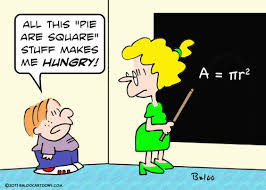
**Math 9**

**Unit 8: Circle Geometry**



**Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Class\_\_\_\_\_\_\_**

**Outcomes:**

1. Solve problems and justify the solution, using the following circle properties:

• the perpendicular from the centre of a circle to a chord bisects the chord

• the measure of the central angle is equal to twice the measure of the inscribed angle subtended by the same arc

• the inscribed angles subtended by the same arc are congruent

• a tangent to a circle is perpendicular to the radius at the point of tangency.

**IXL’s for this unit- It is recommended you do a few questions a night from one of the following IXL’s to keep your knowledge current!**

[**F.1**Parts of a circle](https://ca.ixl.com/math/grade-9/parts-of-a-circle)

[**F.2**Circles: calculate area, circumference, radius and diameter](https://ca.ixl.com/math/grade-9/circles-calculate-area-circumference-radius-and-diameter)

[**F.3**Circles: word problems](https://ca.ixl.com/math/grade-9/circles-word-problems)

[**F.4**Central angles](https://ca.ixl.com/math/grade-9/central-angles)

[**F.5**Arc measure and arc length](https://ca.ixl.com/math/grade-9/arc-measure-and-arc-length)

[**F.6**Area of sectors](https://ca.ixl.com/math/grade-9/area-of-sectors)

[**F.7**Circle measurements: mixed review](https://ca.ixl.com/math/grade-9/circle-measurements-mixed-review)

[**F.8**Arcs and chords](https://ca.ixl.com/math/grade-9/arcs-and-chords)

[**F.9**Tangent lines](https://ca.ixl.com/math/grade-9/tangent-lines)

[**F.10**Perimeter of polygons with an inscribed circle](https://ca.ixl.com/math/grade-9/perimeter-of-polygons-with-an-inscribed-circle)

[**F.11**Inscribed angles](https://ca.ixl.com/math/grade-9/inscribed-angles)

[**F.12**Angles in inscribed right triangles](https://ca.ixl.com/math/grade-9/angles-in-inscribed-right-triangles)

[**F.13**Angles in inscribed quadrilaterals](https://ca.ixl.com/math/grade-9/angles-in-inscribed-quadrilaterals)

**9.0- Into: review and terms**

**Types of angles**

**1. Acute angles**…

**2. Right angles**...

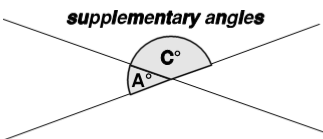
**3. Obtuse angles**...

**4. Reflex angles**...

**Properties of Angles**

1. **Straight Angle** –

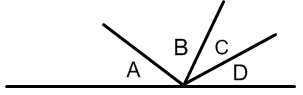
2. Any angles (two or more) that add up to 180 degrees are also called

****

If angle A is 50 degrees, angle C must be \_\_\_\_ degrees.

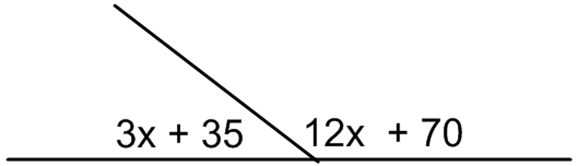
If angle A were 35 degrees, angle C must be \_\_\_\_\_ degrees.

Multiple Angles forming a straight angle



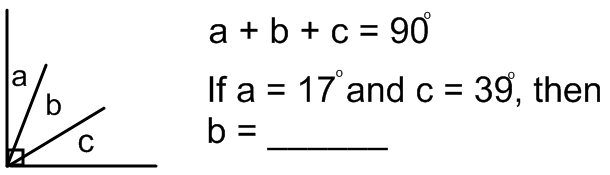
Angles A + B + C + D = \_\_\_\_\_\_\_\_\_ degrees.

How can we solve for unknown angles with variables?

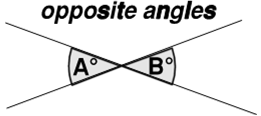


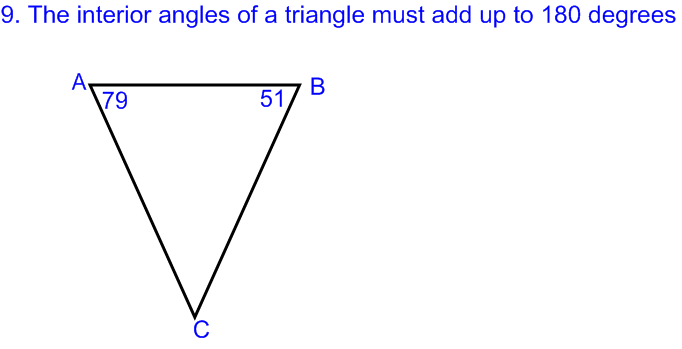
3. Any angles (two or more) that add up to 90 degrees are also

