Core-Plus Mathematics, Course 2

MA.912.A.5.In.a **Use numbers to represent ratios in real-world situations.**

Class Ratios Ask groups of students to model real-world situations, such as the number of girls studying French compared to the total number of girls. Then have students determine a ratio that represents each situation.

MA.912.A.5.In.b **Solve problems involving ratios in real-world situations.**

Height and Shadow Length On a sunny day, measure the height of several volunteers. Then have students go outside and measure the shadow length of one or two of the volunteers. Upon returning to the classroom, use the data to set up ratios and calculate the lengths of the shadows of the remaining volunteers. Time permitting, return outside and confirm class calculations by measuring the length of the shadows.

MA.912.A.5.Su.a **Use simple ratios represented by physical and visual models to solve real-world problems.**

Class Ratios Have students write ratios that represent descriptions, such as those listed below.

- The number of girls compared to the total number of students.
- The number of boys compared to the total number of students.
- The number of girls compared to the number of boys.
- The number of boys compared to the number of girls.
- The number of students wearing [item] compared to the total number of students.

MA.912.A.5.Pa.a **Identify a simple ratio, such as 1 to 2, to solve real-world problems.**

Two-Color Counters Allow students to use two-color counters when solving real-world problems involving simple ratios, such as the one below. Repeat with other real-world problems.

FAVORITE FOODS Ichiko asked 5 of his friends to name their favorite cafeteria lunch. Three of the five students chose pizza as their favorite lunch. Write a ratio that represents the students who chose pizza. $\frac{3}{5}$

To model this problem using two-color counters, students display 5 counters, with the red side facing up for all 5 counters. Then students flip 3 counters to display the yellow side in order to represent the students who chose pizza. Next, students write a ratio comparing yellow counters to total number of counters.

Repeat with other scenarios and ratios.

MA.912.A.7.In.a **Use information from tables and other visual models to plot numbers on a line graph representing real-world situations.**

Determine Minimum and Maximum Values and Scales When graphing data, guide students through the process of using a table's input-output values to determine the minimum and maximum values that should be displayed on the axes, as well as an appropriate scale for each axis.

The table below shows the miles an athlete runs each week to train for a marathon.

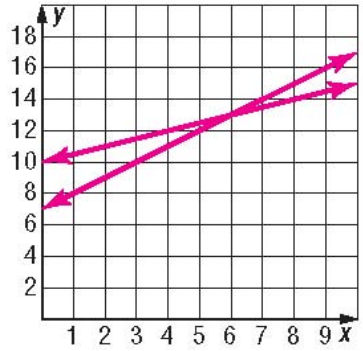
Week	Week 1	Week 2	Week 3	Week 4	Week 5
Miles	5	12	18	21	25

Before graphing this data, have students discuss the minimum and maximum values they need to display on both axes, as well as appropriate scales. Mention that horizontal and vertical axes can show different intervals of values and can have different scales. For the table shown above, the horizontal axis could run from 0 to 6, with a scale of 1, and the vertical axis could run from 0 to 25 or 30, with a scale of 5. Once the axes have been numbered, students are ready to plot points.

Mention that it is helpful to choose maximum values greater than the table values when the graph will be used for making predictions.

MA.912.A.7.In.b Compare quantities from real-world situations represented on a graph and explain similarities and differences.

Carnival Rides The graph below represents the cost for purchasing carnival rides at two fairs. The line $y = 0.5x + 10$ represents the cost for riding x number of rides at a school fair. The line $y = x + 7$ represents the cost for riding x number of rides at a county fair.



Show the graph to the students and ask questions comparing ride costs, such as the ones below.

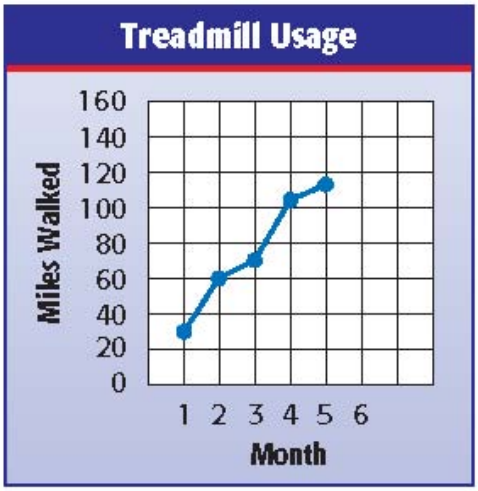
- **For how many rides do the companies charge the same amount? What is the charge?** 6 rides, $13
- **For how many rides does the school fair charge less money?** more than 6 rides
- **For how many rides does the county fair charge less money?** fewer than 6 rides
- **How are the graphs similar? How are they different?** Similar: They both share the point (6, 13). Both lines are increasing. Different : The rates at which costs increase are different, as indicated by different slopes.

MA.912.A.7.In.c Use equations involving addition, subtraction, multiplication, and division of whole numbers to solve real-world problems.

Verbal and Symbolic Representations Lead a discussion to develop a class list of words that identify addition, subtraction, multiplication, and division, as well as the equals sign. Then reference the list as you help students translate real-world problems to equations.

MA.912.A.7.Su.a **Identify information from tables and simple line graphs representing real-world situations.**

Interpret Line Graphs Display the line graph shown below.

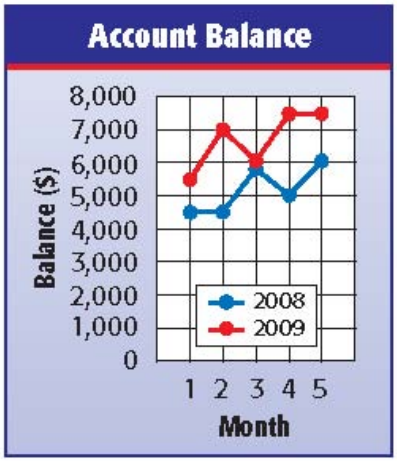


Ask students the following questions.

