Creative Core Curriculum for Mathematics with STEM Literacy and Arts Grades K-8

Fully aligned to the Common Core State Standards for Mathematics
TPS Publishing Inc. and partners present
A Mathematics Project Based Toolbox
A collaborative effort for the benefit of all students
Program Design

• Exciting projects for all students, leading to content mastery and real world applications
• Teacher friendly – shift to project based learning
• Low teacher preparation time, no erroneous data
• Ecologically responsible; space, cost, and health benefits
• Continual visual and written assessment
• Improved test scores
• Consistent with the Common Core Standards for Mathematics, the Creative Core Curriculum has made careful use of a large and growing body of evidence. The evidence base includes:

• scholarly research;
• surveys on what skills are required of students entering college and workforce training programs;
• assessment data identifying college- and career-ready performance; and comparisons to standards from high-performing states and nations.

The *Standards* draw on conclusions from TIMSS and other studies of high-performing countries that the traditional US mathematics curriculum must become substantially more coherent and focused in order to improve student achievement.

*U.K. experience and results.*
Two Perspectives on Curricula

Machine/Program

• Raw material in
• Finished product of acceptable quality out
• Train our teachers on how to operate the program
• Works well for standardization and uniformity

Does this program improve test scores?
We have not had an industrial-based society for over 40 years.

Tools

• A wide variety of tools for diverse situations
• Infinitely adjustable
• Teacher as skilled professional
• Works well for individualized instruction

Can our teachers use these tools to maximize learning (as evidenced by increased scores)? The classroom teacher is best able to determine and implement the most effective pedagogy.
CA Criteria

- **Focus**: Place strong emphasis where the Standards focus

- **Coherence**: Think across grades, and link to major topics in each grade

- **Rigor**: In major topics, pursue with equal intensity:
  - conceptual understanding
  - procedural skill & fluency
  - applications

Creative Core Curriculum

- CCC precisely follows the Common Core (as shown on each page)

- Real World STEM Applications for each major topic that cut across grades.

- Intensity in Traditional, STEM and Crafting editions matches these three criteria
Smarter Balanced Consortium and PARCC
Formative, Summative and Interim assessment materials:

- The Assessment database holds thousands of questions by standard and by ability level allowing the teacher to create quizzes
- STEM projects by strand by grade
- Arts projects by standard by grade
- Focus Tutorial can be used to assess student mastery for each standard
- Web-based interactive homework
Three key inquiry based components

Traditional Lesson Plans

STEM Learning Cycles

Arts and Crafts Communications Based Projects
Beginning of a strand

Determine student's initial understanding using TPS assessment database, visual assessments such as STEM or Arts or Informal assessment strategies.

Determine best possible strategy to address needs, individually and/or collectively

Direct instruction with practice

Science is a Verb lab and TPS Publishing traditional textbook

Know but do not understand

STEM Projects

Need creative approach

Arts and crafts, which may include activity guides and reader books

Additional individual help

Focus Tutorials, AVIMBA

Additional individual help

Universal Access Alternative lessons

Assess student understanding of TEKS by using TPS assessment database and/or visual assessments such as STEM or Crafting

From data and observations, determine if students are ready to move on to the next TEKS or if more instructional time is needed.

All instruction supported by Parent/Teacher Guide, Craft Packs and Kits, Invicta Manipulatives, and Professional Development

TPS Publishing Inc.
Traditional Lesson Plans

The traditional textbooks provide the building blocks of our program and we provide a Teacher and Student Edition for each grade.
Some words and their meanings

Length is the distance between two given points.

Perimeter is the distance all around a shape.

Area is the surface area of the boundary.

Weight is used to measure the heaviness of an object.

Mass is a measure of the matter in an object.

Volume is the amount of space taken up by an object.

Capacity is the measurement that tells us how much a container holds.

Time is the measurement we use between one event and another; elapsed time.

Temperature is the measure of how hot or cold items are and the degrees in between these two extremes.

