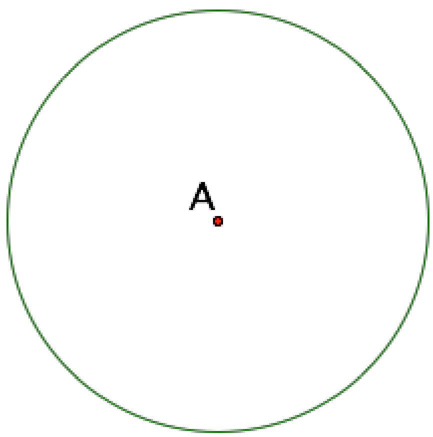
Name ______________________________ Date ________________

Lesson 1: Thales' Theorem

Exit Ticket

Circle A is shown below.

1. Draw two diameters of the circle.
2. Identify the shape defined by the endpoints of the two diameters.
3. Explain why this shape will always result.

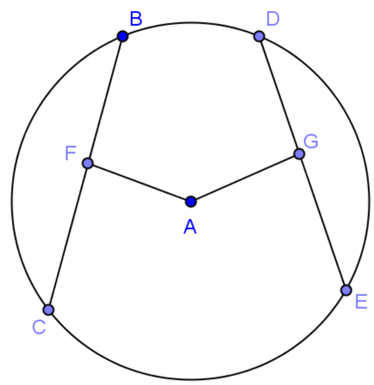


Name ______________________________ Date ______________

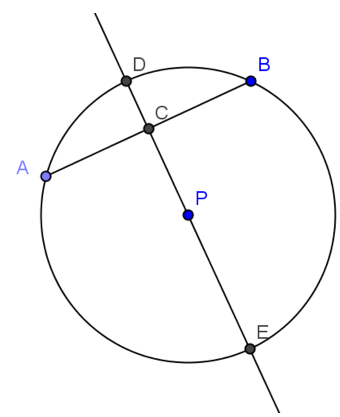
Lesson 2: Circles, Chords, Diameters, and Their Relationships

Exit Ticket

1. Given circle A shown, $AF = AG$ and $BC = 22$. Find DE.



2. In the figure, circle P has a radius of 10. $\overline{AB} \perp \overline{DE}$.



   a. If $AB = 8$, what is the length of AC?

   b. If $DC = 2$, what is the length of AB?

Graphic Organizer on Circles

Diagram	Explanation of Diagram	Theorem or Relationship

Name ______________________________ Date ______________

Lesson 3: Rectangles Inscribed in Circles

Exit Ticket

Rectangle $ABCD$ is inscribed in circle P. Boris says that diagonal AC could pass through the center, but it does not have to pass through the center. Is Boris correct? Explain your answer in words, or draw a picture to help you explain your thinking.

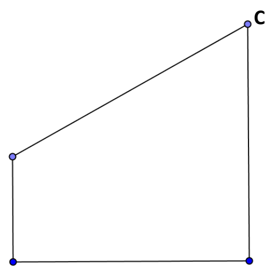
Name ____ Date____________________

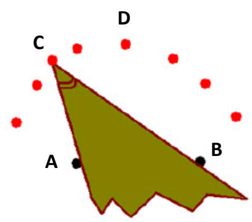
Lesson 4: Experiments with Inscribed Angles

Exit Ticket

Joey marks two points on a piece of paper, as we did in the Exploratory Challenge, and labels them A and B. Using the trapezoid shown below, he pushes the acute angle through points A and B from below several times so that the sides of the angle touch points A and B, marking the location of the vertex each time. Joey claims that the shape he forms by doing this is the minor arc of a circle and that he can form the major arc by pushing the obtuse angle through points A and B from above. "The obtuse angle has the greater measure, so it will form the greater arc," states Joey.

Ebony disagrees, saying that Joey has it backwards. "The acute angle will trace the major arc," claims Ebony.



