Geometry

Sample Assessments for Big Ideas, per the CPS Geometry Planning Guide, 2012-2013

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Big Idea: Congruence, Proof, and Constructions

Assessment: Using Tools of Geometry

1) Using the tools of geometry students will construct the following concurrent points of an acute scalene triangle. They will then prove the following:

   a. the incenter is the center of the inscribed triangle.
   b. the circumcenter is the center of the circumscribed circle.
   c. the centroid divides the median into two segments with a ratio of 2:1

   Optional - the centroid divides the triangle into six triangles with equal area. (Note: students must know the area formulas for triangles)

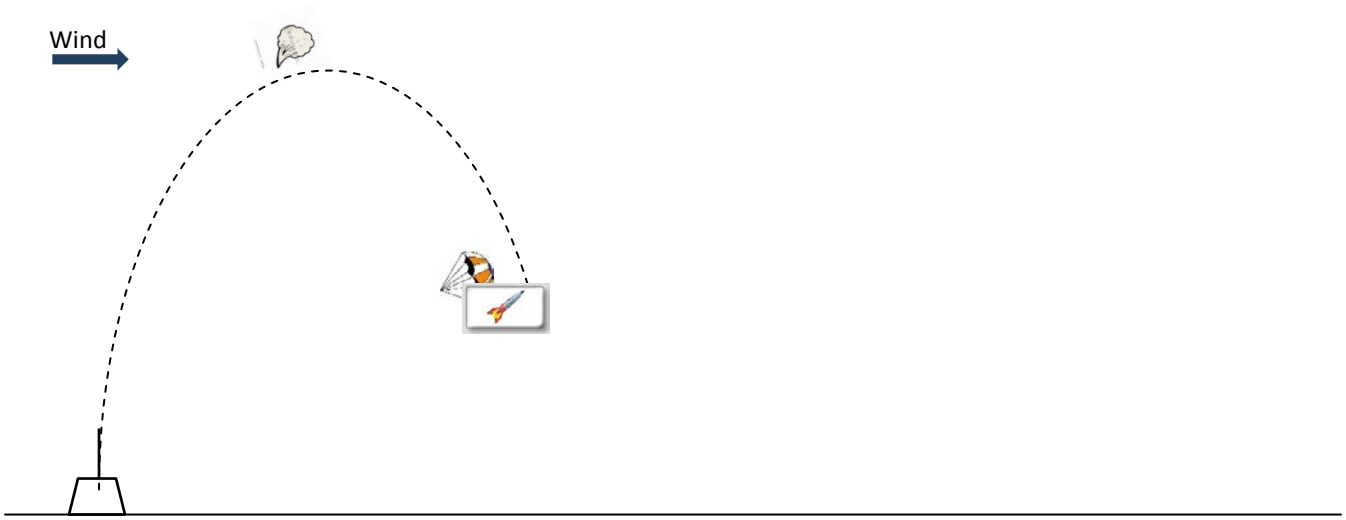
2) Students should be able to argue that any two congruent figures in the plane, geometric and Cartesian, can be mapped onto each other with no more than three transformations.

Big Idea: Similarity & Congruence

Assessment: Montrose High Rocket Club

Montrose High's Rocket Club has recently studied some right triangle mathematics so they will be able to determine how high each rocket goes into the sky. The picture below shows the expected flight path of the rocket.

Create a plan and explain how the club could apply their knowledge of right triangle trigonometry to accurately determine the greatest vertical distance the rocket achieved. The models used always release a puff of smoke at the highest point in their flight.



Plan:

_____

_____

_____

_____

_____ _____

Explanation of how the plan will accurately determine the rockets height:

_____

_____

_____

_____

_____ _____

Big Idea: Extending to Three Dimensions

Assessment: Dream House

Designing and building your dream home project to include: a scaled blueprint, a model construction of the blue print with an appropriate scale. Your dream house must include two or more of these shapes: cone, pyramid, cylinder and sphere. Calculations of all surface areas and volumes of each open space including the shapes chosen must be included with the model of your dream home. Calculations to include: the amount of paint needed to paint all the walls and ceilings, assuming a gallon of paint will cover 200 ft^2, the cost of roofing materials assuming $53.50 per square yard of roof coverage, floor coverings assuming an average of $73.75 per square yard, and the amount of paint it would take to paint your model in gallon units.

Big Idea: Connecting Algebra and Geometry Through Coordinates

Assessment: Neighborhood Map

You have been learning about properties of lines, how to use the distance formula on the coordinate plane, and how to apply the results to the solution of problems.

