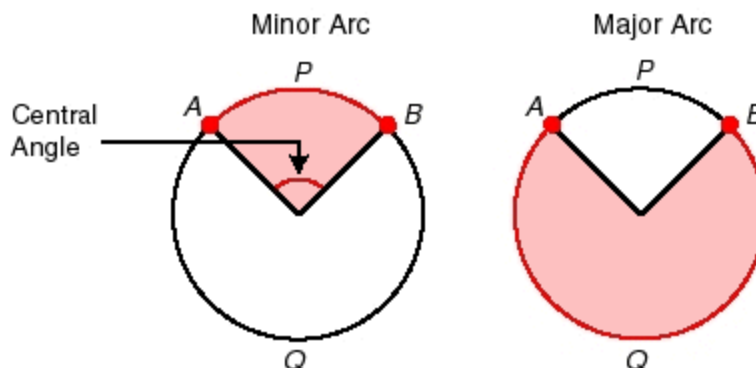


CIRCLES

ARCS AND CENTRAL ANGLES



Unit Overview

In this unit, students will identify and describe relationship among central angles and arcs.

Key Vocabulary

Chord	Segment whose endpoints lie on a circle
Central angle	An angle with measure less than or equal to 180 degrees whose vertex lies at the center
Inscribed angle	An angle whose vertex lies on a circle and whose sides contain chords of the circle.
Radius	The distance from the center of the circle to its outer rim
Diameter	A chord that passes through the center of a circle; the length of a diameter is two times the length of a radius
Circle	Set of all points in the plane that are the same distance away from a specific point, called the center.
Center	A circle is usually named by its center point.
Arc	Part of the circumference of a circle.
Circumference	The distance around the circle
Major arc	Composed of two endpoints and the points on the circle that are not on the interior of its central angle.
Minor arc	Composed of two endpoints and the points on the circle that are on the interior of its central angle
Semicircle	An arc whose endpoints are the endpoints of a diameter of the circle

Arcs and Central Angles

An angle whose vertex is at the center of a circle is called a **central angle**. A central angle separates a circle into two arcs called a **minor arc** and a **major arc**. In the circle above, $\angle APB$ is the central angle.

An **arc** is a section of a circle. The **semicircle** is an arc that measures 180° . A **minor arc** is smaller than a semicircle and a **major arc** is larger than a semicircle.

A **minor arc** is composed of two endpoints on the circle and the points on the circle that are on the interior of its central angle. In the circles above, points **A** and **B** and all points of the circle *interior* to $\angle APB$ form a minor arc called arc **AB**. The measure of the minor arc is equal to the measure of its central angle.

A **major arc** is composed of two endpoints and the points on the circle that are not on interior of the central angle. In the circle above, points **A** and **B** and all points of the circle *exterior* to $\angle APB$ form a major arc called arc **AQB**. The measure of a major arc is equal to 360° minus of its central angle.

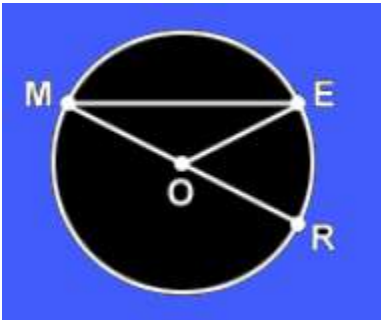
A **semicircle** is an arc whose endpoints are the endpoints of a diameter of a circle. The measure of a semicircle is 180° .

Click on the link to watch a video on [Intro to Arc Measures](#).

Hint: When given two letters it will be the minor arc and when given three letters it will be the major arc.

Let's Practice – Vocabulary Identification

Use *Circle O* below to identify the correct vocabulary word that describes each of the following figures. Use the Key Vocabulary list in the beginning of the unit.



- 1.) *arc MER*
(**semicircle** – can be thought of as a half circle)
- 2.) *angle MOE*
(**central angle** – angle that has a vertex at the center of the circle)
- 3.) *arc ER*
(**minor arc** – composed of two endpoints on the interior of the central angle)
- 4.) *segment OE*
(**radius** – segment that joins the center of a circle to a point on the circle)
- 5.) *segment ME*
(**chord** – segments whose endpoints lie on the circle)
- 6.) *arc MRE*
(**major arc** – composed of two endpoints that are not on the interior of the central angle)

Minor and Major Arcs

A central angle is the angle formed by two radii with its vertex at the center of the circle.

A **minor arc** is an arc that is greater than 0° and less than 180° . A **major arc** is an arc that is greater than 180° and less than 360° .