- **What does the line graph represent?** treadmill usage
- **What do the numbers on the horizontal axis represent?** the month
- **What do the numbers on the vertical axis represent?** the number of miles walked
- **What is the number of miles walked in Month 1? Month 2? Month 3? Month 4? Month 5?** about 30; 60; about 70; about 105; about 115
- **Between which two months do the miles walked show the biggest increase?** Months 3 and 4
- **Between which two months do the miles walked show the smallest increase?** Months 2 and 3; Months 4 and 5

MA.912.A.7.Su.b **Compare quantities from similar real-world situations represented on a graph.**

Interpret Double-Line Graphs Display the line graph shown below.



Ask students the following questions.

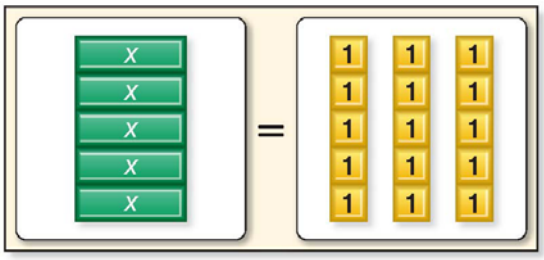
- **What does the double-line graph represent?** account balances in 2008 and 2009
- **What do the numbers on the horizontal axis represent**? the month
- **What do the numbers on the vertical axis represent?** the balance in dollars
- **How are the two years represented?** blue represents 2008, red represents 2009
- **What is the balance for Month 1 in 2008? In 2009?** $4500; $5500
- **For which month are the 2008 and 2009 balances almost equal?** Month 3
- **How does the 2008 Month 4 balance compare to the 2009 Month 4 balance?** The 2009 Month 4 balance is $2500 greater than the 2008 Month 4 balance.
- **How can you describe the overall relationship between the 2008 and 2009 balances?** The 2009 balance is greater for all 5 months, although the balances are almost equal at Month 3.
- **How can you describe the overall relationship between the 2008 and 2009 balances?** The 2009 balance is greater for all 5 months, although the balances are almost equal at Month 3.

MA.912.A.7.Su.c **Solve number sentences (equations) using visual and physical models representing real-world situations.**

Manipulatives and Diagrams Allow students to use manipulatives and/or draw diagrams to solve equations that represent real-world problems. A real-world problem and its algebra tile solution are shown below.

TOYS Mrs. Hiroshi bought 15 toys to give to her 5 nieces and nephews. Each child will receive the same number of toys. How many toys will each child receive?

1. Model $5x = 15$.



2. There are 5 x-tiles. Arrange the tiles into 5 equal groups.

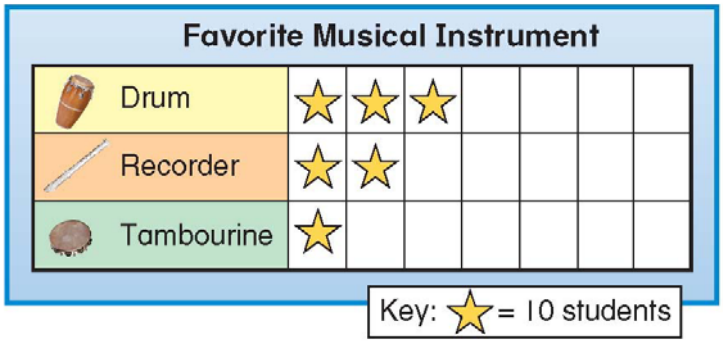
3. Count the tiles paired with one x-tile.
   $x = 3$

3 toys per child

MA.912.A.7.Pa.a **Compare the number of objects, pictures, or symbols used in a three-category pictograph to identify which groups have more or less.**

Pictographs Display the pictograph shown below. Have students determine which musical instrument was selected by more (or the most) students. Then have students determine which musical instrument was selected by less (or the least) students. most: drum, least: tambourine

The activity can be extended by having students use the key to determine how many students selected each type of musical instrument. drum: 30 students, recorder: 20 students, tambourine: 10 students



Repeat with other pictographs.

MA.912.A.7.Pa.b **Solve problems by joining or separating quantities to 10 using objects, pictures, or symbols.**

Manipulatives Allow students to use manipulatives and/or draw diagrams when solving problems involving joining and separating, such as the ones below. Have students present solutions to the class.

SCHOOL SUPPLIES Julio needs 2 folders for his language class, 3 folders for his mathematics class, 1 folder for his science class, and 2 folders for his history class. How many folders does Julio need altogether? 8 folders

SNACK PACKS Mrs. Harrington bought 10 snack packs for her children's lunches. Last week, she used 3 of the snack packs. This week, she used 4 more snack packs. How many snack packs does Mrs. Harrington have left? 3 snack packs

MA.912.A.10.In.a **Use a variety of problem-solving strategies, such as finding key information to determine the correct operation and using graphic representations for numbers, to solve real-world problems.**

Problem-Solving Strategies Have students use the four-step problem solving plan when solving real-world problems.

Step 1: Students **understand** key words and identify unnecessary information.

Step 2: Students **plan** to solve the problem using a problem-solving strategy. Strategies include:

Act it out.
Solve a simpler problem.
Draw a diagram.
Make a model.
Make a table.
Use a graph.
Work backward.
Use an equation or formula.

Step 3: Students **solve** the problem using the selected strategy.

Step 4: Students **check** the solution using a different strategy.

MA.912.A.10.In.b **Use estimation strategies, such as rounding, grouping, and comparing, to determine if answers are reasonable.**

Estimation Work with students to estimate using several different strategies. Teach them how to round fractions to 0, $\frac{1}{2}$, or 1, how to round whole numbers to the largest place value, and how to round decimals to the nearest whole number. Provide students with real-world problems, such as the one below. Encourage them to determine if their answer is reasonable by estimating the answer and comparing it to their exact answer.