In this "Neighborhood Map" assignment, you will be engaged in the following scenario:

In an effort to help teenagers who are new to the area, you are planning to make a map of your neighborhood which shows the distance to several of your favorite places. Below are the places you are going to include on your map.

- You will place your map on a coordinate grid and let your home be located at the origin.
- You know your school is 6 blocks due east of your home and your best friend's house is 8 blocks due north of the school.
- State Avenue runs diagonally through town. Your house is located at the corner of First Street and State Avenue and your best friend lives at Pine Street and Sate Avenue.
- The Pizza Shoppe, located on State Avenue, is halfway between your house and your best friend's house.
- The Community Center is located on Maine Street; another street runs diagonally across town and is parallel to your street, State Avenue. The Community Center is three blocks due west and 1 block due north of your home.

Using the above information you will need to complete the following:

1) Use graph paper to make your map.
2) For streets that run north/south or east/west, let one square on the grid represent one city block.
3) Write the coordinates of the school, your best friend's house, the Pizza Shoppe, and the Community Center.
4) Find the distance between the following locations.
    a) Your house and your best friend's house.
    b) Your house and the Pizza Shoppe.
    c) Your house and the Community Center.
    d) Your school and best friend's house.
5) Use your knowledge of coordinate geometry to **verify** that State Avenue and the street where the Community Center is located will not intersect.
6) Use your knowledge of coordinate geometry to verify that First Street and Pine Street are perpendicular.
7) Write an **informational letter** to the teens new to the area which summarizes the above information and includes:
    - all calculations,
    - the map, and
    - explanations about the formulas, calculations, or other methods used to complete the assignment.

Big Idea: Circles With and Without Coordinates

Assessment: Circular Reasoning

Level A

Janet and Lydia want to learn more about circles. They decide to measure different size circles that they can find. They measure the circles in two ways. One way is across a centerline of the circle. The centerline is called the diameter. Another way is around the outside of the circle. The distance around the outside of a circle is called the circumference.

Measure various size circles using either physical objects or the included page of circles. Measure both the circumference and diameter of each circle with a tape measure (paper or cloth tape). Create a table that compares the length of the diameter with the circumference of the circle. Measure at least five different size circles.

Diameter	Circumference

Compare the numbers between the two columns. What patterns do you see?

Explain any relationship you see between the length of the diameter and the circumference.

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Assessment: Circular Reasoning (continued)

Level B

Measure a tennis ball can. First measure the height of the can, from the top of the can to the bottom. Record the measurement.

Next, measure the circumference around the can. Be accurate with your measurements.

Compare the measurements.

Explain the relationship between the two measurements.

How does the number of balls in the can relate to the measurements and their relationship?

What other parts of the can or tennis balls can you measure and compare?

Describe the relationship of those measurements? How are they related?

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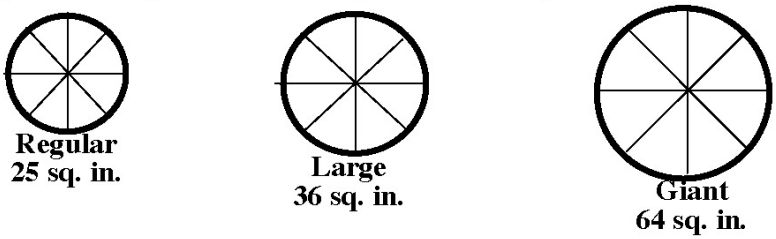
Assessment: Circular Reasoning (continued)

Level C

You work for a pizza parlor. You currently have three sizes of pizza: regular (area 25 square inches), large (area 36 square inches) and giant (area 64 square inches).



The storeowner has asked you to determine some information about the amount of pizza that is made.

How much bigger is the giant pizza than the large pizza in terms of area? How much bigger is the large pizza than the regular pizza in terms of area?

The owner sells a regular cheese pizza for $8.25. He wants to know what to charge for the large and giant sized pizzas. He wants to cover the cost of the ingredients and make a proportional amount of profit on the other two pizzas. What should he charge for a large and giant cheese pizza?

The owner sells pizza by the slice. He has been selling a large pizza by the slice for $1.35. Each pizza is cut into eight equal slices. The owner wants to know whether he has priced it right to make more money selling by the slice than the whole pizza. Explain to him, using mathematics, how his prices for the slices and the whole pizza compare.