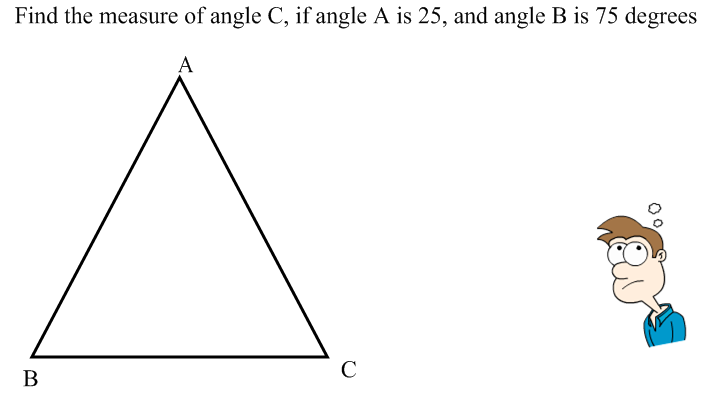
called

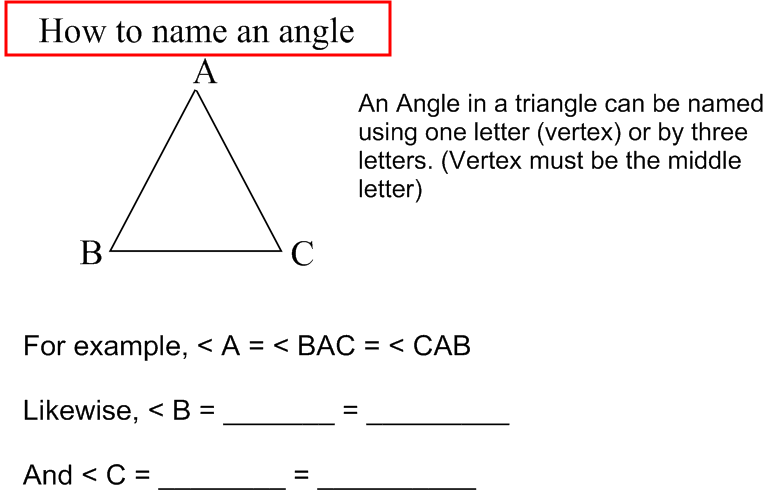


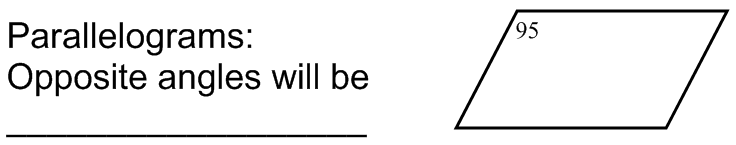
4. **Opposite angles**…

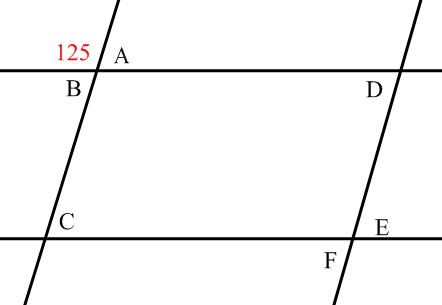


5.











Worksheet: Circle Geometry Intro: Working with angles

**9.0b Properties of Circles & Their Definitions**

A **radius**

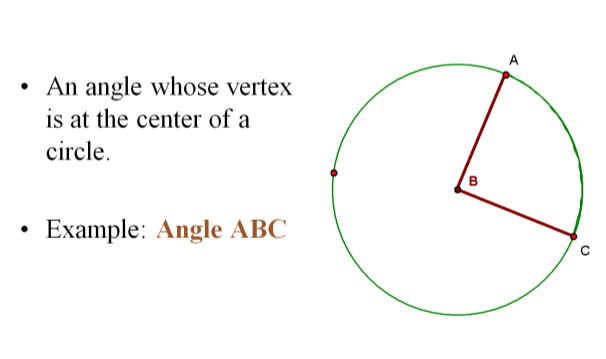
Chord

Diameter:

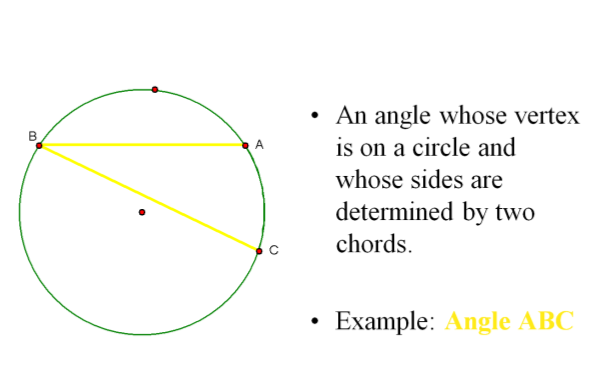
Secant:

