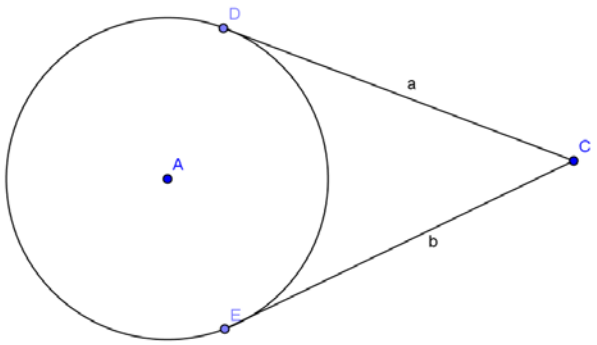
Lesson 11: Properties of Tangents

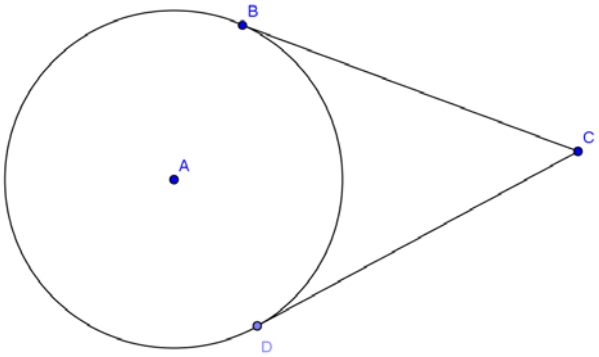
Classwork

Exercises 1–3

1. $\overline{CD}$ and $\overline{CE}$ are tangent to circle A at points D and E respectively. Use a two-column proof to prove $a = b$.



2. In circle A, the radius is 9 mm and $BC = 12$ mm.
   a. Find AC.
   b. Find the area of ΔACD.
   c. Find the perimeter of quadrilateral $ABCD$.

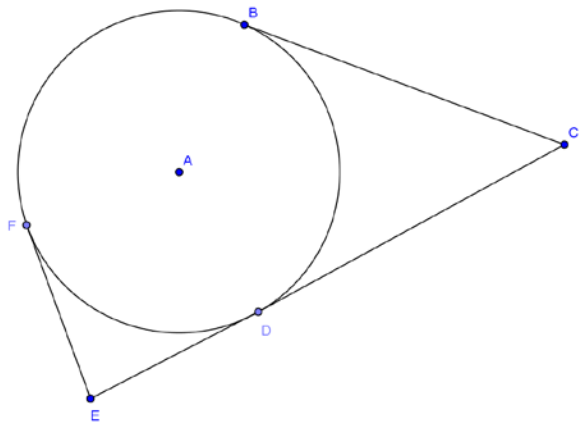


3. In circle A, $EF = 12$ and $AE = 13$. $AE:AC = 1:3$. Find

   a. The radius of the circle.

   b. BC (round to the nearest whole number)

   c. EC



Lesson Summary

THEOREMS:

- A tangent line to a circle is perpendicular to the radius of the circle drawn to the point of tangency.
- A line through a point on a circle is tangent at the point if, and only if, it is perpendicular to the radius drawn to the point of tangency.

Relevant Vocabulary

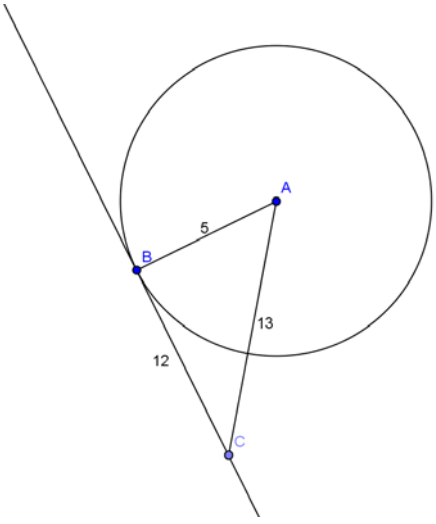
- **INTERIOR OF A CIRCLE**: The *interior of a circle with center O and radius r* is the set of all points in the plane whose distance from the point O is less than r.

  A point in the interior of a circle is said to be *inside the circle.* A disk is the union of the circle with its interior.
- **EXTERIOR OF A CIRCLE**: The exterior of a circle with center O and radius r is the set of all points in the plane whose distance from the point O is greater than r.

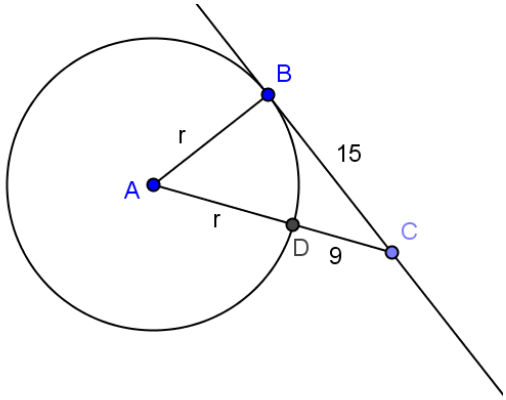
  A point exterior to a circle is said to be *outside the circle.*
- **TANGENT TO A CIRCLE**: A *tangent line to a circle* is a line in the same plane that intersects the circle in one and only one point. This point is called the *point of tangency*.
- **TANGENT SEGMENT/RAY**: A segment is a *tangent segment to a circle* if the line that contains it is tangent to the circle and one of the end points of the segment is a point of tangency. A ray is called a *tangent ray to a circle* if the line that contains it is tangent to the circle and the vertex of the ray is the point of tangency.
- **SECANT TO A CIRCLE**: A *secant line to a circle* is a line that intersects a circle in exactly two points.
- **POLYGON INSCRIBED IN A CIRCLE**: A polygon is *inscribed in* a circle if all of the vertices of the polygon lie on the circle.
- **CIRCLE INSCRIBED IN A POLYGON**: A circle is *inscribed* in a polygon if each side of the polygon is tangent to the circle.