Note to Teachers:

Two Systems of Measurement

There are two systems you can use for measuring:

Metric and U.S.

We can use these to measure length, perimeter, area, weight, mass, volume, capacity, time, and temperature.
Lesson Plan:

**Title:** Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit 3

**Time Required to Teach This Lesson:**
50 minutes

**Vocabulary:** Length, height, breadth, perimeter, area, inch, foot, yard, millimeter, centimeter, meter, kilometer.

**Materials Required in This Lesson:**
- Square inch, square foot, square yard, square millimeter, square centimeter, square meter.
- Laminated sharing boards and dry erase pens (per student).

**Objective:**
- Students will be able to apply the area and perimeter formulas for rectangles in real world and mathematical problems.

**What Students Should Know Already:**

**Concepts:**
- Students will understand concepts of area measurement.
- Students will understand the concept of perimeter.
- Students will be able to distinguish between linear and area measurements.

**Skills:**
- Students will be able to measure area by counting unit squares.
- Students will be able to multiply side-lengths to find areas of rectangle with whole number side-lengths.
- Students will be able to calculate perimeter given the side lengths.

**Lesson Structure:**

**Learning Targets:**
- To apply the area and perimeter formulas for rectangles in real world and mathematical problems. For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.

**Introduction (5-10 minutes):**
Open a discussion relating to a scenario of a farmer who has to fence off a sheep pen because the sheep keep escaping. Have students suggest how to measure for new fencing. Lead the discussion to the idea that the perimeter is the distance all around a field or any polygon. Now relate to a field where the grass has become so poor that it has to be replaced. Have students suggest how to measure for new grass. Lead the discussion to the idea that the area is the interior of the field. Explain that the area is the interior of a field or any figure.

**Middle (15-20 minutes):**

Students have come across perimeter and area in Grade 3 and should already be familiar with the method of calculating these. It should be possible to cover both areas easily in one 50-minute lesson, but if students are insecure about these concepts it may be better to split this into two lessons, one on perimeter and one on area.
Guided teaching:

- Draw a rectangle on the board something like this:

  6 yards
  3 yards
  3 yards
  6 yards

Ask students to suggest ways that if this were a family room, the owner could calculate the measurement of the perimeter. Look for answers that suggest adding the lengths of each of the sides: $6 \text{ yards} + 3 \text{ yards} + 6 \text{ yards} + 3 \text{ yards} = 18 \text{ yards}$

- Look at the page on calculating perimeter by addition in the student textbook.

- Using the same rectangle, ask students if they can see a way to work out the perimeter that involves multiplying. This is something they have done in Grade 3, but may need reminding. The rectangle has two sides which are 3 yards long. It has two sides which are 6 yards long. So we could work it out like this: $(2 \times 3) + (2 \times 6) = 18 \text{ yards}$ Or we could do it this way (which is just the same): $2 \times (3 + 6) = 2 \times 9 = 18 \text{ yards}$

- Look at the page on finding the perimeter by multiplication in the student textbook.

- Draw a rectangle on the board something like this:

  6 inches
  4 inches
  4 inches
  6 inches

Activity (20 minutes):

Individual Activity:

- Draw some rectangles on the board with measurements for students to calculate areas and perimeters.
- Have students work through the exercises in the textbook.

Extension Activity:

- Give students some examples of areas and perimeter to work out, which include halves in the edge length.
**Support**

**SEN:** Students may need to continue to draw out problems on grids for some time before they can fully understand the formula. Relate it to times tables: 3 rows of 4 squares is the same as 3 lots of 4 or 3 x 4.

**ELL:** Have students work with a partner to help them understand the language used in the word problems.

**Summary:** (5 minutes)
- Review how to find a perimeter and an area.

**ELL Support**

Have students tell you the definition of perimeter and area. Build an array out of cubes and ask what the perimeter is and what the area is. Do this enough times that they understand that to find the perimeter you add the lengths of all the sides and for area you multiply the length of the two sides. Work through several of the Student Exercise sheets to be sure they understand what it is they are to do.