Tangent

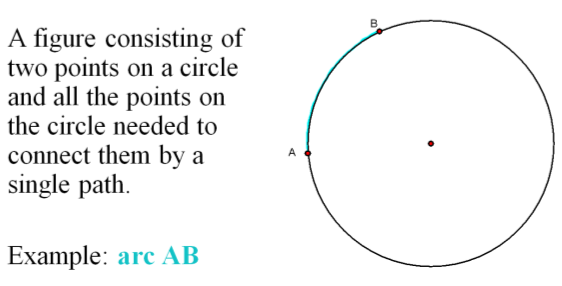
**Central Angle**



**Inscribed Angle**

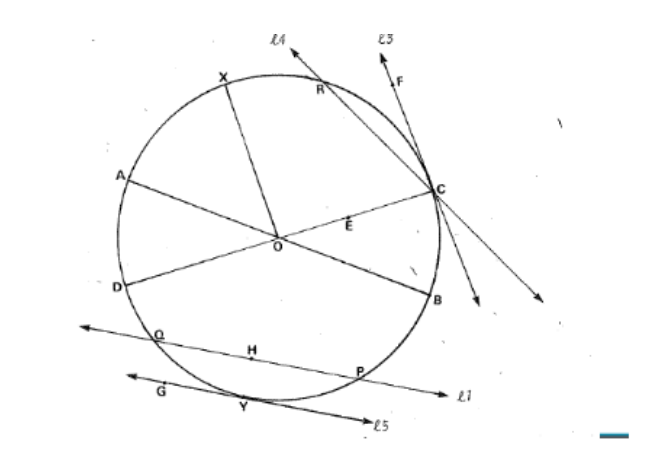


**Arc**

****

**Subtended**

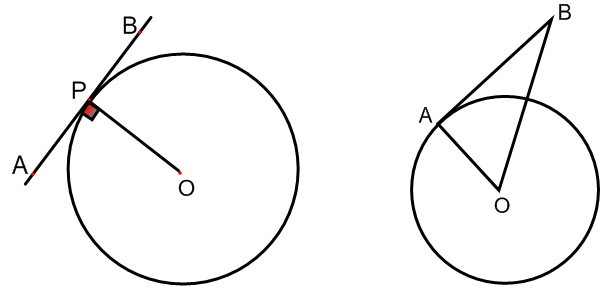
**Label each Circle Property**



**Radius - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Diameter - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
Tangent - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Point of Tangency - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Inscribed Angle - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Central Angle - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Chord - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Secant - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
Major Arc - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Minor Arc - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

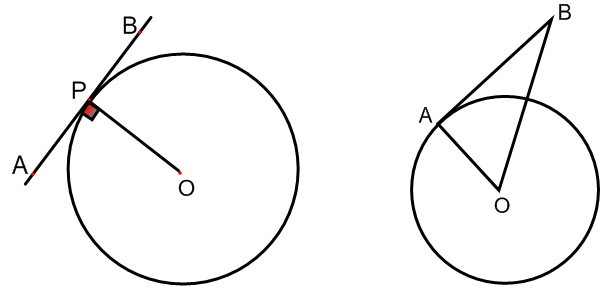
IXL F.1 and F.2

**9.1 Tangent Property #1:**

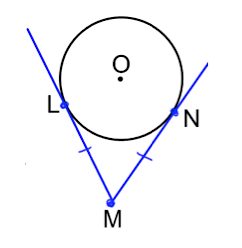
****

\*\* We use this property to create right triangles. Then we can use Pythagorean theorem to solve for side lengths.

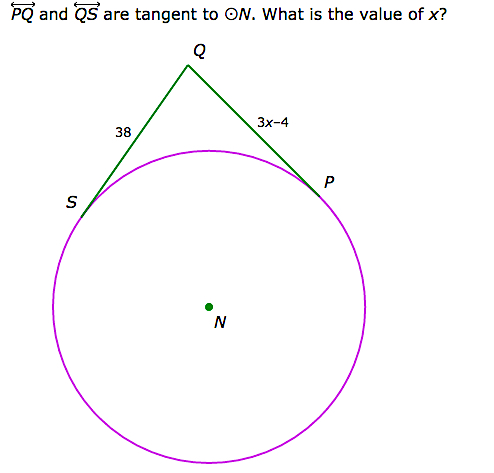
1) What is the measure of BO if the diameter of the circle is 10cm and AB is 6cm?

****

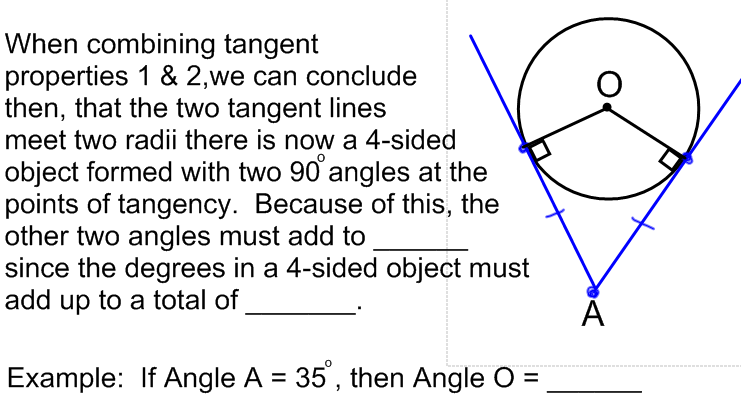
**Tangent Property #2:**

1) If the radius is 5cm and the distance from the origin (centre) to point M is 20cm, can we determine the length of each tangent line to point M?