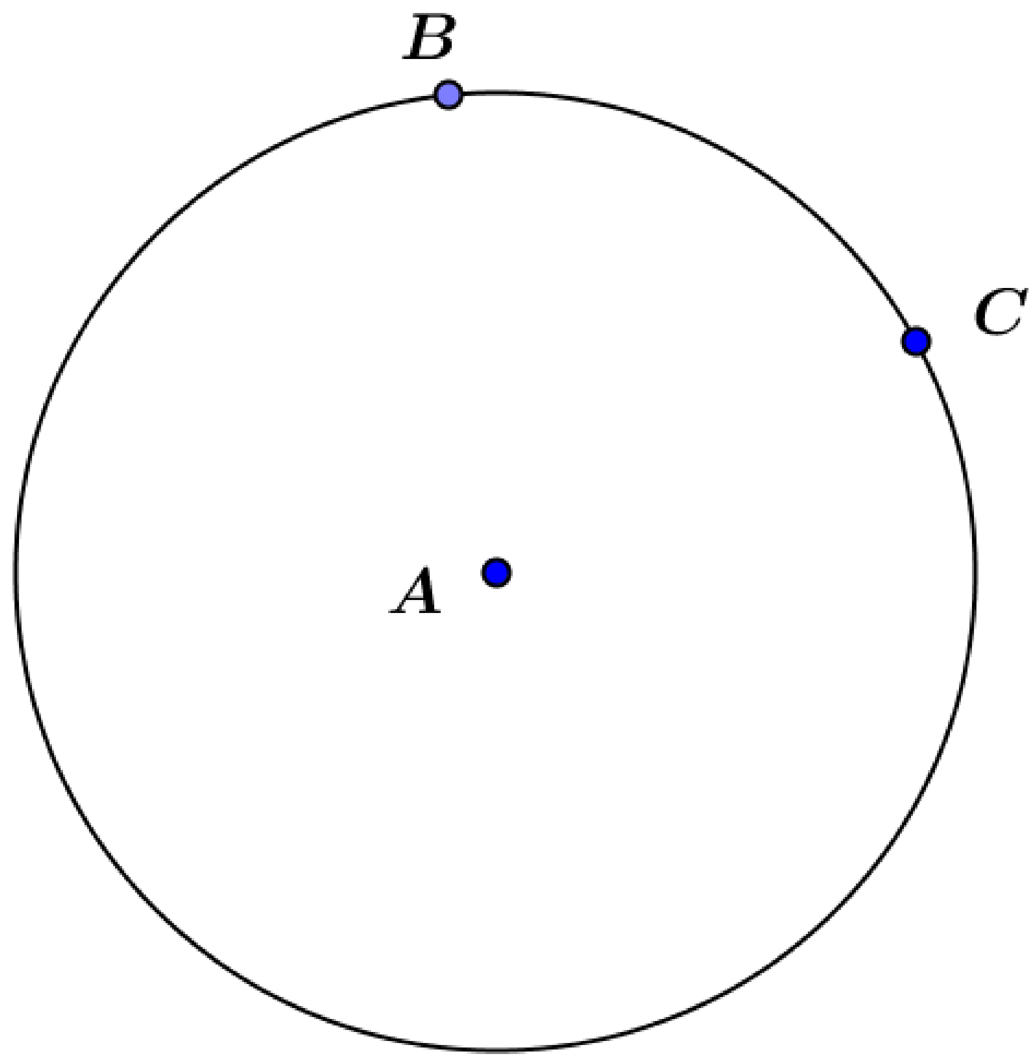


1. Who is correct, Joey or Ebony? Why?

2. How are the acute and obtuse angles of the trapezoid related?

3. If Joey pushes one of the right angles through the two points, what type of figure is created? How does this relate to the major and minor arcs created above?

Example 2

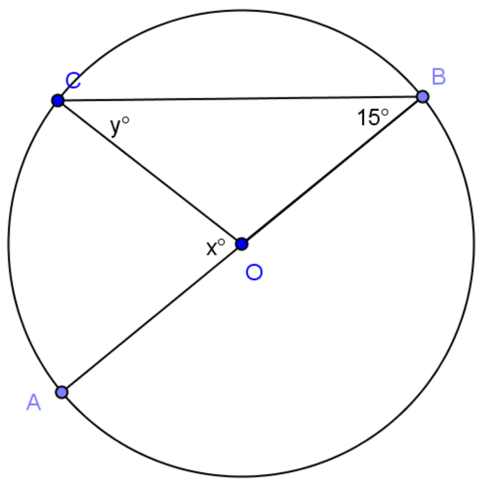


Name ________________________________ Date ________________

Lesson 5: Inscribed Angle Theorem and Its Applications

Exit Ticket

The center of the circle below is O. If angle B has a measure of 15 degrees, find the values of x and y. Explain how you know.

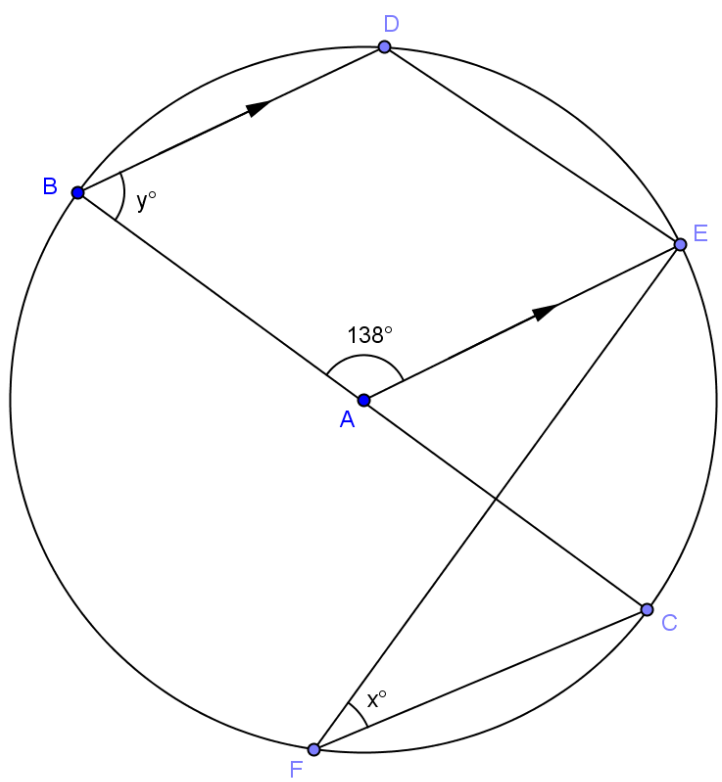


Name ____ Date ____________________

Lesson 6: Unknown Angle Problems with Inscribed Angles in Circles

Exit Ticket

Find the measure of angles x and y. Explain the relationships and theorems used.