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**Teacher Assessment Notes:**

<table>
<thead>
<tr>
<th>Names/Initials</th>
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<table>
<thead>
<tr>
<th>Students exceeding objectives:</th>
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</table>

<table>
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<th>Students yet to achieve objectives:</th>
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<table>
<thead>
<tr>
<th>Students Absent:</th>
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</table>
Classroom Activity:

Handy Hint

Think of area and perimeter as a fenced field.

Think of the perimeter as the fence.  
Think of the area as the grass.

The fence is the perimeter and the area is the grass.

Finding the Perimeter by Addition

The perimeter is the distance all around a figure.
Look at this rectangle:

```
<table>
<thead>
<tr>
<th>6 inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 inches</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>3 inches</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>6 inches</td>
</tr>
</tbody>
</table>
```

You can find the distance around this figure by adding:

6 inches + 3 inches + 6 inches + 3 inches = 18 inches

You have added the lengths of all the sides together.

Look at this square:

```
<table>
<thead>
<tr>
<th>3 inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 inches</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>3 inches</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>3 inches</td>
</tr>
</tbody>
</table>
```

Finding a perimeter by addition:
You can find the distance around this figure by adding:

3 inches + 3 inches + 3 inches + 3 inches = 12 inches

You have added the lengths of all the sides together.

Classroom Activity:

Finding the Perimeter by Multiplication

A rectangle has 2 equal lengths and 2 equal widths.

To find the perimeter of a rectangle, add the lengths to the widths.

```
5 in
+ 4 in
---
9 in
```

To find the perimeter of a square, simply multiply the length of the side by the number of sides.

```
3 in
---
3 x 4 = 12 in
```

Multiply 3 in x 4 sides = 12 in
(3 x 4 is the same as 3 + 3 + 3 + 3 = 12)
**Student Exercise:**

Put a check mark in the correct box.

A square handkerchief measures 6 inches by 6 inches.
What is the perimeter of the handkerchief?

20 in  
12 in  
24 in  ✓
30 in  

A square table has 4 sides that are 2 ft long.
What is the perimeter of the table?

10 ft  
8 ft  ✓
20 ft  
18 ft  

The classroom has two sides of 20 feet and two sides of 15 feet.
What is the perimeter of the classroom?

30 ft  
40 ft  
60 ft  
70 ft  ✓

**Teacher Tip**

Ask a volunteer student to come up and help you do the first problem and resolve it. Then ask students to do the next problem and try to answer all of the problems on the next page. Choose a student for each question and work through their answer, correcting any misconceptions. Focus them on the multiplication approach.
### Student Exercise:

#### A square has sides of 2 inches. What is the area of the square?

<table>
<thead>
<tr>
<th>Square Inches</th>
<th>Four square inches</th>
<th>Six square inches</th>
<th>Eight square inches</th>
<th>Ten square inches</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td><img src="checkmark.png" alt="Check" /></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### A rectangle is 5 meters long by 2 meters wide. What is the rectangle's area?

<table>
<thead>
<tr>
<th>Square Meters</th>
<th>Seven square meters</th>
<th>Ten square meters</th>
<th>Fourteen square meters</th>
<th>Twenty-four square meters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td><img src="checkmark.png" alt="Check" /></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

#### A rectangle measures 12 yards by 3 yards. What is the area of the rectangle?

<table>
<thead>
<tr>
<th>Yard Measurement</th>
<th>One hundred twenty-three square yards</th>
<th>Seven square yards</th>
<th>Thirty-six square yards</th>
<th>Thirty square yards</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td><img src="checkmark.png" alt="Check" /></td>
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</tr>
</tbody>
</table>

#### A rectangle measures 6 centimeters by 7 centimeters. What is the area of the rectangle?

<table>
<thead>
<tr>
<th>Centimeter Measurement</th>
<th>Forty-two square centimeters</th>
<th>Twenty-four square centimeters</th>
<th>Sixty-seven square centimeters</th>
<th>Twenty-one square centimeters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td><img src="checkmark.png" alt="Check" /></td>
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</tr>
</tbody>
</table>