2. PQ and QS are tangent to N. What is the value of x?

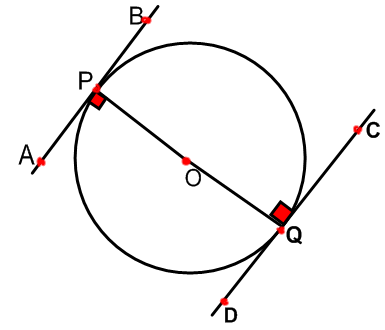


**Combining Tangent Properties 1 & 2:**

****

**Tangent Property #3:** **Locating the Origin using Tangent Lines**

**Tangent Property #4:** **Parallel Tangent Lines**



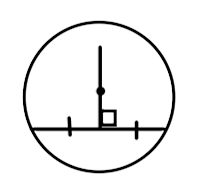


Pythagorean Theorem worksheet

IXL F.9 Tangent Lines

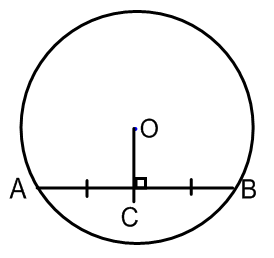
**9.2 Chord Properties**

Chord properties:

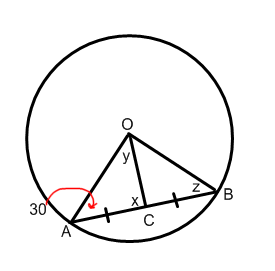


We use these properties to create ***triangles***.

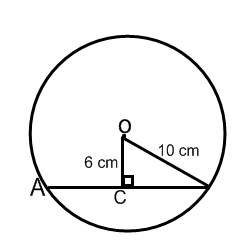
We can combine these 3 chord properties into one rule:



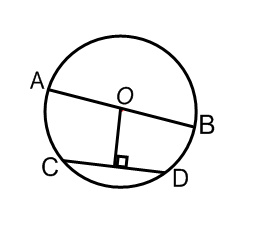
**Example #1:** **Determine the measures of Angles *x*, *y*, and *z*.**



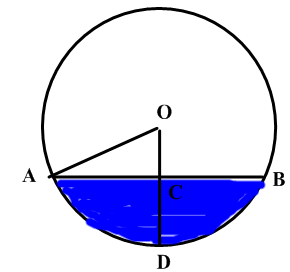
**Example #2:** O is the center of the circle. Find the length of chord AB.



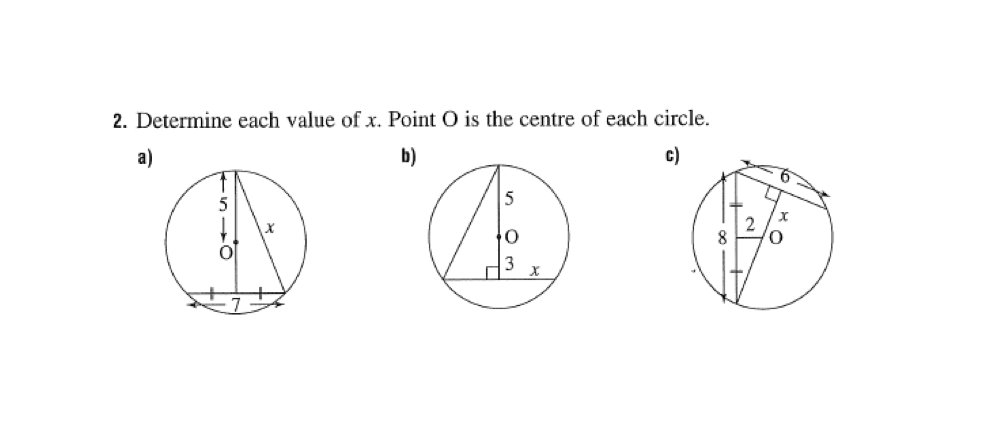
**Example #3:** AB is a diameter with length 26 cm. CD is a chord that is 10 cm from the center O. What is the length of the chord?

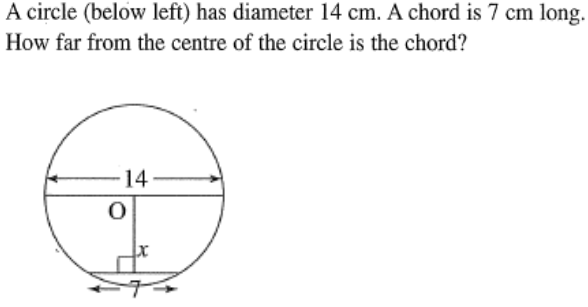


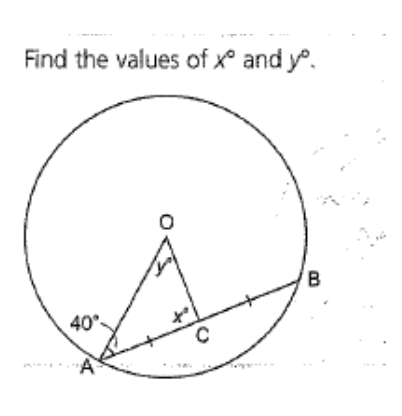
**Example #4**: A horizontal pipe has a circular cross section, with center O. Its radius is 22 cm. Water fills less than one-half of the pipe. The surface of the water AB is 40 cm wide. Determine the maximum depth of the water (CD).