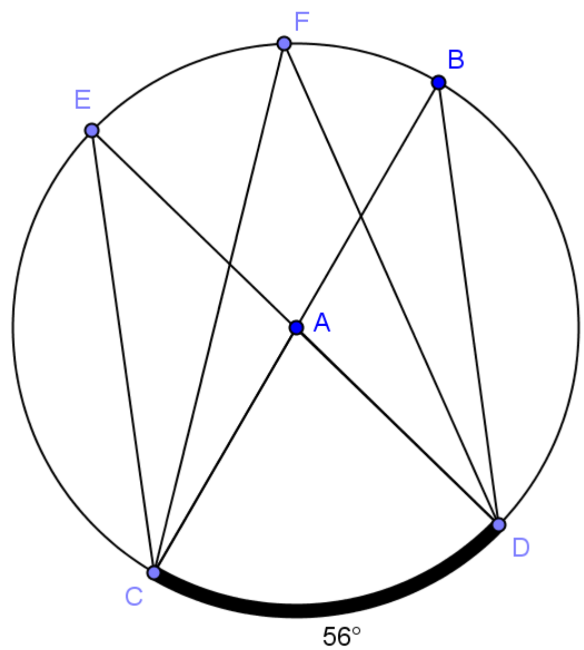


Name ____ Date ____________________

Lesson 7: The Angle Measure of an Arc

Exit Ticket

Given circle A with diameters $\overline{BC}$ and $\overline{DE}$ and $m\widehat{CD} = 56°$.



a. Name a central angle.

b. Name an inscribed angle.

c. Name a chord that is not a diameter.

d. What is the measure of $\angle CAD$?

e. What is the measure of $\angle CBD$?

f. Name 3 angles of equal measure.

g. What is the degree measure of $\widehat{CDB}$?

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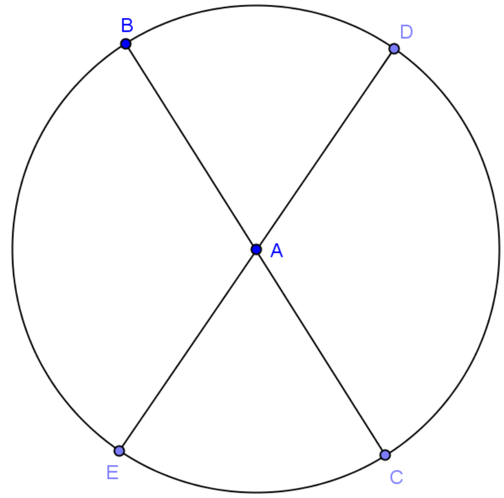
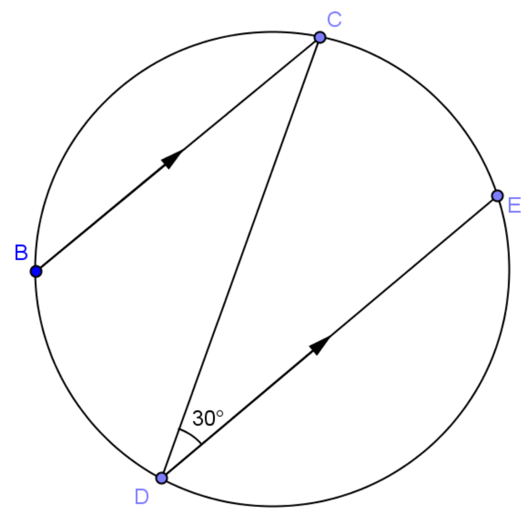
Lesson 8: Arcs and Chords

Exit Ticket

1. Given circle A with radius 10, prove $BE = DC$.



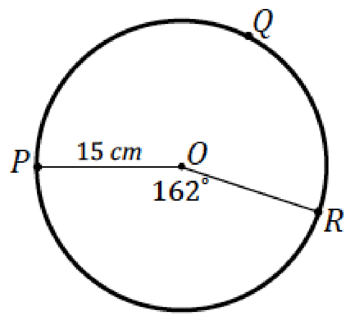
2. Given the circle at right, find $m\widehat{BD}$.