#### A rectangle measures 15 inches by 5 inches. What is the area of the rectangle?

<table>
<thead>
<tr>
<th>Inch Measurement</th>
<th>Twenty-five square inches</th>
<th>Twenty square inches</th>
<th>One hundred fifty square inches</th>
<th>Seventy-five square inches</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td><img src="checkmark.png" alt="Check" /></td>
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</tr>
</tbody>
</table>
Student Exercise:

The window in my family room has an area of 30 square feet. It is 6 feet high. How wide is it? Write a multiplication equation using a letter to represent the unknown factor for each problem.

5 feet ☑ 6 feet ☐ 15 feet ☐ 20 feet ☐

Answer: 6 x a = 30 square feet. Students may use any letter for these answers.

The fireplace is 3 feet wide and has an area of 9 square feet. How high is it?

27 feet ☐ 24 feet ☐ 6 feet ☐ 3 feet ☑

Answer: 3 x b = 9 square feet.

The rug in front of the fire has an area of 20 square feet. It is 5 feet long. How wide is it?

2 feet ☐ 3 feet ☐ 4 feet ☑ five feet ☐

Answer: 5 x c = 20 square feet.

The game board has an area of 4 square feet. It is 2 feet wide. How long is it?

1 foot ☐ 3 feet ☐ 18 inches ☐ 24 inches ☑

Answer: 2 x d = 4 square feet.

My yard is a perfect rectangle. It is 20 meters long and has an area of 300 square meters. How wide is it?

10 meters ☐ 15 meters ☑ 20 meters ☐ 30 meters ☐

Answer: 20 x h = 300 square feet.

4.MD.3 - Apply the area and perimeter formulas for rectangles in real world and mathematical problems. For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.

Student Exercise:

Mr. Kiamura needs to buy some new fencing for his field. The field measures 50 feet by 40 feet.

What length of fencing does he need?

_________________________________________ 180 feet

He needs to buy some grass seed now, but to work out how much seed he needs, he needs to know the area of the field.

What is the area of the field?

_________________________________________ 2,000 square feet

Pla is remodeling her living room. The room measures 6 meters by 8 meters. She needs to order some new flooring for the room. How much flooring will she need?

_________________________________________ 48 square meters

Pla is adding a decorative border all around the room. What length of tile will she need?

_________________________________________ 28 meters
Common Misconceptions:
- Make sure that students recognize which unit of measurement they need to use in different situations.
- Students may use rulers and other measuring tools incorrectly.
- Make sure that students measure with a ruler by placing the object or line to be measured at zero on the ruler.
- Make sure that students are accurate when drawing lines with a ruler.

In the Classroom:
- Give students lots of practical examples to explore.
- Ask students to discuss their answers with you and other students.
- Make sure that students understand how they are to convert measurements.
- Explain to students that there are two systems of measurement in operation:
  - The U.S. system of measurement is the more traditional system for measurement and has been in use for a long time.
  - The metric system is used widely around the world and is based on measurements of tens, hundreds, and thousands.
- Students should be encouraged to draw a picture and model a problem which will help them to reason an answer.

In the Home:
- Talk about units of measurement in relation to household items.
- Point out the measurement intervals on scales, jugs, rulers etc.
- Look for opportunities to discuss quantities on bottles and containers: bath-time, baking, at the gas station, etc.
- Practice using the vocabulary.
- Refer to quart bottles and liter bottles, rather than just bottles.
- Refer to the quantity on the label: pound of sugar, rather than a bag of sugar. This way children learn to make associations with weights and measures.
STEM Learning Cycles

STEM projects provide project-based, career-targeted challenges related to specific standards.
STEM Learning Cycles

A typical teacher lesson plan.
Clear, concise with step-by-step instruction and clear output visuals.
STEM Learning Cycles

A student’s view.