GUITAR PRACTICE Maria practiced her guitar for $\frac{1}{4}$ hour on Monday, $\frac{5}{8}$ hour on Tuesday, and $\frac{8}{12}$ hour on Wednesday. So far this week, how much time has Maria spent practicing?

Exact answer: $\frac{1}{4}+\frac{5}{8}+\frac{8}{12}=\frac{37}{24}=1\frac{13}{24}$

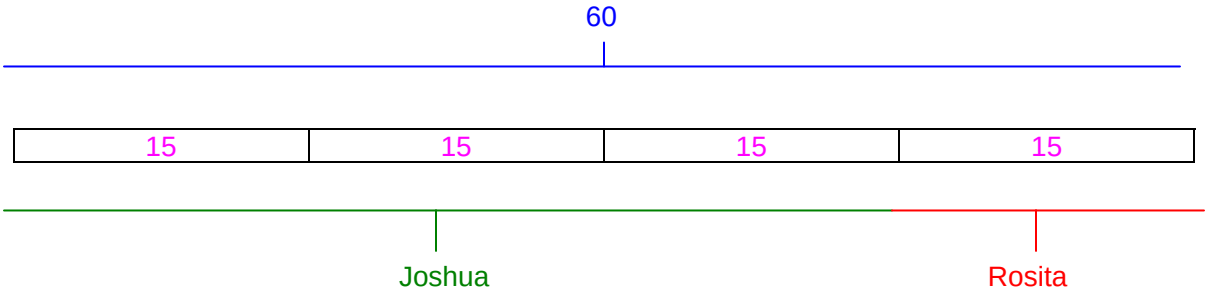
Estimated answer: 0 + $\frac{1}{2}$ + 1 = $1\frac{1}{2}$

The exact answer is the very close to the estimate.
The exact answer is reasonable.

MA.912.A.10.Su.a **Use visual and physical models as strategies for solving real-world mathematical problems.**

Bar Diagrams Have students use bar diagrams when solving real-world problems, as shown in the following example.

HOBBIES Joshua and Rosita collect trading cards. Joshua has three times as many trading cards as Rosita. They have 60 cards altogether. How many cards does Joshua have? 45 cards



MA.912.A.10.Su.b **Use a variety of problem-solving strategies, such as finding key information to determine the correct operation and using graphic representations for numbers, to solve real-world problems.**

Problem-Solving Strategies Many times students want to rush through real-world problem-solving exercises. Encourage students to follow the four-step problem-solving strategy, and emphasize the importance of checking their answers.

Step 1: Students **understand** the information provided in the exercise, as well as the information needed to supply the correct response.

Step 2: Students **plan** to solve the problem using a problem-solving strategy. Strategies include:

Act it out.
Solve a simpler problem.
Draw a diagram.
Make a model.
Make a table.
Use a graph.
Work backward.
Use an equation or formula.

Step 3: Students **solve** the problem.

Step 4: Students **check** their answers.

Technology provides a valuable resource that students can use to check their answers. Many times students understand the problem and are able to plan their strategy. However, mathematical errors can lead students to provide incorrect answers. Allowing students to check their calculations, using technology such as calculators, can empower them to find their errors and build confidence in their ability to solve word problems.

MA.912.A.10.Pa.a **Solve real-world problems involving quantities to 10, matching the result to the correct answer to determine accuracy.**

Classroom Routines Establish a procedure for solving real-world problems using play money. Provide opportunities for students to "earn" the play money for "a job well-done." Give them one dollar at a time for following established procedures, such as turning in their work on time, following classroom rules, or showing respect to other students. Once students have earned ten dollars, allow them to trade the money for a privilege, such as being the class leader for a week. Ask students to use a money chart to match their "dollars" to the number of dollars required to earn the classroom privilege.

Adapt this idea in accordance with classroom and school requirements in order to meet the needs of the students.

MA.912.G.2.In.d **Use physical and visual models to show that a change in orientation, such as turns (rotations), slides (translations), and flips (reflections), does not change the size or shape of a polygon.**

Geoboards Students can use geoboards to create reflections. They can create figures that are mirror images of each other on both sides of one line of pegs.

Grid Paper Students can also use grid paper to draw reflections of objects. They can use the squares of the grid paper to help them correctly draw a reflected object.

Cut-Outs Another alternative is to use construction paper cut-outs to understand reflections, translations, and rotations. Have students trace the object as it is, then flip it, rotate it, slide it (respectively), and trace it again. Ask students to compare the drawings.

MA.912.G.2.In.e **Find the perimeter and area of rectangles to solve real-world problems.**

State Areas Provide students with a map of the United States. Determine the scale of the map. Using square tiles, have students create and write a plan to determine the area of a state. Students should then use their plans to find the area of a state. States that resemble parallelograms, such as Colorado and Tennessee, may be easiest to determine area.

MA.912.G.2.In.f **Identify the effects of changes in the lengths of sides on the perimeter and area of rectangles using visual models to solve real-world problems.**

Measure It Distribute a set of rectangles of various sizes cut from paper or cardstock. Cut each side length so that it is easily measure to the nearest half-inch or half-centimeter. Have students work together in pairs or small groups. Then tell students to measure each rectangle and record the perimeter and area. Ask them to explain how changes in the side lengths affect the measures of perimeter and area.

MA.912.G.2.Su.d **Match identical polygons in different positions including turns (rotations), slides (translations), and flips (reflections), using physical models.**

Real-World Reflections Provide students with pictures from architecture from around the world that use reflected shapes in their design. Students should trace the shapes onto a sheet of paper and draw a line of reflection.