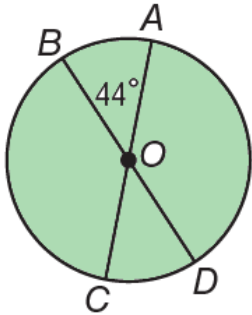
Put this in practice by clicking on the word [Arc](#) to identify the difference between a major and

minor arc. Once, you practice recognizing the differences click on the word [Calculate](#) to measure the minor and major arcs of a circle.

Let's Practice – Minor and Major Arcs

Identify each arc as either *major arc*, *minor arc*, or *semicircle*.

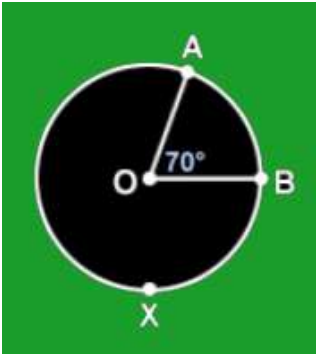
Segment BD and AC are diameters of circle O.



- 7.) arc BA (minor arc)
- 8.) arc BCD (semicircle)
- 9.) arc ACB (major arc)
- 10.) arc BAD (semicircle)

11.) Find the measure of *arc AXB*.

HINT: The measure of a minor arc is equal to the measure of its central angle = x° .
Remember a circle has a total of 360°



Step 1: The measure of a major arc is equal to 360° minus the central angle (70°)

Step 2: $360^\circ - 70^\circ = 290^\circ$

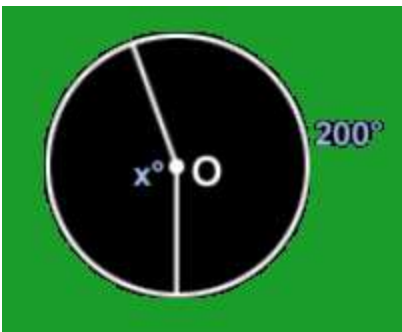
Step 3: measure of *arc AXB* = 290°

12.) Find the value of x° .

HINT: The measure of a minor arc is equal to the measure of its central angle = x° .

Remember a circle has a total of 360° .

Use the Arc Addition Postulate.



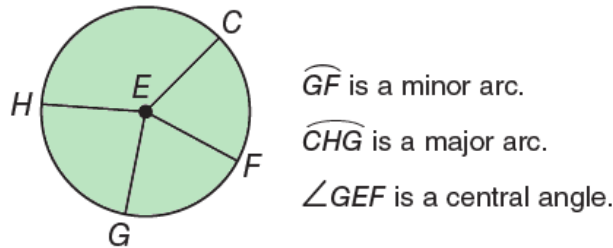
Step 1: $x + 200 = 360$

Step 2: $x = 360 - 200$

Step 3: $x = 160^\circ$

Central Angle Properties

Look at the figure below and the properties of central angles and arcs.

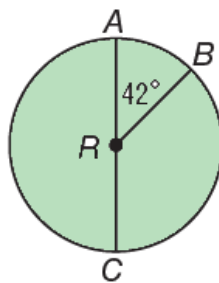


- The sum of the measures of the central angles of a circle with no interior points in common is 360° . $\rightarrow m\angle HEC + m\angle CEF + m\angle FEG + m\angle GEH = 360$
- The measure of a minor arc is less than 180 and equal to the measure of its central angle $\rightarrow \text{arc } CF = m\angle CEF$
- The measure of a major arc is 360 minus the measure of the minor arc. $\rightarrow \text{arc } CGF = 360 - \text{arc } CF$
- The measure of a semicircle is 180° .
- **Arc Addition Postulate:** the measure of an arc formed by two adjacent arcs is the sum of the measures of the two arcs. $\rightarrow \text{arc } CFG = \text{arc } CF + \text{arc } FG$

Click on the words [Central Angle Properties](#) to watch a video demonstration on the measures of arcs.

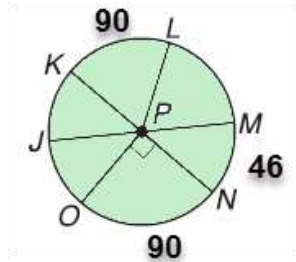
Example A – Find *minor arc AB* and *major arc ACB*.

Segment AC is a diameter of circle R.



- **Angle ARB** is a central angle and measure of **Angle ARB = 42**
- Central angle and its minor arc have the same measure, **minor arc AB = 42**
- Major arc ACB = $360 - 42$
- So **major arc ACB = 318**

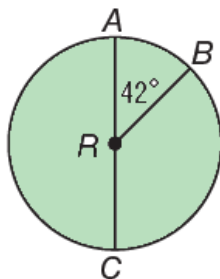
Example B – Find *minor arc OK*.