Name ____ Date ____________________

Lesson 9: Arc Length and Areas of Sectors

Exit Ticket



1. Find the arc length of $\widehat{PQR}$.

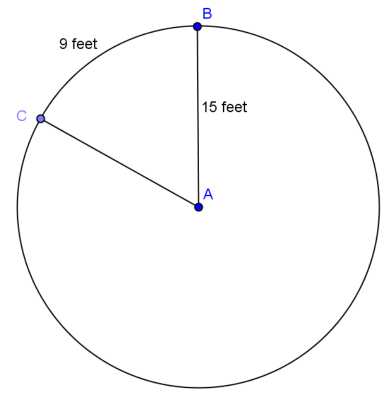
2. Find the area of sector POR.

Name ______________________________ Date ______________

Lesson 10: Unknown Length and Area Problems

Exit Ticket

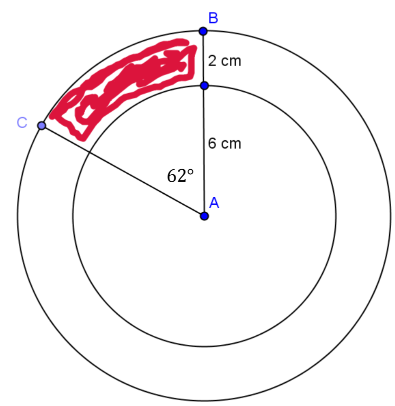
1. Given circle A, find the following (round to the nearest hundredth).



   a. $m\widehat{BC}$ in degrees

   b. Area of sector $\widehat{BC}$

2. Find the shaded area (round to the nearest hundredth).



Name ____ Date ____________________

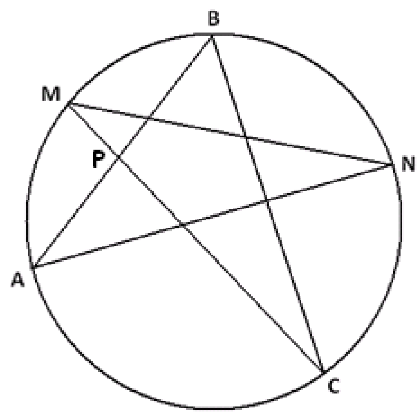
1. Consider a right triangle drawn on a page with sides of lengths 3 cm, 4 cm, and 5 cm.

   a. Describe a sequence of straightedge and compass constructions that allow you to draw the circle that circumscribes the triangle. Explain why your construction steps successfully accomplish this task.

   b. What is the distance of the side of the right triangle of length 3 cm from the center of the circle that circumscribes the triangle?

c. What is the area of the inscribed circle for the triangle?

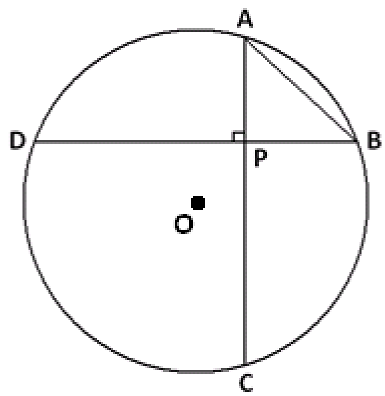
2. A five-pointed star with vertices A, M, B, N, and C is inscribed in a circle as shown. Chords $\overline{AB}$ and $\overline{MC}$ intersect at point P.



a. What is the value of $m\angle BAN + m\angle NMC + m\angle CBA + m\angle ANM + m\angle MCB$, the sum of the measures of the angles in the points of the star? Explain your answer.

b. Suppose M is the midpoint of the arc AB, N is the midpoint of arc BC, and $m\angle BAN = \frac{1}{2}m\angle CBA$. What is $m\angle BPC$, and why?

3. Two chords, $\overline{AC}$ and $\overline{BD}$ in a circle with center O, intersect at right angles at point P. $\overline{AB}$ equals the radius of the circle.



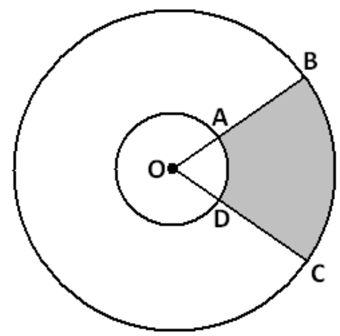
a. What is the measure of the arc AB?

b. What is the value of the ratio $\frac{DC}{AB}$? Explain how you arrived at your answer.

4.

a. An arc of a circle has length equal to the diameter of the circle. What is the measure of that arc in radians? Explain your answer.

b. Two circles have a common center O. Two rays from O intercept the circles at points A, B, C, and D as shown.



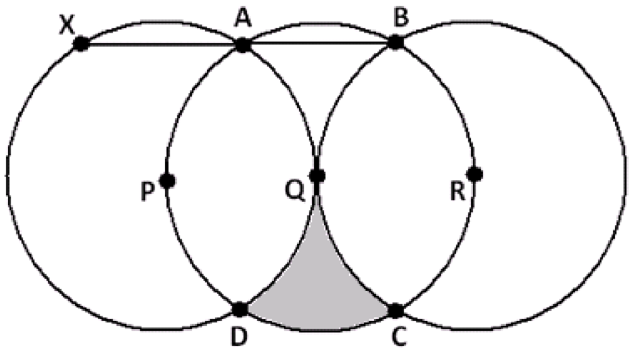
Suppose $OA : OB = 2 : 5$ and that the area of the sector given by A, O, and D is 10 cm^2.

i. What is the ratio of the measure of the arc AD to the measure of the arc BC?

ii. What is the area of the shaded region given by the points A, B, C, and D?

iii. What is the ratio of the length of the arc AD to the length of the arc BC?