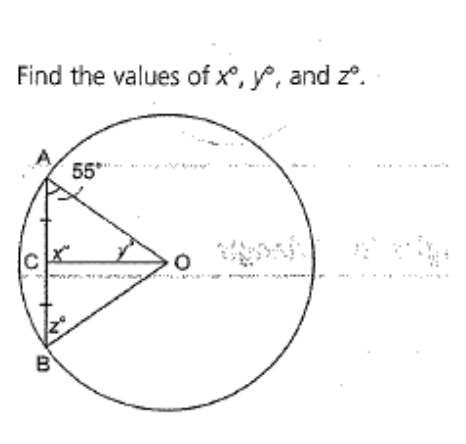
**Example #5:**



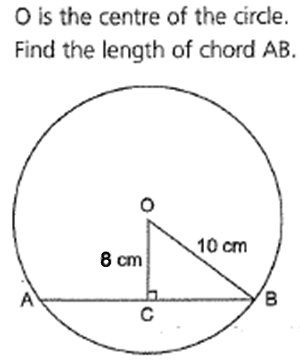
Your turn, try these…  
1.



2.



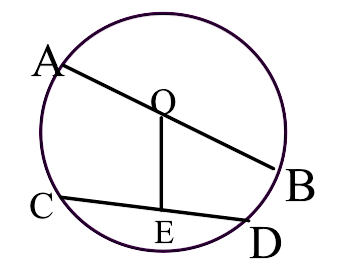
3.



4.

5. AB is a diameter with length 36 cm. CD is a chord that is 10 cm

from the center O. What is the length of the chord?

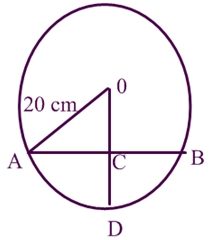


6. A horizontal pipe has a circular cross section with center O.

It has a radius of 20 cm. Water fills less than one-half of the

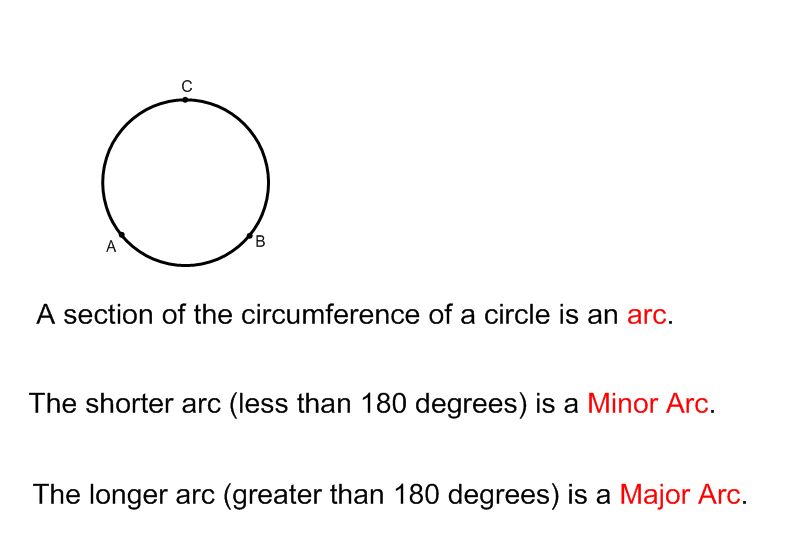
pipe. The surface of the water AB is 24 cm wide. Determine

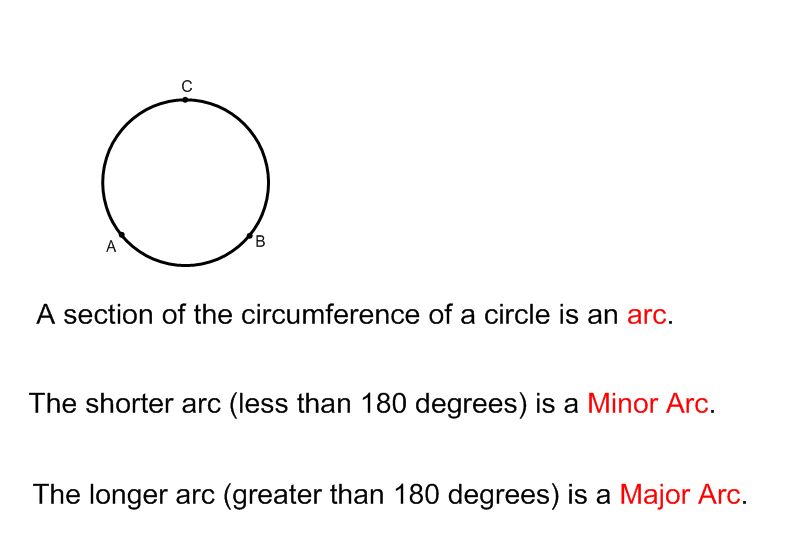
the maximum depth of the water which is the depth CD.