Inviting, Fun and mathematically sound

5. Add up the price of all the parts on your Build Sheet.

Total cost of the parts____________________

Selling price of the mini chopper____________________
STEM Learning Cycles

Higher level thinking and problem solving

DAPIC

**Define:** Try to figure out exactly what is wrong.

**Assess:** Come up with lots of ideas about how to fix it and decide which idea is best.

**Plan:** What do you need and how are you going to do it?

**Implement:** Make the part or fix the problem.

**Communicate:** Share your ideas with others in your group. What do they think?
Crafting Projects - Understanding Mathematics Through Art

Students access learning through fun action based, and fully inclusive crafting and reader activity book materials.

Individual Activity
Lucy says:
1. Die cut the letters to title a poster “Perimeter”.
2. Die cut one rectangle.
3. Glue the title, centered, onto a piece of background paper.
4. Glue the rectangle three inches below the title.
5. Measure the sides.
6. Die cut the measurements and label each side.
7. Use multiplication. Calculate the perimeter.

Answer: \((2 \times 3) + (2 \times 4) = 14\) inches

You now know the perimeter of your die shape. This is important to the company who makes them as they need to package them to ship to customers.
Universal Access – RTI student population

In large classrooms a diverse population can often benefit from activity based math, no student book.
**Tier I:** A strong, evidence-based, Tier 1, core curriculum, grounded in the Common Core standards, and rich in which multi-modal, differentiated instruction and STEM and Arts activities, to promote universal access, cross curriculum connections, problem solving, and higher order thinking.

**Tier II:** Focused tutorials, Archway, AVIMBA ABC and 123 games, Interactive Homework system and reteach and applied math libraries all provide integrated Tier II strategic intervention materials for teachers and students.
Crafting Projects - Modeling Mathematics

Students access learning through fun action based, and fully inclusive crafting and reader activity book materials.

Teachers and students can watch the wonderful aligned videos
Student Workbooks

Review exercises by standard provide wonderful resources to use before examinations
Activity Readerbooks

The thematic activity reader books engage students with fun characters and stories.
Amelia Rose Explores

STEM Activity Readerbook linking Mathematics, Science and Literacy with Crafting activities. Uses Invicta Education Manipulatives.
TPS provide parent ready materials including a series of mathematics with literacy activities.

Use expanded notation to represent numbers (e.g., 3,206 = 3,000 + 200 + 6).

- To help students understand what expanded notation means, it is best to have them build the numbers with base ten blocks on place value boards. After building the numbers, they can actually see and be able to write the value of each digit. This is especially important when a number has a "0" in a place value. They can visually see that there are no blocks in the column and thus does not need to be noted when writing expanded notation, but that a 0 must be used when writing the standard notation of a number.

Find the sum or difference of two whole numbers between 0 and 10,000.

- Have students build the two numbers to be added with base ten blocks on place value boards. Have them combine the base ten blocks from the two numbers and determine how many they have altogether. Be sure they are changing groups of 10 unit cubes for 1 ten rod, and 10 ten rods for 1 hundred flat. They should also draw the two numbers they are adding together (use squares to represent 100, a line to represent 10, and an x to represent each unit cube) and the total. Students need to write a number sentence to show the math they have done. At the beginning of the year students need to build, draw, and write the number sentence to help reinforce what they learned the previous year.

- The "partial products" methods is good for students who no longer need to build the numbers, but are still having problems with place value. Students record the sum of two numbers but do no "trading" (see example below).

```
797
+278
15 (7 + 8)  
160 (90 + 70)  
900 (700 + 200)  
1,075
```
Mathematics in the Real World
Financial Literacy

A component focusing on the link between Mathematics and Finance
Assessment Database

Houses over 3,700 assessment questions categorized by grade, standard and student ability level
Focus Tutorial

recommended for use for students who really struggle with traditional textbook learning, either due to low EL skills or other special educational needs.