5. In this diagram, the points P, Q, and R are collinear and are the centers of three congruent circles. Q is the point of contact of two circles that are externally tangent. The remaining points at which two circles intersect are labeled A, B, C, and D, as shown.



   a. $\overline{AB}$ is extended until it meets the circle with center P at a point X. Explain, in detail, why X, P, and D are collinear.

   b. In the diagram, a section is shaded. What percent of the full area of the circle with center Q is shaded?

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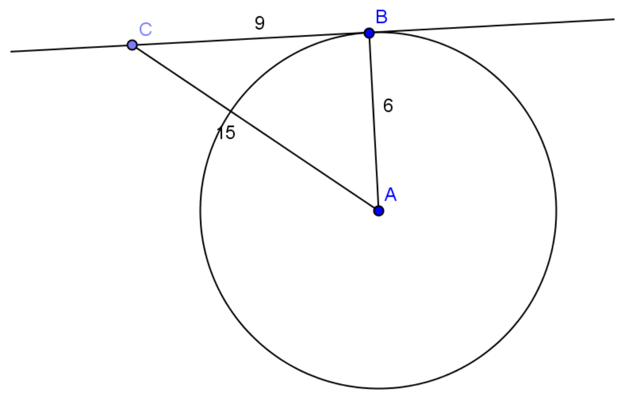
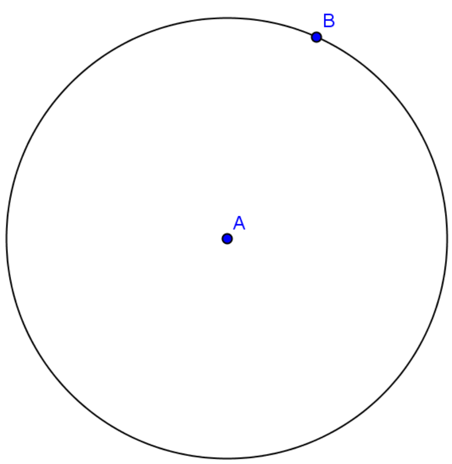
Lesson 11: Properties of Tangents

Exit Ticket

1. If $BC = 9$, $AB = 6$, and $AC = 15$, is line $\overleftrightarrow{BC}$ tangent to circle A? Explain.



2. Construct a line tangent to circle A through point B.



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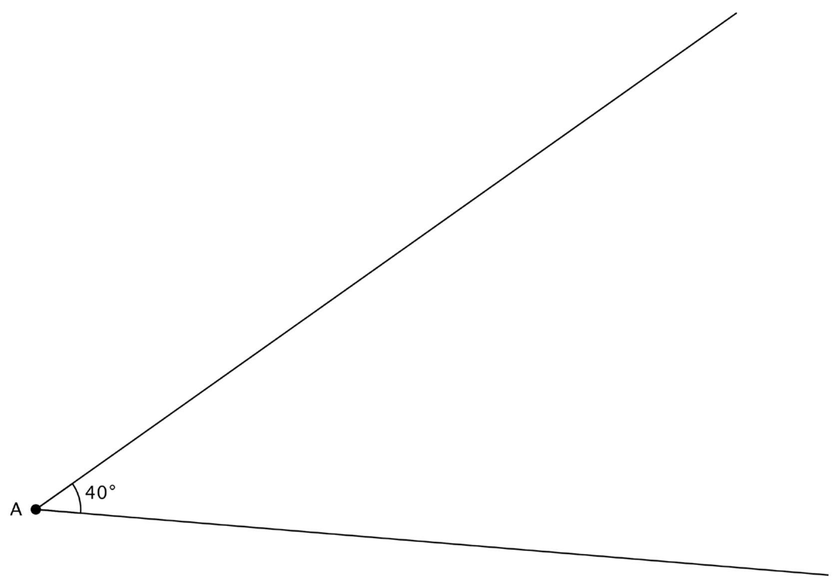
Lesson 12: Tangent Segments

Exit Ticket

1. Draw a circle tangent to both rays of this angle.



2. Let B and C be the points of tangency of your circle. Find the measures of $\angle ABC$ and $\angle ACB$. Explain how you determined your answer.

