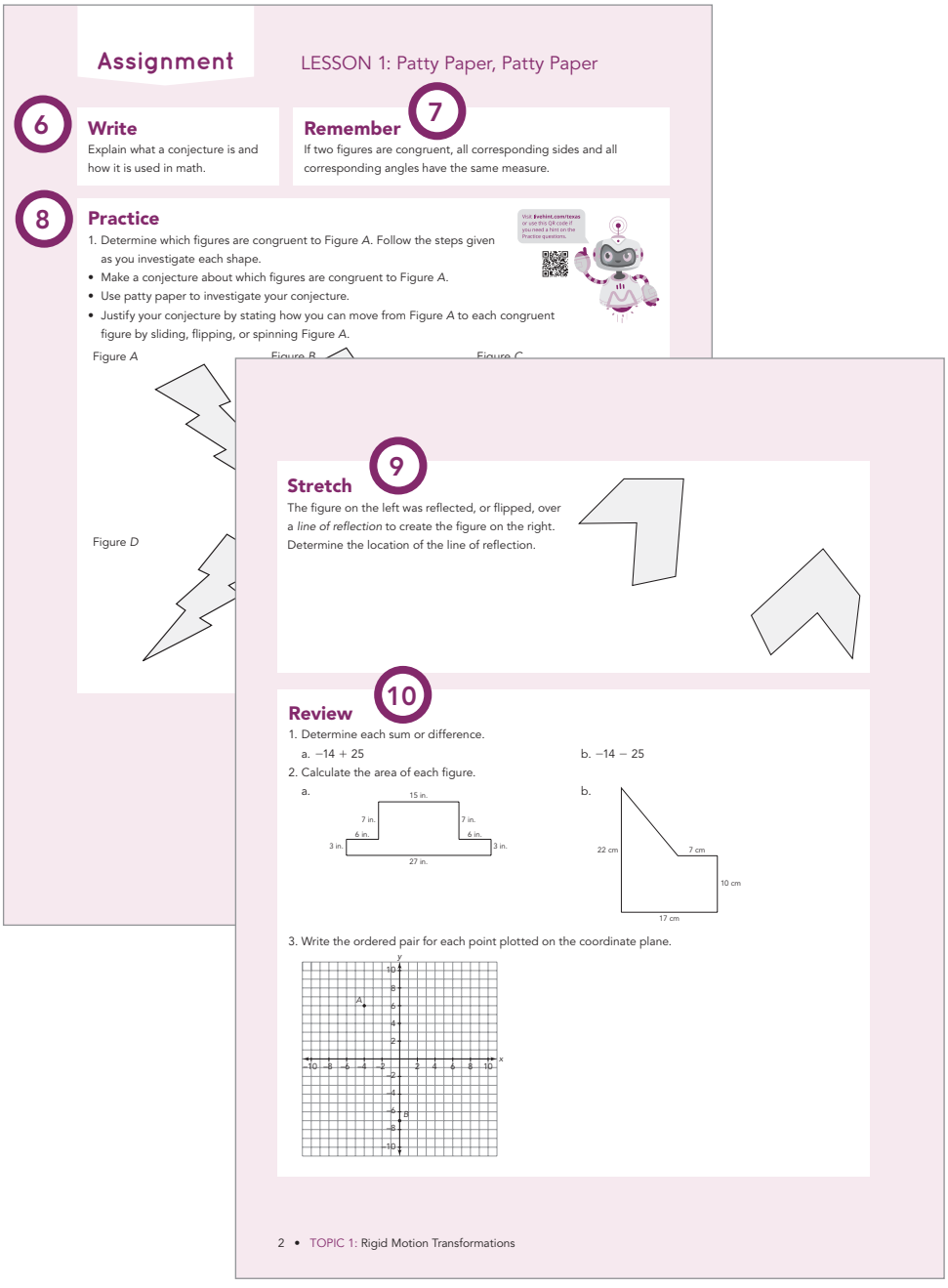
Talk the Talk gives you an opportunity to reflect on the main ideas of the lesson.

- Be honest with yourself.
- Ask questions to clarify anything you don't understand.
- Show what you know!

Don't forget to revisit the question posed on the lesson opening page to gauge your understanding.