MA.912.G.2.Su.e **Solve real-world problems involving perimeter using visual models.**

Grid Paper Provide students with grid paper and a real-world problem, such as the one shown below. Allow students to draw a diagram using the grid paper. Remind students that the perimeter is the distance around a shape or region. Have them count the length of each side to determine the perimeter. Then, ask them to write a number sentence that could be used to find the perimeter.

FENCING Marla wants to place a fence around the outside of her vegetable garden to keep the rabbits from eating her carrots. Her rectangular garden is 4 feet long and 3 feet wide. How many feet of fencing will Marla need to build her fence?
14 feet; 4 + 3 + 4 + 3 = 14

MA.912.G.2.Su.f **Solve real-world problems to find the area of a rectangle to identify total square units using visual models.**

Grid Paper Provide students with grid paper and a real-world problem, like the one shown below. Allow students to draw a diagram using the grid paper. Remind students that the area is the interior region of a figure. Have them count the number of grid squares to determine the area. Then, ask them to write a number sentence that could be used to find the area.

GARDENS Marla wants to plant a vegetable garden in her backyard. Her rectangular garden is 4 feet long and 3 feet wide. What is the area of Marla's garden? 12 square feet; 4 × 3 = 12

MA.912.G.2.Su.g **Identify the effect of changes in the lengths of sides of rectangles on perimeter using physical and visual models.**

Measure It Distribute a set of rectangles of various sizes cut from paper or cardstock. Cut each side length so that it is easily measured to the nearest half-inch or half-centimeter. Have students work together in pairs or small groups. Then tell students to measure each rectangle and record the perimeter. Ask them to explain how changes in the side lengths affect the measures of perimeter.

Rectangles drawn onto grid paper can also be used to modify this activity.

MA.912.G.2.Pa.b **Match two or more objects with polygons based on a given feature in real-world situations.**

Manipulative Storage Different math manipulatives often come in various shaped storage containers. For instance, rectangular fraction strips are often stored in rectangular boxes and memo cubes are comprised of square sheets of paper. Encourage students to compare the lid or the base of the storage container with the two-dimensional shape of the math manipulative. Consider using other storage containers and household items as additional examples.

MA.912.G.2.Pa.c **Identify objects, pictures, or signs with polygons in real-world situations.**

Safety Walk Take a short walk around the school campus. Point out various signs that are used to promote safety as you walk. Encourage students to describe the shape of the signs and include information about the number of sides of each sign.

Show students photos from magazines, newspapers, or other printed media. Encourage students to compare the shapes of various street and road signs, such as yield signs, stop signs, county road markers, and no parking signs. Ask students to identify the shape of each sign.

MA.912.G.3.In.a **Identify four-sided shapes (quadrilaterals), such as square, rectangle, rhombus, and diamond, in the environment using visual models.**

Classify Quadrilaterals Provide a table to students that helps them to classify and name quadrilaterals.

Quadrilateral	Sides	Angles
Trapezoid	one set of parallel sides	
Parallelogram	two sets of parallel sides	
Rhombus	two sets of parallel sides; four congruent sides	
Rectangle	two sets of parallel sides	four right angles
Square	two sets of parallel sides; four congruent sides	four right angles

Distribute a variety of cut-out quadrilaterals cut from paper or cardstock. Ask students to classify the quadrilaterals based on the information from the chart.

Finally, ask students to identify different quadrilaterals found in the classroom. Students should draw these objects, classify the quadrilateral, and explain the classification in a math journal.

MA.912.G.3.In.b **Use tools to identify shapes as having one set of opposite sides parallel and equal in length (parallelograms).**

Materials: cut-out parallelograms, rulers, protractors

Classifying Angle Relationships On the board, draw two parallel lines with a transversal passing through them. Label each angle formed with a letter. Have the students work in pairs to explain how to identify the corresponding and vertical angle relationships in the diagram. Tell each group to write a sentence labeling each pair of angles. For more proficient students, ask them to identify the alternate interior and alternate exterior angles. Encourage them to write their sentences using the congruency symbol.

Next, have students work in pairs or small groups. Distribute a set of various parallelograms. Use a table to compare the attributes of various parallelograms.

The rulers should be used to measure the length of each side of each figure. Ask students to use transversals to determine if two sides of a figure are parallel. Students should use the protractors to measure the alternate, corresponding, and vertical angles. Once students have determined if sides are parallel and equal in length, they can determine the classification of each parallelogram, based on these measurements.

MA.912.G.3.Su.a **Identify four-sided shapes (quadrilaterals), such as square, rectangle, and diamond, in the environment using physical and visual models.**

Classify Quadrilaterals Provide a table to students that help them to classify and name different quadrilaterals.

Quadrilateral	Sides	Angles
Square	two sets of parallel sides; four congruent sides	four right angles
Rectangle	two sets of parallel sides; two sets of congruent sides	four right angles
Diamond (Rhombus)	two sets of parallel sides; four congruent sides	

Distribute a variety of cut-out paper or cardstock quadrilaterals. Ask students to classify the quadrilaterals based on the information from the chart.

Finally, ask students to identify different quadrilaterals found in the classroom. Students should draw these objects, classify the quadrilateral, and explain the classification in a math journal.

MA.912.G.3.Su.b **Determine whether shapes are rectangular or square by measuring the sides.**

Materials: rulers, a variety of cut-out rectangles and squares
paper or cardstock, work mats

Classify Quadrilaterals Distribute a ruler, a variety of cut-out rectangles and squares cut from paper or cardstock, and a work mat to each pair of students. Students should measure and label the length of each side on the paper figures. Ask each pair to classify the quadrilaterals based on lengths of the sides. Finally, ask students to sort the figures on the work mat. They should place the rectangles on the left side of the mat and the squares on the right side of the mat.