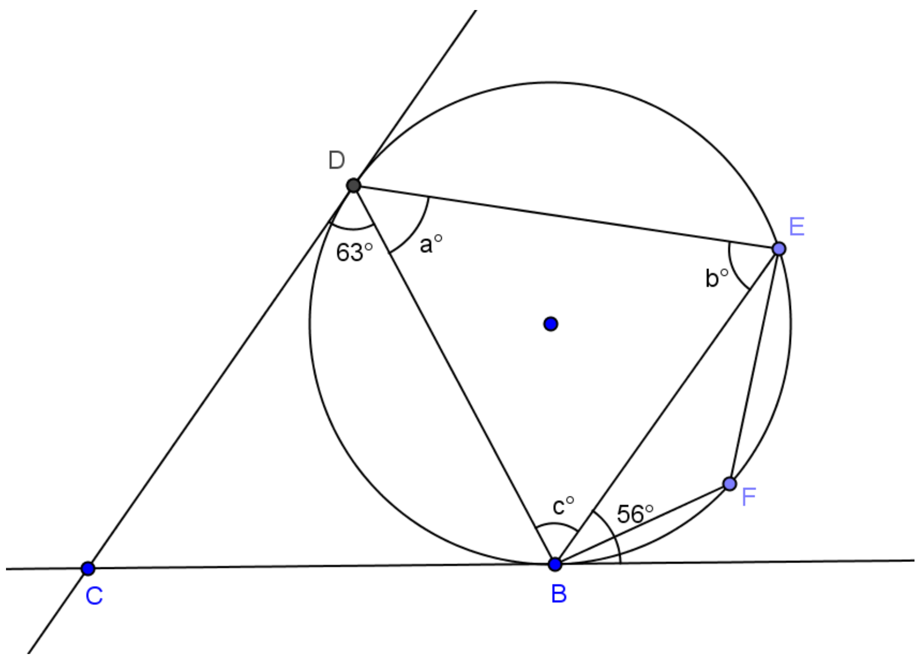
3. Let P be the center of your circle. Find the measures of the angles in $\triangle APB$.

Name ____ Date ____________________

Lesson 13: The Inscribed Angle Alternate—A Tangent Angle

Exit Ticket

Find a, b, and c.

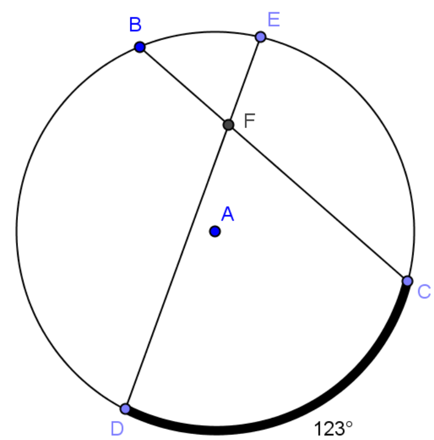


Name ___________________________ Date ______________

Lesson 14: Secant Lines; Secant Lines That Meet Inside a Circle

Exit Ticket

1. Lowell says that $m\angle DFC = \frac{1}{2}(123) = 61°$ because it is half of the intercepted arc. Sandra says that you cannot determine the measure of $\angle DFC$ because you do not have enough information. Who is correct and why?



2. If $m\angle EFC = 9°$, find and explain how you determined your answer.

   a. $m\angle BFE$

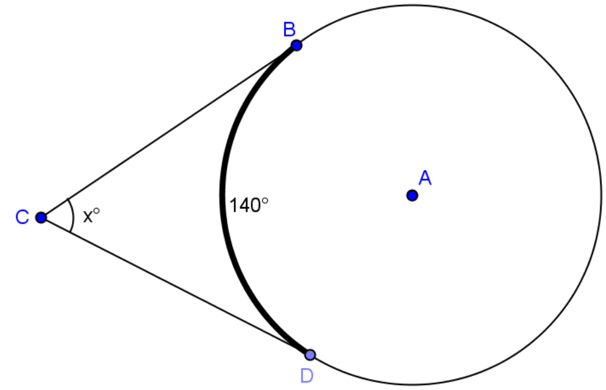
   b. $m\widehat{BE}$

Name ____ Date ____________________

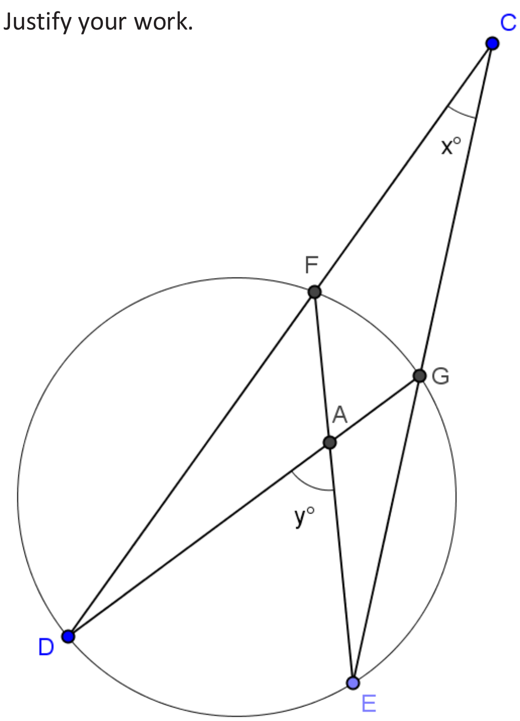
Lesson 15: Secant Angle Theorem, Exterior Case