Assignment



Assignment

LESSON 1: Patty Paper, Patty Paper

6 **Write**

Explain what a conjecture is and how it is used in math.

7 **Remember**

If two figures are congruent, all corresponding sides and all corresponding angles have the same measure.

8 **Practice**

1. Determine which figures are congruent to Figure *A*. Follow the steps given as you investigate each shape.
   - Make a conjecture about which figures are congruent to Figure *A*.
   - Use patty paper to investigate your conjecture.
   - Justify your conjecture by stating how you can move from Figure *A* to each congruent figure by sliding, flipping, or spinning Figure *A*.

Figure *A*

Figure *D*

9 **Stretch**

The figure on the left was reflected, or flipped, over a *line of reflection* to create the figure on the right. Determine the location of the line of reflection.

10 **Review**

1. Determine each sum or difference.
   a. −14 + 25
   b. −14 − 25
2. Calculate the area of each figure.
   a.
   b.

3. Write the ordered pair for each point plotted on the coordinate plane.

2 • TOPIC 1: Rigid Motion Transformations

6. Write

Reflect on your work and clarify your thinking.

7. Remember

Take note of the key concepts from the lesson.

8. Practice

Use the concepts learned in the lesson to solve problems.

9. Stretch

Ready for a challenge?

10. Review

Remember what you've learned by practicing concepts from previous lessons and topics.

Problem Types You Will See

Worked Example

When you see a Worked Example:

- Take your time to read through it.
- Question your own understanding.
- Think about the connections between steps.

Ask Yourself:

- What is the main idea?
- How would this work if I changed the numbers?
- Have I used these strategies before?

WORKED EXAMPLE

The first right triangle has sides of length 3 units, 4 units, and 5 units, where the sides of length 3 units and 4 units are the legs and the side with length 5 units is the hypotenuse.

The sum of the squares of the lengths of the legs: $3^2 + 4^2 = 9 + 16 = 25$

The square of the hypotenuse: $5^2 = 25$

Therefore $3^2 + 4^2 = 5^2$, which verifies the Pythagorean Theorem, holds true.

The Pythagorean Theorem can be used to determine unknown side lengths in a right triangle. Evan and Sophi are using the theorem to determine the length of the hypotenuse, c, with leg lengths of 2 and 4. Examine their work.

Sophi

$c^2 = 2^2 + 4^2$
$c^2 = 4 + 16 = 20$
$c = \sqrt{20} \approx 4.5$

The length of the hypotenuse is approximately 4.5 units.

Evan

$c^2 = 2^2 + 4^2$
$c^2 = 6^2$
$c = 6$

The length of the hypotenuse is 6 units.

Thumbs Up

When you see a Thumbs Up icon:

- Take your time to read through the correct solution.
- Think about the connections between steps.

Ask Yourself:

- Why is this method correct?
- Have I used this method before?

Thumbs Down

When you see a Thumbs Down icon:

- Take your time to read through the incorrect solution.
- Think about what error was made.

Ask Yourself:

- Where is the error?
- Why is it an error?
- How can I correct it?

Isabel says that $2^2 + 2^3 = 2^5$, and Elizabeth says that $2^2 + 2^3 \neq 2^5$. Who is correct? Explain your reasoning.

Who's Correct

When you see a Who's Correct icon:

- Take your time to read through the situation.
- Question the strategy or reason given.
- Determine correct or not correct.

Ask Yourself:

- Does the reasoning make sense?
- If the reasoning makes sense, what is the justification?
- If the reasoning does not make sense, what error was made?

The Crew

The Crew is here to help you on your journey. Sometimes they will remind you about things you already learned. Sometimes they will ask you questions to help you think about different strategies. Sometimes they will share fun facts. They are members of your group—someone you can rely on!

Teacher aides will guide you along your journey. They will help you make connections and remind you to think about the details.

Mathematical Process Standards

Texas Mathematical Process Standards

Effective communication and collaboration are essential skills of a successful learner. With practice, you can develop the habits of mind of a productive mathematical thinker. The "I can" expectations listed below align with the TEKS Mathematical Process Standards and encourage students to develop their mathematical learning and understanding.

▶ Apply mathematics to problems arising in everyday life, society, and the workplace.