MA.912.G.3.Su.c **Identify shapes with one set of opposite sides parallel and equal in length (parallelograms) in the environment using physical and visual models.**

Parallelograms Use geoboards to present the concept of parallelograms. Students can explore how to create parallelograms of various sizes and shapes, such as squares, rectangles, and rhombi. Allow students to draw diagrams in their math journals of the shapes they created on the geoboards. Each figure should be labeled according to its name and its attributes. Students can compare these diagrams to real-world objects in the classroom in order to classify them.

MA.912.G.3.Pa.a **Identify objects, pictures, or signs with four-sided shapes (quadrilaterals), such as square, rectangle, or diamond.**

Classify Quadrilaterals Distribute a variety of cut-out paper or cardstock quadrilaterals, including squares, rectangles, and rhombi. Ask students to describe the similarities and differences between these figures.

Finally, ask students to identify different quadrilaterals found in the classroom. Students should draw a picture of these objects, and describe the shape of the object in a math journal. Ask students to number the sides of each object that was drawn in their math journals.

MA.912.G.3.Pa.b **Match two or more objects with four-sided shapes (quadrilaterals), based on a given feature, such as length of side or size of the area.**

Materials: rulers, a variety of cut-out rectangles and squares on paper or cardstock, real-world objects

Match Quadrilaterals Distribute a ruler, a variety of cut-out rectangles and squares, and several real-world objects to each pair of students. Use real-world objects, such as a self-stick note or a greeting card. Make sure that one of the cut-out shapes is congruent to each real-world object.

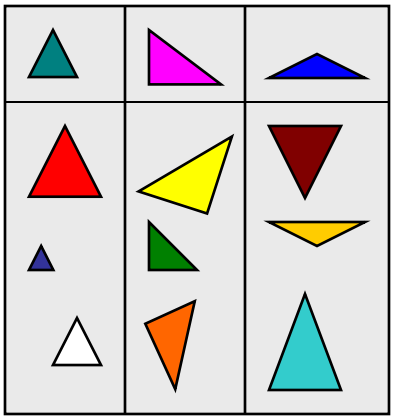
Students should compare the length of each side of the paper figures with the length of each side of various real-world objects using a ruler. Ask students to match the cut-outs to a real-world object based on lengths of the sides.

As an extension to this activity, students can also calculate the area of different cut-out figures and real-world objects. Have them identify which figures and objects have equivalent area. Use at least one pair that has an equal area, but a different shape, such as a square that is 4 inches by 4 inches, and a rectangle that is 2 inches by 8 inches.

MA.912.G.4.In.a **Discriminate between triangles that have equal sides and angles (equilateral), triangles that have two equal sides and two equal angles (isosceles), and triangles that have one right angle (right triangle) using visual and physical models.**

Materials: protractors, rulers, triangle cut-outs, sorting mat

Equal Lengths Provide students with various cut-out triangles, including equilateral, isosceles, and right triangles, made from paper or cardstock.



Ask students to use rulers to measure the length of each side of the cut-out triangles. Students should use protractors to measure each angle of the triangles. Allow them to write their measurements on the triangles. Finally, have students sort the figures into three categories; equilateral, isosceles, and right. Provide a sorting mat with one column for each type of triangle. Students can glue the cut-out shapes to the correct column of their sorting mat.

Triangles Create a set of three index cards. On each card, draw an image of an isosceles triangle, an equilateral triangle, and a scalene triangle. Arrange students into pairs and give each group a geoboard. Have one student select an index card. The other student makes the figure on the geoboard. Point out that finding an angle measure on a geoboard is difficult, so try to classify the figures by side lengths and parallel sides.

MA.912.G.4.In.b **Identify the height (altitude) in equilateral and isosceles triangles using physical and visual models.**

Number Cubes Have students measure the height of equilateral and isosceles triangles using number cubes. Provide construction paper cutouts of equilateral and isosceles triangles of various sizes. They should line the cubes up along the altitude and count the number of cubes to determine the measurement. The can use grid paper or the corner of a rectangular piece of paper to create a right angle from the vertex of the correct angle to the midpoint of the correct side. Students can compare the sizes of triangles based upon the number cube measurements.

MA.912.G.4.In.c **Measure sides and angles of triangles to determine whether triangles are the same size and shape (congruent) or the same shape, but different size (similar).**

Materials: index cards, flexible rulers

Comparing Size Prepare a set of index cards by drawing or printing triangles of different sizes on each card. Give groups of 3 or 4 students a set of index cards and flexible rulers.

- Have 2 students each select a card. Ask them to decide whether the figures are the same or different in size.
- Have the students use rulers and protractors to measure the triangles to see if they are correct. Tell them to keep track of whether their guesses were correct or incorrect.

MA.912.G.4.Su.a **Discriminate between triangles that have equal sides and angles (equilateral) and triangles that have two equal sides and two equal angles (isosceles) using physical models.**

Geoboards Draw or print pictures of isosceles and equilateral triangles on index cards, write the name of the triangle on the card. The student turns over a card with the name of a figure and says the name. The student models the figure on a geoboard. Students should then compare the figure on the card to the model on the geoboard to see if they match.

MA.912.G.4.Su.b **Measure the length of sides of triangles to verify if two triangles are the same shape and size (congruent).**

Materials: centimeter rulers, pairs of triangle cut-outs

Congruent Triangles Provide students with various pairs of cut-out triangles. Be sure to include pairs of right triangles, isosceles triangles, scalene triangles, and equilateral triangles. If possible, choose triangles that can be measured to a whole centimeter. Have students use centimeter rulers to measure each side of each triangle. Encourage students to mark the measurements along the correct side of each triangle. Finally have students compare the lengths of the sides in order to determine which triangles are congruent.