Now the owner wants to cut each pizza into nine slices, instead of eight. How much smaller will the slices be? He is interested in comparing both the width (angle in numbers of degrees) and the area of each slice.

The owner wants to sell the nine slices at the same price as he did when the pizza was cut into eight slices. He wants to know how much more he will make cutting the pizzas into smaller slices. He wants to compare the prices of selling the nine slices individually with the price of selling an entire large pizza. He asks you to calculate and explain the difference in prices and amounts.

The owner also thinks he can save more money if he sells slices from regular sized pizzas instead of large sized pizzas. You cut both the regular and large pizzas into nine equal slices. How much larger is a single slice from a large pizza than that of a slice from a regular pizza? Explain your answer in terms of degrees of the angle and area of the slice.

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Assessment: Circular Reasoning (continued)

Level D

You are a quality controller for a barrel manufacturing company. Your company makes barrels of all different sizes. The company makes very large storage vats for vineyards. They even make very small barrels as earrings that are sold in the gift shop next to the factory. Without exception, the company makes every barrel the same way. They use wood supported with metal rings that go around the barrels. A computer controls the ring-making machine. The computer malfunctioned and made every ring, from the smallest for the earrings to the largest for the wine vats, larger than normal by exactly one foot. In other words, every ring your factory has turned out recently has a circumference that is twelve inches longer than the right size. Your boss has asked you to investigate this matter.

How does the altered rings compare to the original rings? How much bigger do the altered rings look in comparison to the rings on the barrels that they were designed to fit? How will the altered rings compare in size to the rings on the small barrels, like the earrings? How will the altered rings compare to the rings on the large barrels, like the wine vats?

What should the company do with all those altered rings? It would be very costly to dispose of them. Your boss has asked you to tell him what size barrels need to be made to use those rings. Are the barrels usable? What size would you have to make the new barrels in relationship to the original size barrels?

What conclusion can you draw from your findings? Can you explain your findings using mathematics? Why are the results what they are?

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Assessment: Circular Reasoning (continued)

Level E

Archimedes is considered one of the greatest mathematicians of all time. He lived in the Greek city of Syracuse, Sicily between 287 BC and 212 BC and is known for his work in many areas of mathematics and science.

Archimedes mathematical work includes inventing methods of calculating the area and volume of geometric objects, such as the circles, parabolas, cylinders, cones, spheres, hyperbolas and ellipses. He also spent time investigating a rational number approximation of π. The method he used to approximate π involved examining the size of many-sided polygons. Archimedes, as the story is told, drew a large circle on the floor of his apartment. He measured the diameter of the circle and called that distance one unit in length. Next he began to inscribe and circumscribe different size polygons, tangent to the circle. Archimedes would measure the perimeters of the polygons and average the two to approximate π. As the numbers of sides of the polygons were increased, the shaped of the polygon looked more like the circle. The polygons got closer and closer to being the size of the circle and perimeters became ever closer to the value of π. Using that method, he was able to calculate the approximation of π, correct to a value between 3 1/7 and 3 10/71.

How precise was his approximation of π? Give your answer in terms of the number of correct decimal places.

Estimate how many sides his final polygon needed to be to get a number that accurate? Explain your estimate.

Illustrate the method Archimedes used by drawing an interior regular polygon inscribed in a circle and an exterior regular polygon circumscribed about the same circle. Determine the perimeter of both polygons and show how π might be approximated.

Find the area of both polygons and compare the areas with that of the circle. Explain how the area formula is derived from the area formula of the polygon.

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π Problem of the Month Circular Reasoning π

Primary Version Level A

Materials: A picture of a circle, circular objects (i.e. counters, coins), the π-day picture, paper and pencil.

Discussion on the rug: (Teacher holds up a picture of a circle) "What is the name of this shape?" (Students respond to the question). (Teacher hands out circular objects) "These objects are shaped like a circle. Tell us about the shapes?" (Students explore the objects and describe the circles). (Teacher holds up a circle) "A circle is a special shape. Long ago people discovered the circle and tried to measure it. They found a special number called pi. Some people who like math celebrate circles on a special day, March 14. It is called pi day. Here is a picture of people having a picnic on pi day." (Teacher hands-out the picture of the π-day picnic).

In small groups: (Each student has the picture of the π-day picnic). "Look at the picture of the picnic. Find all the things in the picture that are shaped like a circle. Circle each shape you find." (Students answer the following questions).
How many things did you find that are shaped like a circle?
Name the things in the picture that are shaped like a circle.
(At the end of the investigation, have students either discuss or dictate a response to this summary question below.)
Explain how you decided which ones to circle.