- *OK* is a minor arc, so measure *minor arc OK* = measure *angle KPO*
- *Arc KON* is a semicircle
- Measure of *minor arc ON* = measure *angle NPO* (is a right triangle) = **90**
- Arc Addition Postulate → measure of *major arc KON* (180) = measure of *minor arc OK* + measure of *minor arc ON* (90)
- Subtract → $180 - 90 =$ measure of minor arc OK
- **90 = measure of minor arc OK**

Let's Practice – Central Angle Relationships

13.) Segment AC is a diameter. Find the measure of *minor arc BC*.



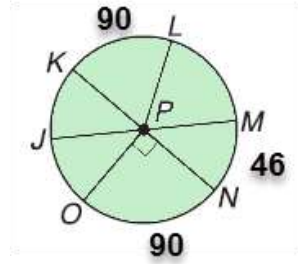
Step 1: *minor arc AB* and *minor Arc BC* are adjacent angles

Step 2: Arc Addition Postulate → *arc ABC* (180) = *arc AB* (42) + *arc BC*

Step 3: *arc BC* = $180 - 42$

Step 4: *arc BC* = **138**

14.) Find the measure of *major arc JKO*.



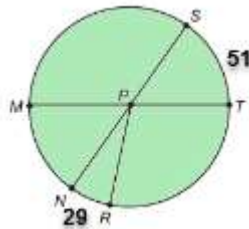
Step 1: Arc Addition Postulate $\rightarrow m \text{ arc } JKO = m \text{ arc } JLM + m \text{ arc } MN + m \text{ arc } NO$

Step 2: measure *arc JKO* = 180 + 46 + 90

Step 3: *major arc JKO* = 316

15.) Find the measure of *minor arc RT*.

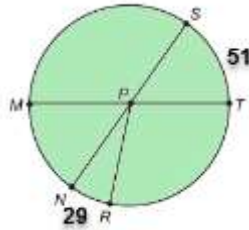
Segment SN and *MT* are diameters.



$$(100 \rightarrow 180 - \text{arc } MN(51) - \text{arc } NR(29) = 100$$

16.) Find the measure of *major arc TSR*.

Segment SN and *MT* are diameters.

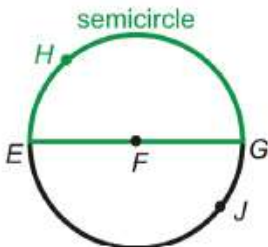


$$(190 \rightarrow 360 - \text{arc } TS(51) - \text{arc } SM(129) - \text{arc } MN(51) - \text{arc } NR(29))$$

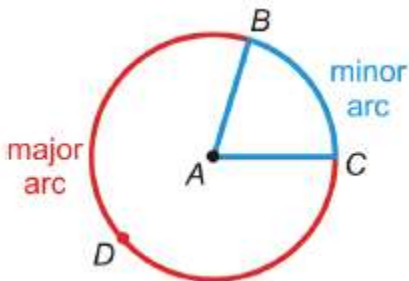
Summary – Arcs and Central Angles

Arcs are sections of a circle. The letters used to label an arc are the points on the circle. There are three main types of arcs.

- **Semicircle:** an arc that measures 180° . It is half of a circle. Look at the example below showing a semicircle outlined in green.



- **Minor arc:** an arc that measures less than 180° . Look at the example below showing a minor arc outlined in blue.
- **Major arc:** an arc that is greater than 180° . Major arcs are labeled with three letters to distinguish them from a minor arc.



minor arc BC and major arc BDC

The **central angle** divides the circle into two arcs: either two semicircles or one major arc and one minor arc.

Arc Addition Postulate: The measure of the arc formed by two adjacent arcs is the sum of measure of the two arcs. BC and CD are adjacent arcs. **$Arc\ CDB = Arc\ CD + Arc\ DB$**

Let's Practice – Summary

17.) A (semicircle) is an arc that measures 180° .

18.) A minor arc measures (less) than 180° .

19.) A major arc measures (greater) than 180° .

20.) The Arc Addition Postulate states that the measure of the arc is formed by two (adjacent) arcs is the sum of the two arcs.



Below are additional educational resources and activities for this unit.



Click on the icon to the left to watch a video and complete a quiz on Circles.



Click on the icon to the left to watch a video on Intro to arc measures.

[Practice 1: Arcs and Central Angles](#)

[Practice 2: Central Angles and Arcs](#)