I can:

- use the mathematics that I learn to solve real world problems.
- interpret mathematical results in the contexts of a variety of problem situations.

▶ Use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying a solution, and evaluating the problem solving process and reasonableness of the solution.

I can:

- explain what a problem "means" in my own words.
- create a plan and change it if necessary.
- ask useful questions in an attempt to understand the problem.
- explain my reasoning and defend my solution.
- reflect on whether my results make sense.

▶ Select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate; and techniques including mental math, estimation, and number sense as appropriate, to solve problems.

I can:

- use a variety of different tools that I have to solve problems.
- recognize when a tool that I have to solve problems might be helpful and when it has limitations.
- look for efficient methods to solve problems.
- estimate before I begin calculations to inform my reasoning.

▶ Communicate mathematical ideas, reasoning, and their implications using multiple representations including symbols, diagrams, graphs, and language as appropriate.

I can:

- communicate and defend my own mathematical understanding using examples, models, or diagrams.
- use appropriate mathematical vocabulary in communicating mathematical ideas.
- make generalizations based on results.
- apply mathematical ideas to solve problems.
- interpret my results in terms of various problem situations.

▶ Create and use representations to organize, record, and communicate mathematical ideas.

I can:

- consider the units of measure involved in a problem.
- label diagrams and figures appropriately to clarify the meaning of different representations.
- create an understandable representation of a problem situation.

▶ Analyze mathematical relationships to connect and communicate mathematical ideas.

I can:

- identify important relationships in a problem situation.
- use what I know to solve new problems.
- analyze and organize information.
- look closely to identify patterns or structure
- look for general methods and more efficient ways to solve problems.

▶ Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

I can:

- work carefully and check my work.
- distinguish correct reasoning from reasoning that is flawed.
- use appropriate mathematical vocabulary when I talk with my classmates, my teacher, and others.
- specify the appropriate units of measure when I explain my reasoning.
- calculate accurately and communicate precisely to others.

Academic Glossary

Visit the Students & Caregivers Portal on the Texas Support Center at www.CarnegieLearning.com/texas-help to access the Mathematics Glossary for this course anytime, anywhere.

There are important terms you will encounter throughout this book. It is important that you have an understanding of these words as you get started on your journey through the mathematical concepts. Knowing what is meant by these terms and using these terms will help you think, reason, and communicate your ideas.

ANALYZE

Related Phrases

- Examine
- Evaluate
- Determine
- Observe
- Consider
- Investigate
- What do you notice?
- What do you think?
- Sort and match

Definition

To study or look closely for patterns. Analyzing can involve examining or breaking a concept down into smaller parts to gain a better understanding of it.

Ask Yourself

- Do I see any patterns?
- Have I seen something like this before?
- What happens if the shape, representation, or numbers change?

EXPLAIN YOUR REASONING

Related Phrases

- Show your work
- Explain your calculation
- Justify
- Why or why not?

Definition

To give details or describe how to determine an answer or solution. Explaining your reasoning helps justify conclusions.

Ask Yourself

- How should I organize my thoughts?
- Is my explanation logical?
- Does my reasoning make sense?
- How can I justify my answer to others?

REPRESENT

Definition

To display information in various ways. Representing mathematics can be done using words, tables, graphs, or symbols.

Ask Yourself

- How should I organize my thoughts?
- How do I use this model to show a concept or idea?
- What does this representation tell me?
- Is my representation accurate?

Related Phrases

- Show
- Sketch
- Draw
- Create
- Plot
- Graph
- Write an equation
- Complete the table

ESTIMATE

Definition

To make an educated guess based on the analysis of given data. Estimating first helps inform reasoning.

Ask Yourself

- Does my reasoning make sense?
- Is my solution close to my estimation?

Related Phrases

- Predict
- Approximate
- Expect
- About how much?

DESCRIBE

Definition

To represent or give an account of in words. Describing communicates mathematical ideas to others.

Ask Yourself

- How should I organize my thoughts?
- Is my explanation logical?
- Did I consider the context of the situation?
- Does my reasoning make sense?

Related Phrases

- Demonstrate
- Label
- Display
- Compare
- Determine
- Define
- What are the advantages?
- What are the disadvantages?
- What is similar?
- What is different?