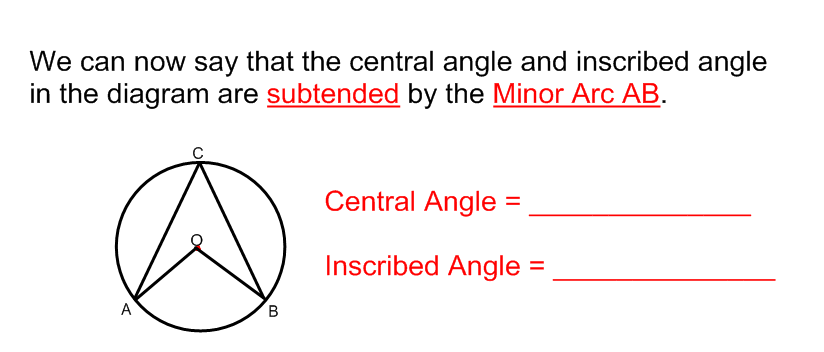


Chord properties worksheet



**9.3 Angles and arcs in a Circle**



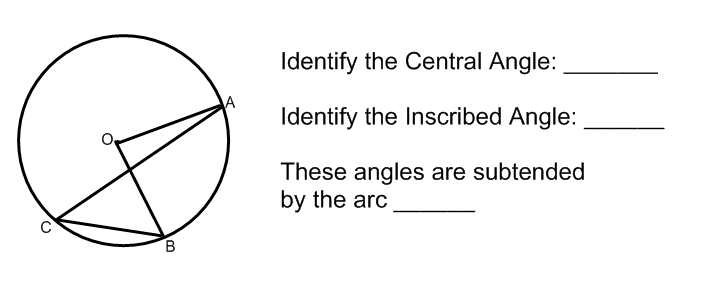


**Property #1:** Central Angle and Inscribed Angle Property

An inscribed angle and a central angle subtending the same arc follow this rule:

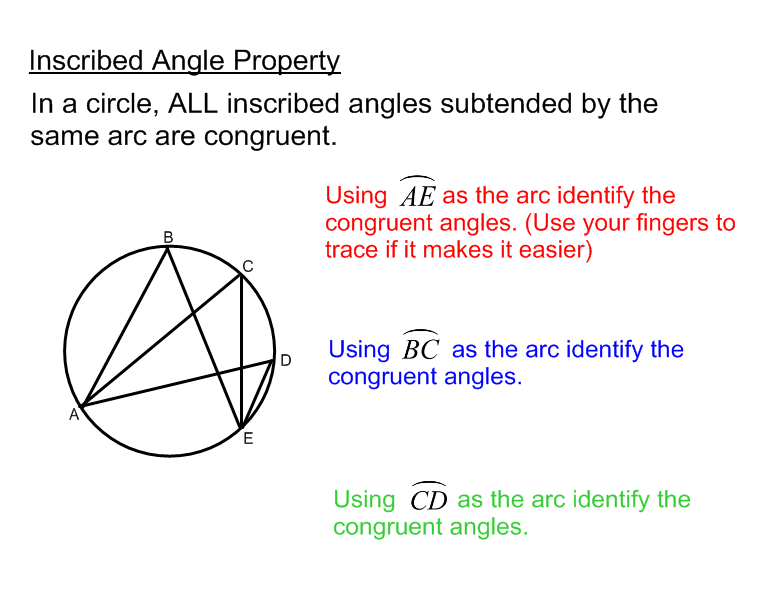
Inscribed angle:

Central angle:



\*\*\* <OAC is NOT an inscribed because the sides do not touch the edge of the circle.

**Property #2:** Inscribed Angle PropertyInscribed angles from the same arc look like a ***bow-tie*** in many situations.