MA.912.G.4.Pa.a **Identify objects, pictures, or signs with a triangle in real-world situations.**

Materials: paper, scissors, glue, magazines

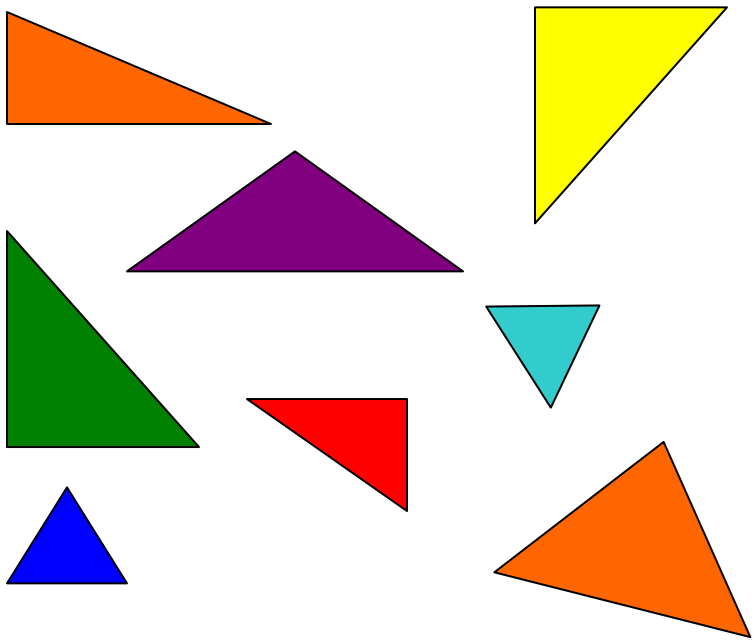
Shape Search

- Have students look through magazines to find pictures of objects containing triangles.
- When students find a triangle, have them cut it out and glue it on their paper.
- Encourage students to explain their choices and allow them to share their work with a partner.

MA.912.G.4.Pa.b **Match two or more objects with a triangle based on a given feature, such as the length of the side or the size of the angle, in real-world situations.**

Side Lengths and Angle Measures Students work in pairs to match triangles according to side lengths and angle measures. Provide each pair of students with a set of triangles, such as those shown below. You may wish to include right triangles in the set. Some triangles have equal side lengths while other triangles have equal angle measures.

Instruct students to find triangles that have equal side lengths. Students can cut out figures and physically match up congruent sides or measure triangle side lengths with a ruler. Students using a ruler can be challenged to find sides with specified lengths. Then instruct students to find triangles with equal angle measures.



MA.912.G.5.In.b **Identify examples of different kinds of right triangles in the environment using physical models.**

Materials: protractors, right triangle cut-outs, real-world right triangle examples

Right Triangles Distribute protractors, real-world right triangle examples, and cut-outs of various types of right triangles. Use common right triangles that are easily measured, such as a triangle with angles that measure 30°-60°-90° and 45°-45°-90°.

Emphasize to students that the paper cut-outs are good manipulatives for comparing angles. However, to find exact angle measures, student should use the protractors. Show students how to properly use the protractors and paper cut-outs to measure and compare angles.

Once students are comfortable measuring and comparing angles, have them use these tools to evaluate different real-world examples. Provide various examples, such as sketches of roof trusses, children's toys, or decorating tiles. Ask students to identify the type of right triangle by measuring or comparing the measures of the angles.

MA.912.G.5.Su.b **Locate the right angle of right triangles and side opposite the right angle (hypotenuse) in the environment.**

Materials: grid paper, rulers, right triangle cut-outs

Right Triangles Distribute rulers, grid paper, and cut-outs of various sizes of right triangles. Have students use these tools to identify the right angle and the hypotenuse of the triangles.

Emphasize to students that grid paper is a good manipulative for identifying angles as acute, obtuse, or right. Show students how to align one corner of a grid box with each vertex of the triangle, and how to align one side of the triangle with a line of the grid (which includes the vertex). Students can use the grid boxes to determine which angle is the right angle.

Once students have identified the right angle, have them find the hypotenuse. Provide a model of a right triangle which shows the right angle and the hypotenuse labeled. Ask students to identify the hypotenuse and measure its length using the ruler. Use common right triangles that are easily measured, such as a triangle with sides that measure 3 inches, 4 inches, and 5 inches.

MA.912.G.5.Pa.a **Identify objects, pictures, or signs with a right triangle.**

Materials: right triangle cut-outs, real-world right triangle examples

Right Triangles Emphasize to students that the paper cut-outs are good manipulatives for comparing angles. Point out that each right triangle has exactly one right angle. Encourage students to identify and mark each right angle using the appropriate symbol.

Once students are comfortable identifying right angles, have them evaluate different real-world examples. Provide various examples, such as sketches of roof trusses, children's toys, or decorating tiles. Ask students to identify a right triangle by finding the right angle.

MA.912.G.5.Pa.b **Match objects, pictures, or signs with a right triangle by a given feature, such as length of sides.**

Materials: rulers, a variety of cut-out triangles on paper or cardstock, photos of real-world objects

Match Triangles Distribute a ruler, a variety of cut-out triangles, and several photos of real-world objects to each pair of students. Use photos of real-world objects, such as a bridge's trusses. Make sure that one of the cut-out shapes is congruent to each photo.

Students should compare the length of each side on the paper figures with the length of each side of various photos of real-world objects using a ruler. Ask students to match the cut-outs to a photo based on lengths of the sides.

MA.912.G.6.In.a **Identify and describe the circumference, arc, diameter, and radius of circles using physical and visual models.**

Materials: protractors, rulers, circle cut-outs

Explore Vocabulary Draw a circle on the board and ask a student volunteer to identify the diameter of the circle with arrows and blue chalk. Have another student identify the radius of the circle with arrows and red chalk. Finally have another student identify the circumference of the circle with arrows and green chalk. Name points along the circumference of the circle and explain how to name arcs of a circle. Show how to use pi (π) and the other vocabulary words to find the circumference of a circle. It may be helpful to put the information in a chart and post it in the classroom for students to reference.