Exit Ticket

1. Find x. Explain your answer.



2. Use the diagram to show that $m\widehat{DE} = y + x$ and $m\widehat{FG} = y - x$. Justify your work.

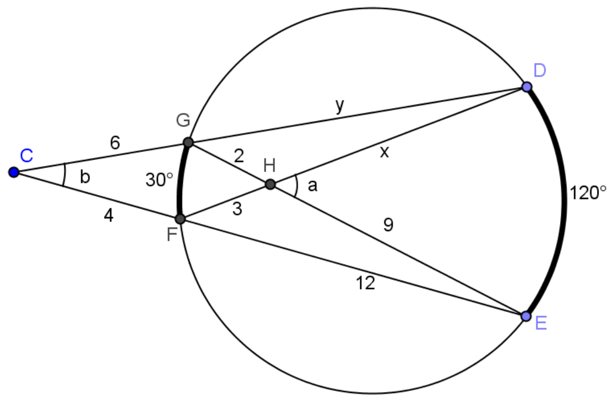


Name ____ Date ____________________

Lesson 16: Similar Triangles in Circle-Secant (or Circle-Secant-Tangent) Diagrams

Exit Ticket

In the circle below, $m\widehat{GF} = 30°$, $m\widehat{DE} = 120°$, $\overline{CG} = 6$, $\overline{GH} = 2$, $\overline{FH} = 3$, $\overline{CF} = 4$, $\overline{HE} = 9$, and $\overline{FE} = 12$.



a. Find a ($m\angle DHE$).

b. Find b ($m\angle DCE$), and explain your answer.

c. Find x ($\overline{HD}$), and explain your answer.

d. Find y ($\overline{DG}$).

Name ______________________________ Date ______________

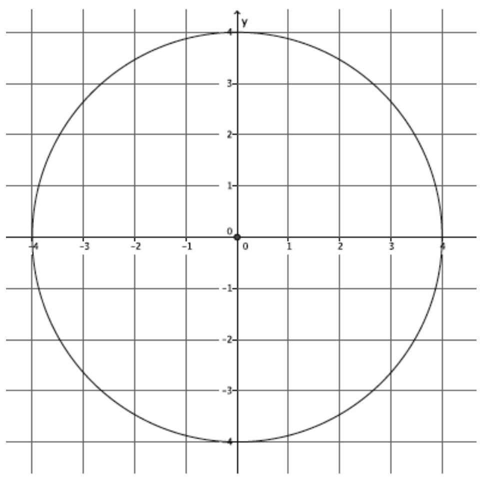
Lesson 17: Writing the Equation for a Circle

Exit Ticket

1. Describe the circle given by the equation $(x-7)^2+(y-8)^2=9$.

2. Write the equation for a circle with center $(0,-4)$ and radius 8.

3. Write the equation for the circle shown below.



4. A circle has a diameter with endpoints at $(6,5)$ and $(8,5)$. Write the equation for the circle.

Name ______________________________ Date ________________

Lesson 18: Recognizing Equations of Circles

Exit Ticket

1. The graph of the equation below is a circle. Identify the center and radius of the circle.

$$x^2 + 10x + y^2 - 8y - 8 = 0$$

2. Describe the graph of each equation. Explain how you know what the graph will look like.

   a. $x^2 + 2x + y^2 = -1$

   b. $x^2 + y^2 = -3$

   c. $x^2 + y^2 + 6x + 6y = 7$

Name ______________________________ Date ______________

Lesson 19: Equations for Tangent Lines to Circles

Exit Ticket

Consider the circle $(x+2)^2 + (y-3)^2 = 9$. There are two lines tangent to this circle having a slope of -1.

1. Find the coordinates of the two points of tangency.

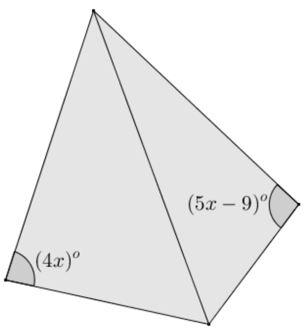
2. Find the equations of the two tangent lines.

Name ____ Date ____________________

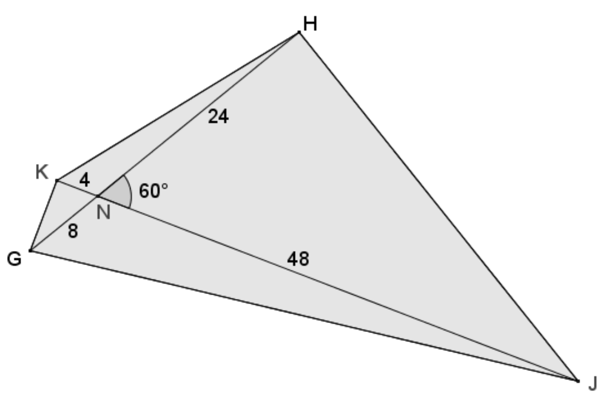
Lesson 20: Cyclic Quadrilaterals

Exit Ticket

1. What value of x guarantees that the quadrilateral shown in the diagram below is cyclic? Explain.



2. Given quadrilateral $GKHJ$, $m\angle KGJ + m\angle KHJ = 180°$, $m\angle HNJ = 60°$, $KN = 4$, $NJ = 48$, $GN = 8$, and $NH = 24$, find the area of quadrilateral $GKHJ$. Justify your answer.