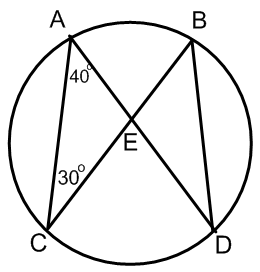


Bow-tie rule:

Angle B= Angle CED=

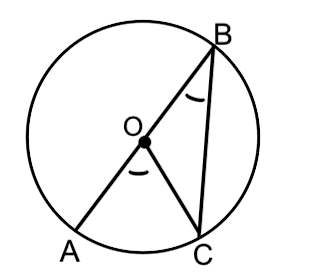
Angle D = Angle AEC=

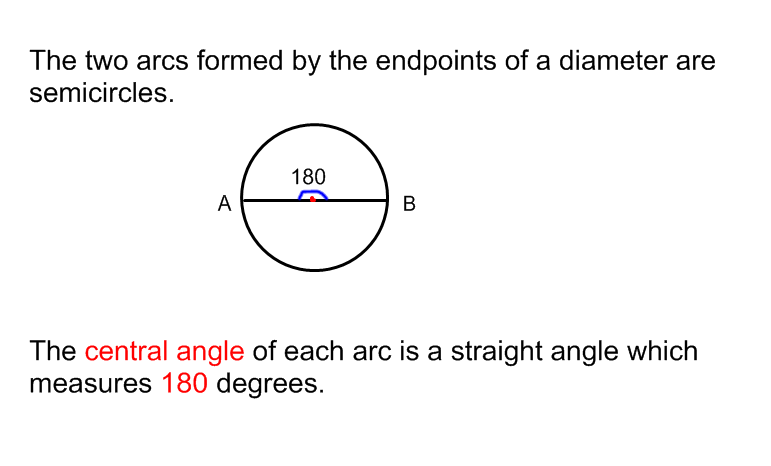
Angle E=



Something to think about….

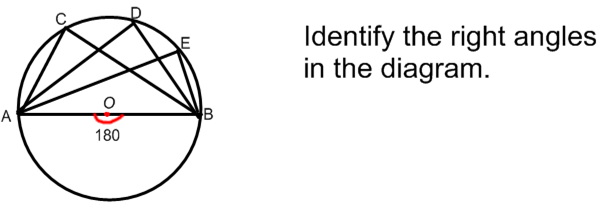
Can an inscribed angle be formed from a diameter?



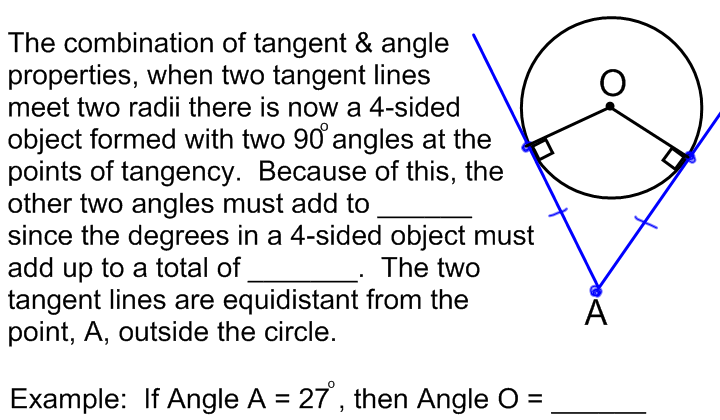


**Property #3:** Angles in a Semicircle Property

All inscribed angles subtended by a semicircle are \_\_\_\_\_\_\_\_\_ angles.

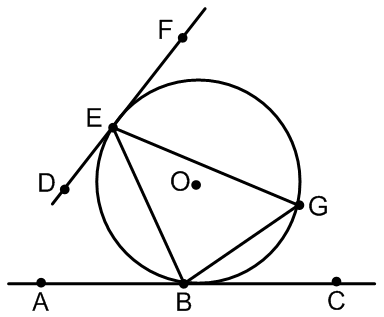
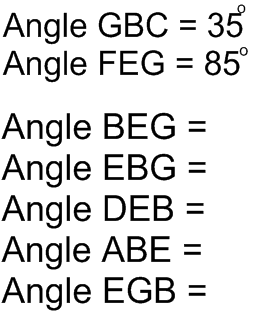


**Property #4:** Two Tangents to Central Angle Property



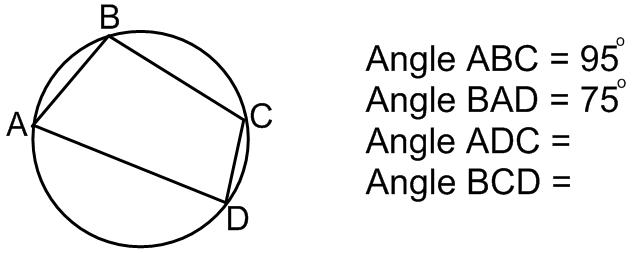
**Property #5:** Tangent to Chord Property

The angle between the tangent line & the chord is \_\_\_\_\_\_\_\_\_\_\_\_\_ to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ angle(s) formed from the same \_\_\_\_\_\_\_\_ as the chord.

**Property #6:** Cyclic Quadrilateral Property

A ***cyclic quadrilateral*** is a \_\_\_\_\_-sided polygon (object) inside a circle created by \_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_. Since \_\_\_-sided polygons have a total of \_\_\_\_\_\_\_\_, ***opposite angles*** of cyclic quadrilaterals MUST add to \_\_\_\_\_\_\_.