Have students work in pairs or small groups. Allow students to explore circle concepts with cut-outs made from paper or cardstock. Color-code the cut-outs so that the measures of each color can be easily checked. For example, distribute congruent red circles to each group. Red circles will have a radius of equal measure (such as 3 inches) and *A*, *B*, and *C* marked along the same points of the circle's circumference. Therefore, all arcs on each red circle will be congruent. Have students record the measurements for each circle in their math journals.

MA.912.G.6.In.b **Measure the diameter and radius of circles to solve real-world problems.**

Circles for Partners Arrange students into pairs and give each pair a circular real-world object, such as a CD, a storage container, or a dinner plate. Instruct the pair to find the center of the circle and to measure the diameter and the radius. Provide a real-world situation in which knowing these measurements would be helpful, such as creating a case for the CD or finding space in a cabinet for the storage container or the dinner plate.

Advise students that you will be collecting their results, and tell them to record their work in their math journals. When all pairs are done and the work is collected, ask for volunteers to share their work. Ask students to explain their results.

MA.912.G.6.In.c **Determine the relationship between a semi-circle and a circle.**

Semi-Circles Arrange students into pairs and give each pair a circular real-world object, such as a CD, a storage container, or a dinner plate. Students should trace the object onto an appropriately-sized piece of paper.

Instruct the pair to find the center of this circle by using a ruler. The center is the point that is equidistant to any point on the circle.

After they have found the point, ask them to draw a line passing through the center from one edge of the circle to the opposite edge. This is called the diameter.

Finally ask students to cut out the circle and to cut the circle into two equal parts by cutting along the diameter. Each piece is called a semi-circle. Students can check their work by comparing the halves. The halves should be equal in size.

MA.912.G.6.Su.a **Identify the circumference, arc, and diameter of circles in real-world situations.**

Materials: protractors, rulers, circle cut-outs

Explore Vocabulary Draw a circle on the board and ask a student volunteer to identify the diameter of the circle with arrows and blue chalk. Have another student identify the circumference of the circle with arrows and green chalk. Name points along the circumference of the circle and explain how to name arcs of a circle. Show how to use pi (π) and the other vocabulary words to find the circumference of a circle. It may be helpful to put the information in a chart and post it in the classroom for students to reference.

Have students work in pairs or small groups. Allow students to explore circle concepts with cut-outs made from paper or cardstock. Color-code the cut-outs so that the measures of each colored circle can be easily checked. For example, distribute congruent red circles to each group. Red circles will have a diameter of equal measure (such as 3 inches) and *A*, *B*, and *C* marked along the same points of the circle's circumference. Therefore, all arcs on each red circle will be congruent. Have students record the measurements for each circle in their math journals.

MA.912.G.6.Su.b **Compare the circumference and diameter of circles in real-world situations.**

Materials: yarn, scissors, rulers, real-world circular objects

Circles Arrange students into pairs and give each pair a circular real-world object, such as a CD, a storage container, or a dinner plate. Instruct the pair to find the center of the circle and to cut a piece of yarn that is equal to the measure the diameter. Next, have students use the yarn to find the distance around the outside of the circle (the circumference). Finally, ask students to use rulers to measure the length of the diameter and the length of the circumference. Allow students to round measurements to the nearest centimeter.

Ask students to measure several different circular objects and to record their measurements in a table. They should compare the measurements of the diameter and circumference and note any patterns they find. Students should notice that the circumference is about 3 times the length of the diameter.

MA.912.G.6.Su.c **Identify examples of semi-circles in the environment.**

Semi-Circles Provide students with cut-out paper circles. Instruct students to fold the circles in half. Each piece is called a semi-circle. Students can check their work by comparing the halves. The halves should be equal in size. Allow students to cut the circles into semi-circles by cutting along the fold lines.

Have them use the semi-circle cut-outs to find semi-circles in the environment. Provide several photo examples of semi-circles, such as a house with a semi-circular glass window above the front door.

MA.912.G.6.Pa.a **Identify objects, pictures, or signs with a circle in real-world situations.**

Circle Rhymes Students may benefit from learning or making up a rhyme about circles. For example, you may teach students to say, “No sides, one curved line, circles are all might fine.” Have students use this rhyme to remind them of the attributes of a circle when they are identifying real-world objects that are in the shape of a circle.

MA.912.G.6.Pa.b **Match two or more objects with a circle based on a given feature, such as size of the distance around the outside (circumference) or inside (area) in real-world situations.**

Materials: yarn, scissors, rulers, real-world circular objects

Circles Arrange students into pairs and give each pair a circular real-world object, such as a CD, a storage container, or a dinner plate. Instruct the pair to use the yarn to find the distance around the outside of the circle (the circumference). Next, ask students to use rulers to measure the length of the circumference. Allow students to round measurements to the nearest centimeter. Ask students to compare several different objects and to record which objects have the same circumference in a table.

MA.912.G.8.In.a **Use problem-solving strategies including visual and physical models and tools, for solving real-world problems involving geometry concepts and skills.**

Real-World Solutions Provide students with a variety of real-world situations which include geometric concepts and skills. They may be asked to determine the preferred shape of a vegetable garden, the area of a garden, or the amount (or volume) of top soil they might need for a small vegetable garden. If possible, allow students to use the measurement to plant a small garden outdoors or use a large plastic basin to create an indoor herb garden.

MA.912.G.8.Su.a **Use given problem-strategies, including using visual or physical models, for solving real-world problems involving geometry concepts and skills.**

Real-World Solutions Provide students with a variety of real-world situations which include geometric concepts and skills. They may be asked to determine the preferred shape of a vegetable garden, the area of a garden, or the amount (or volume) of top soil they might need for a small vegetable garden. If possible, allow students to use the measurement to plant a small garden outdoors or use a large plastic basin to create an indoor herb garden.