Problem Set

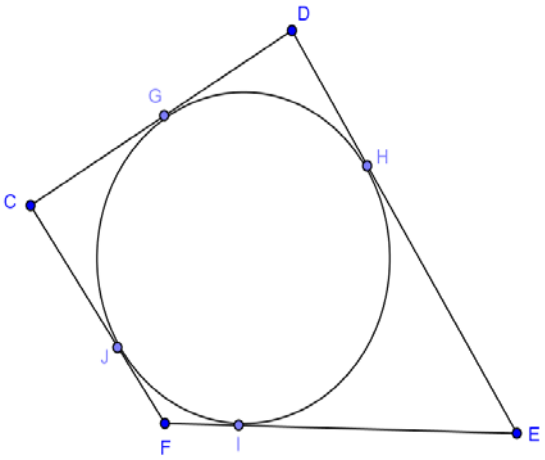
1. If $AB = 5$, $BC = 12$, and $AC = 13$, is $\overleftrightarrow{BC}$ tangent to circle A at point B? Explain.



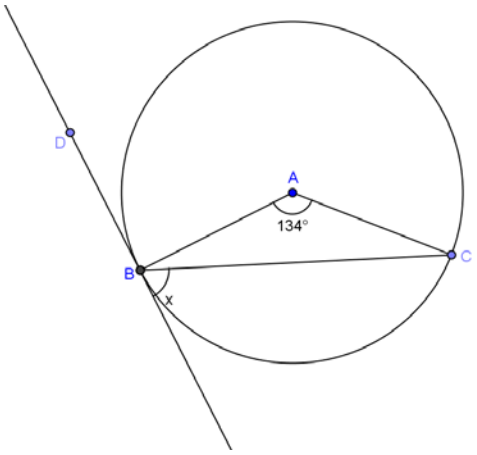
2. $\overleftrightarrow{BC}$ is tangent to circle A at point B. $DC = 9$ and $BC = 15$.
   a. Find the radius of the circle.
   b. Find AC.



3. A circular pond is fenced on two opposite sides ($\overline{CD}, \overline{FE}$) with wood and the other two sides with metal fencing. If all four sides of fencing are tangent to the pond, is there more wood or metal fencing used?



4. Find x if the line shown is tangent to the circle at point B.

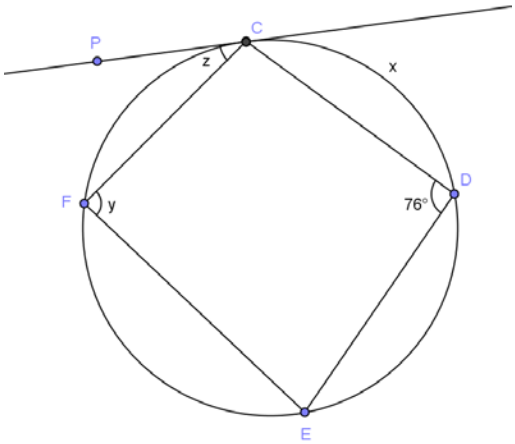


5. Line $\overleftrightarrow{PC}$ is tangent to the circle at point C, and $CD = DE$. Find

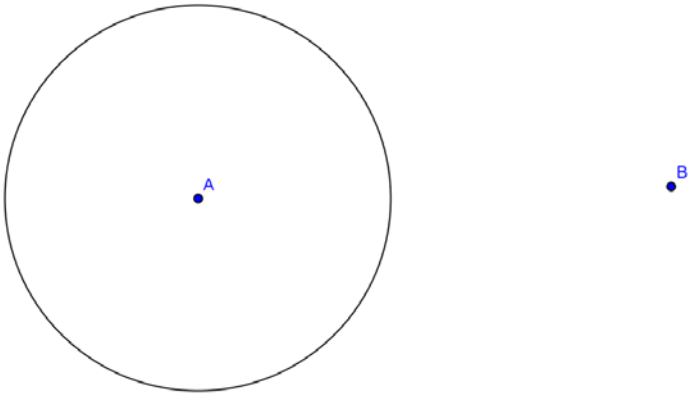
   a. x ($m\widehat{\text{CD}}$)

   b. y ($m\angle CFE$)

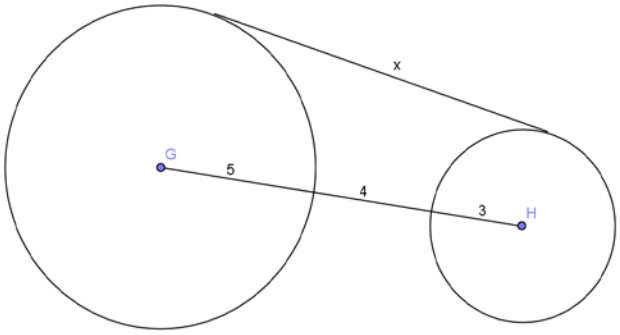
   c. z($m\angle$PCF)



6. Construct two lines tangent to circle A through point B.



7. Find x, the length of the common tangent line between the two circles (round to the nearest hundredth).



8. $\overline{EF}$ is tangent to both circles A and C. The radius of circle A is 9, and the radius of circle C is 5. The circles are 2 units apart. Find the length of $\overline{EF}$, x (round to the nearest hundredth).