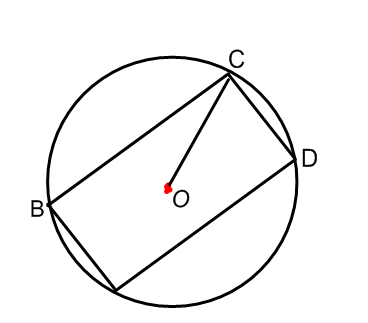


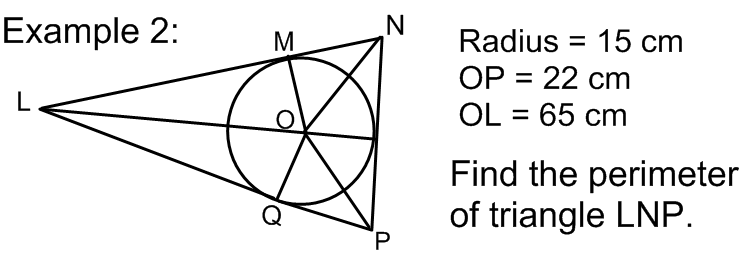
Applying all the properties – Let’s try these together…

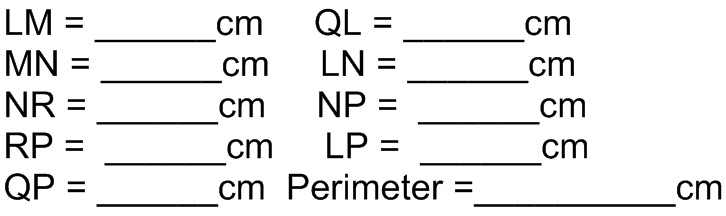
Example 1:

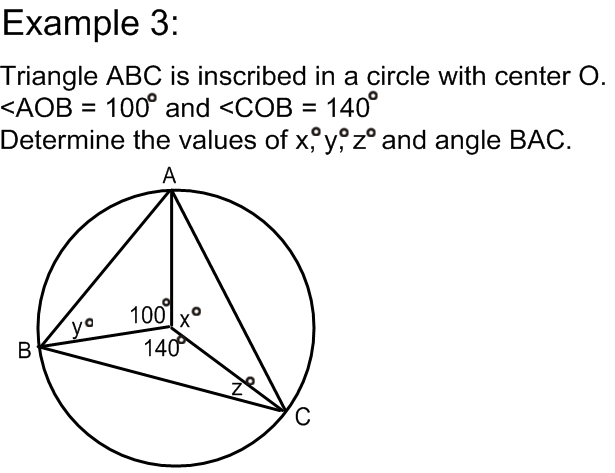
Rectangle ABCD has its vertices on a circle with radius 8.5 cm.

The width of the rectangle is 10 cm. What is its length to the nearest tenth?

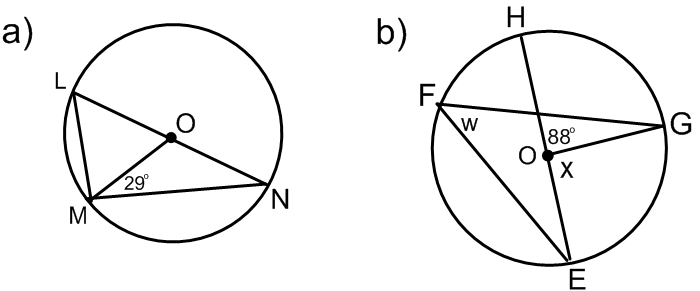




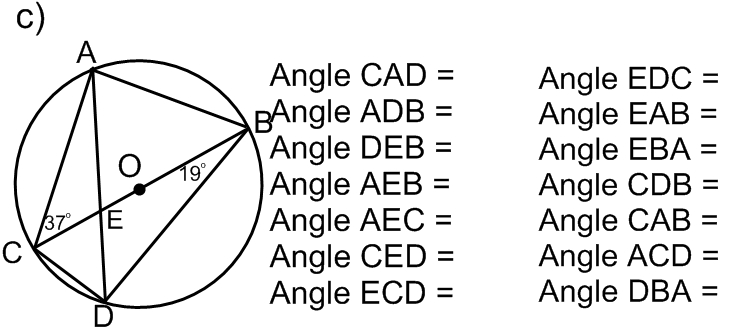


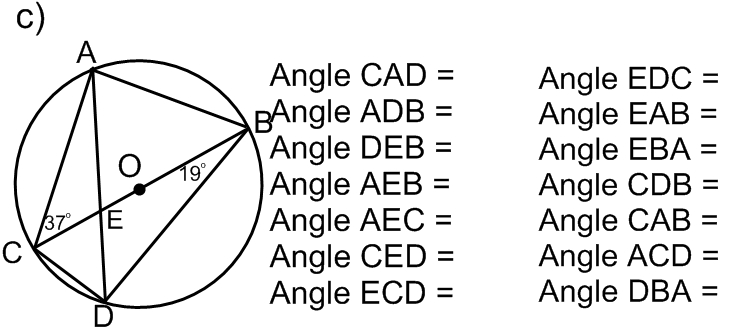


Example 4: Solve all the unknown angles.



\*Bow-tie rule AND inscribed angles subtended by diameter=90o







Arc and angles properties worksheet