MA.912.G.8.Pa.a **Solve real-world problems involving objects with two- and three-dimensional shapes and match the result to the correct answer to determine accuracy.**

Real-World Solutions Provide students with real-world problem-solving opportunities, such as the exercise below.

CRAFT KITS Damion is building a bird house for the backyard. The craft kit comes with two square boards, and 4 rectangular boards. What three-dimensional shape is his birdhouse?

Allow students to use square and rectangular paper cut-outs and tape to assemble a model of the birdhouse. After students have had a chance to complete their birdhouse model, provide a rectangular prism and ask them to compare their model to the rectangular prism.

MA.912.S.2.In.a **Identify when data from part of a group (sample) should not be used to make predictions regarding the whole group.**

Survey for Data Challenge students to create a survey for their classmates with at least five choices. Students should conduct their surveys and write the results in a table. Have them make predictions from the data about what the results might be if they surveyed a bigger group, such as the school. Remind students to consider why the data might not be useful in making predictions regarding the whole population, such as all students at their school. For example, when students are asked to name their favorite class, the results may change according to the grade level of those surveyed versus the entire population of the school. Allow students to share their predictions with classmates.

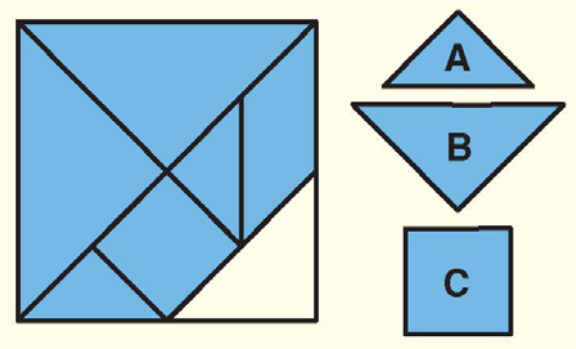
MA.912.S.2.Su.a **Identify problems with inaccurate counting when collecting data and use strategies to correct mistakes.**

Vote for Data Challenge students to create a voting ballot for their classmates with at least five choices. Students should collect the data and write the results in a table using tally marks. Have students double-check their results by comparing the number of students responding to each choice with the total number of students who cast a ballot. Discuss the problems that could occur from inaccurately reporting voting results, such as misleading information or unfavorable results. News reports about real-world issues with voting can provide a valuable context to the discussion.

MA.912.S.2.Pa.a **Identify a missing part of objects, pictures, or symbols in real-world situations.**

Tangram Puzzle

Step 1: Distribute or display the following diagram and list. Read the list of tangram parts with students.



2 large triangles
2 small triangles
1 medium triangle
1 square
1 parallelogram

Step 2: Have students identify the listed figures in the tangram until they discover the missing piece.

Step 3: Ask students to explain why figures A and C do not qualify as the medium triangle.

Step 4: Have students write “turn and slide,” “flip and slide,” or “slide” to describe how to fit triangle B into the tangram.

MA.912.T.2.In.a **Compare the length of the straight sides in a right triangle with the length of the side opposite the right angle (hypotenuse) by measuring the sides.**

Materials: grid paper, rulers, right triangle cut-outs

Right Triangles Distribute rulers, grid paper, and cut-outs of various sizes of right triangles. Use common right triangles that are easily measured, such as a triangle with sides that measure 3 inches, 4 inches, and 5 inches.

Emphasize to students that grid paper is a good manipulative for identifying angles as acute, obtuse, or right. Show students how to align one corner of a grid box with each vertex of the triangle, and how to align one side of the triangle with a line of the grid (which includes the vertex). Students can use the grid boxes to determine which angle is the right angle.

Once students have identified the right angle, have them find the hypotenuse. Provide a model of a right triangle which shows the right angle and the hypotenuse labeled. Ask students to identify the hypotenuse and measure its length using the ruler. Next, have students measure the length of the other two sides (the legs). Students should compare the length of the hypotenuse with the lengths of the other two sides of each triangle. Have them note any patterns they find. They should determine that the hypotenuse is always longer than either of the other two legs of a right triangle.

MA.912.T.2.Su.a **Measure the sides of a right triangle to determine which side is the longest.**

Materials: grid paper, rulers, right triangle cut-outs

Right Triangles Distribute rulers, grid paper, and cut-outs of various sizes of right triangles. Use common right triangles that are easily measured, such as a triangle with sides that measure 3 inches, 4 inches, and 5 inches.

Emphasize to students that grid paper is a good manipulative for identifying angles as acute, obtuse, or right. Show students how to align one corner of a grid box with each vertex of the triangle, and how to align one side of the triangle with a line of the grid (which includes the vertex). Students can use the grid boxes to determine which angle is the right angle.

Once students have identified the right angle, have them find the hypotenuse. Provide a model of a right triangle which shows the right angle and the hypotenuse labeled. Ask students to identify the hypotenuse and measure its length using the ruler. Next, have students measure the length of the other two sides (the legs). Students should compare the length of the hypotenuse with the lengths of the other two sides of each triangle. Have them note any patterns they find. They should determine that the hypotenuse is always longer than either of the other two legs of a right triangle.

MA.912.T.2.Pa.a **Recognize a right triangle in objects, pictures, or signs in real-world situations.**

Materials: paper, scissors, glue, magazines, protractor or grid paper

Shape Search

- Have students look through magazines to find pictures of objects containing right triangles.
- When students find a right triangle, have them cut it out and glue it on their paper. They can use a protractor or grid paper to determine which angle is the right angle.
- Encourage students to explain their choices and allow them to share their work with a partner.