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Assessment: Circular Reasoning (continued)

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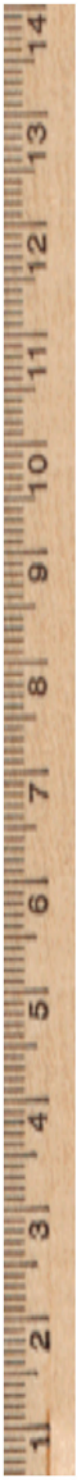
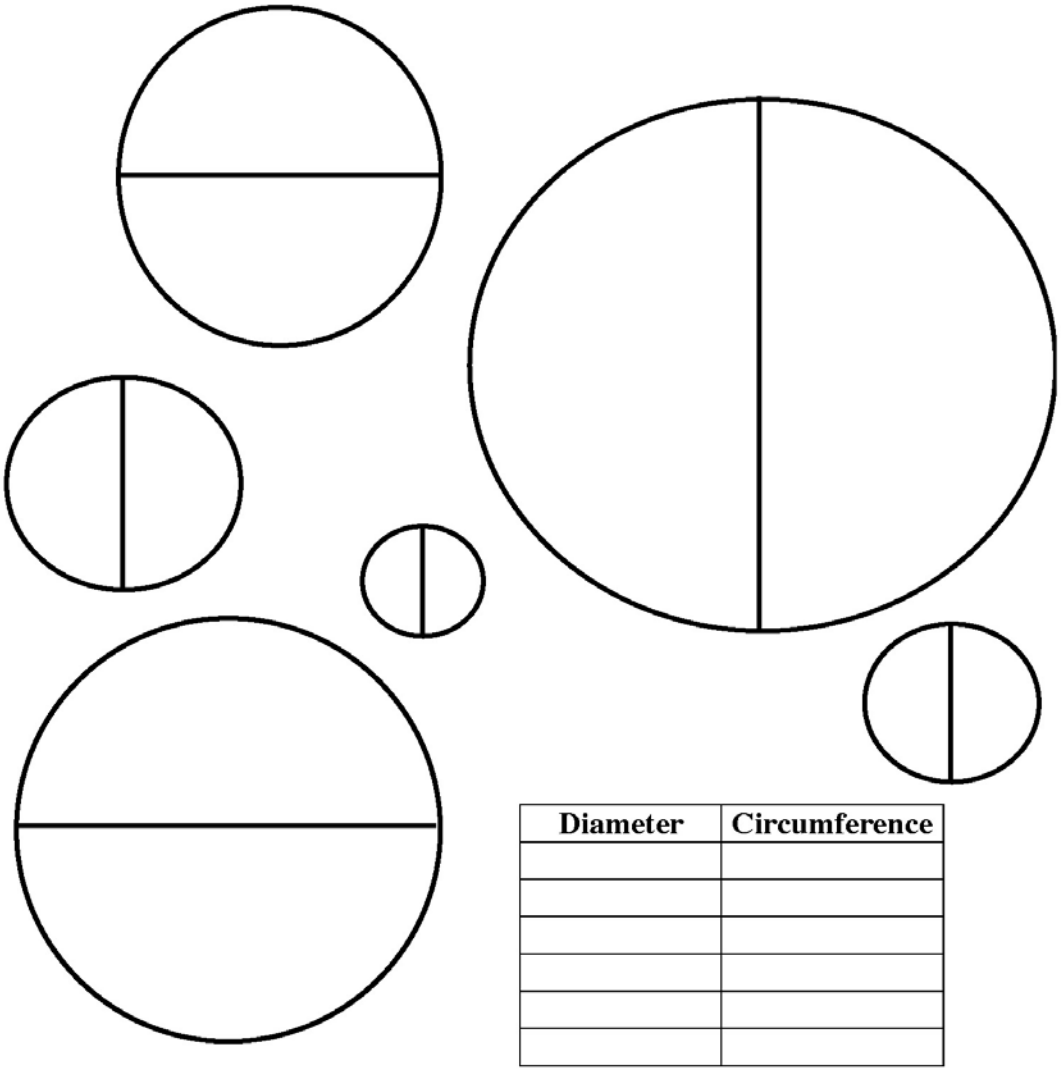
Assessment: Circular Reasoning (continued)





Diameter	Circumference

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