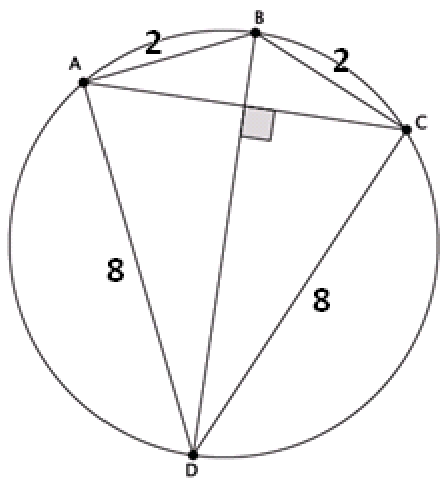


Name ___________________________________ Date ____________________

Lesson 21: Ptolemy's Theorem

Exit Ticket

What is the length of the chord $\overline{AC}$? Explain your answer.



Name ______________________________ Date ______________

1. Let C be the circle in the coordinate plane that passes though the points $(0,0)$, $(0,6)$, and $(8,0)$.

   a. What are the coordinates of the center of the circle?

   b. What is the area of the portion of the interior of the circle that lies in the first quadrant? (Give an exact answer in terms of π.)

c. What is the area of the portion of the interior of the circle that lies in the second quadrant? (Give an approximate answer correct to one decimal place.)

d. What is the length of the arc of the circle that lies in the first quadrant with endpoints on the axes? (Give an exact answer in terms of π.)

e. What is the length of the arc of the circle that lies in the second quadrant with endpoints on the axes? (Give an approximate answer correct to one decimal place.)

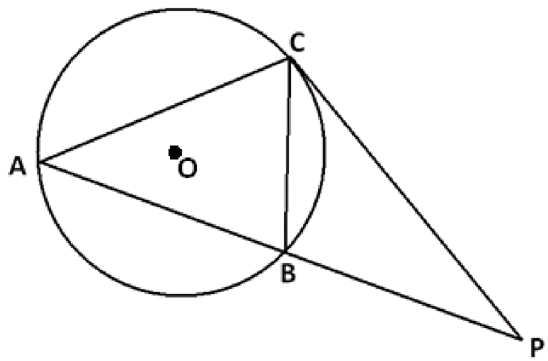
f. A line of slope -1 is tangent to the circle with point of contact in the first quadrant. What are the coordinates of that point of contact?

g. Describe a sequence of transformations that show circle C is similar to a circle with radius one centered at the origin.

h. If the same sequence of transformations is applied to the tangent line described in part (f), will the image of that line also be a line tangent to the circle of radius one centered about the origin? If so, what are the coordinates of the point of contact of this image line and this circle?

2. In the figure below, the circle with center O circumscribes $\triangle ABC$.

   Points A, B, and P are collinear, and the line through P and C is tangent to the circle at C. The center of the circle lies inside $\triangle ABC$.

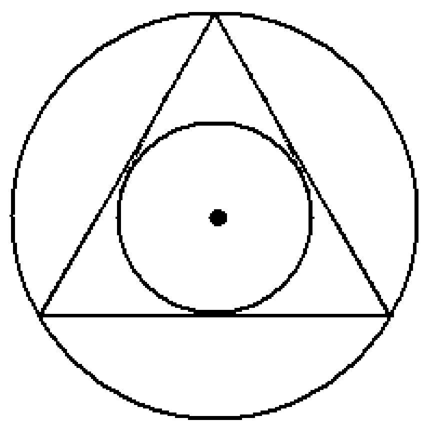


   a. Find two angles in the diagram that are congruent, and explain why they are congruent.

   b. If B is the midpoint of $\overline{AP}$ and $PC = 7$, what is the length of $\overline{PB}$?

c. If $m\angle BAC = 50°$, and the measure of the arc AC is $130°$, what is $m\angle P$?

3. The circumscribing circle and the inscribed circle of a triangle have the same center.



a. By drawing three radii of the circumscribing circle, explain why the triangle must be equiangular and, hence, equilateral.

b. Prove again that the triangle must be equilateral, but this time by drawing three radii of the inscribed circle.

c. Describe a sequence of straightedge and compass constructions that allows you to draw a circle inscribed in a given equilateral triangle.

4.

a. Show that

$$(x-2)(x-6)+(y-5)(y+11)=0$$

is the equation of a circle. What is the center of this circle? What is the radius of this circle?

b. A circle has diameter with endpoints (a, b) and (c, d). Show that the equation of this circle can be written as

$$(x-a)(x-b)+(y-c)(y-d)=0.$$

5. Prove that opposite angles of a cyclic quadrilateral are supplementary.