Classroom Activity:

Finding a perimeter by addition:

You can find the distance around this figure by adding:

3 inches + 3 inches + 3 inches + 3 inches =

You have added the lengths of all the sides together.
Interactive Homework System

students can complete their assigned homework activities wherever there is an internet connection; no excuse for lost papers anymore!

Student Exercise:

The after school science club have been offered two locations to have their sessions. One room is a rectangle shape, the other a square room. The members of the club decide to choose the room with the largest perimeter. Calculate the perimeter of each room and confirm which room they choose.

Room A

4 m

6 m

4 m

6 m

(2 lengths) 2 x 6 = 12 m

(2 widths) 2 x 4 = m

m + m = m

TPS Publishing Inc.
AVIMBA School and Family Circle

a totally secure system within which families can work with their children and other families to provide additional support to mathematics and science learning, K - 5
Exploring the Idea I

1. Study the three number systems below, using the Hindu-Arabic number system as a guide. How are they similar? How are they different?

<table>
<thead>
<tr>
<th>Hindu-Arabic</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
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<tr>
<td>Babylonian</td>
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<td></td>
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<tr>
<td>Mayan</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roman Numbers</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV</td>
<td>V</td>
<td>VI</td>
<td>VII</td>
<td>VIII</td>
<td>IX</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

2. Your archeological group has found the following stone in one of their digs. How can you decipher these symbols? How does this system work? Use the following information to help you.

- a. represents 72
- b. represents 602
- c. represents 1,201
- d. represents 40,261
- e. represents 258,261

Using your calculator and the table above, try to figure out how the Babylonian number system works. What are the characteristics of the system? What might be the purpose of the symbols? How do you represent zero in this system? Write a paragraph in your journal describing the DAMIC method you used to solve this problem.

3. Another archeological group found the following stone with these Mayan numbers. Decipher the code. (Note: The place value for the Mayan System is vertical.) How does the use of spacing in the Mayan System compare to the use of spacing in the Babylonian System?)
After School Math Club

Creative activities where students develop Mathematics skills whilst completing fun activities.
After School PSHE Club

Arts cross curricular projects cover personal, social and health education topics, including Math links.
Literacy and Reteach Library

A library of resources which link Mathematics and Literacy as well as providing further reteach opportunities.
Didax Manipulative Kits

Provides a variety of activities to connect the use of manipulatives to written methods, including by grade Common Core kits.
Blackline Master

Reproducible master sheets for commonly used items like charts and tables plus Benchmark tests and literacy.

Common Core State Standards Content — Level 3

Relationships in Geometry

Area = \pi r^2

Solve for \( r \) (radius): 16 inches

Solve for \( d \), showing all your work: 8 inches

3. There are relationships between the gray parallelogram and the clear triangle. Use the information you know to represent and solve the problems below.

Write a formula (using \( b \) and \( a \)) to represent the perimeter of the parallelogram:

\[ 2a + 2b \]

Solve for perimeter:

\[ 2(3.2) + 2(4.5) = 6.4 + 9 = 15.4 \text{ cm} \]

What is the area of the triangle? Show all your work, including the formula using the variables \( b \) and \( h \).

\[
\begin{align*}
\text{area} &= \frac{1}{2} b \times h \\
\text{area} &= \frac{1}{2}(1.5) \times 4
\end{align*}
\]
Professional Development

All Professional Development is provided by Illinois State University Center for Mathematics, Science and Engineering. One of the largest producers of teachers in the nation. CeMaST is one of the first STEM Centers in the U.S.A.

- Elements of the Creative Core Curriculum program require a paradigm shift for some educators. It is based more on the teacher’s ability to ask leading questions than provide predetermined answers. The effective educator will be skilled at managing and facilitating the educational environment.
Does It Work?

How do we learn?

Youtube video and then try it ourselves

Traditional instruction:

• 85% of dropouts say they drop due to Algebra I
• leads to 50% or more of our college students taking remedial courses
• People say they “hate math” or are “not good in math”

Research and Experience
Thank you

TPS Publishing Inc.