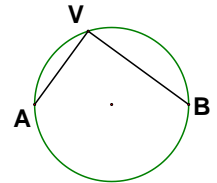


## GSP: Circles, Quadrilaterals and Angles

- ✓ Partner work required (\*Submit one lab write up per group)
- ✓ Name example: Smith\_Jones\_9.2CirclesQuadrilateralsAngles.gsp
- ✓ Save your work frequently. Sometimes the network crashes your application.
- ✓ Use multiple tabs; 1 for part 1, 2 for part 2, etc.

### 1. Inscribed Angles on a Diameter

Points, A, V, B, are on the circumference of the circle. Angle AVB is called an **Inscribed Angle** because the vertex of the angle is on the circle and segment VA and segment VB are chords of the circle. In the diagram, for this specific example, Point A and Point B are chosen as endpoints of a diameter of the circle.



#### Construction Directions 1

- Use the *Circle Tool* to create a circle. Use Transform > Rotate to move a copy of the one point already on the circle to the other end of a diameter of the circle (the diameter itself does not need to show).
- Use the *Point* tool: Move the Point cursor over the circle and SNAP a point to the circle.  
(OR: Select the circle and use Construct > Point on Circle to add an additional point to the circle.)
- Right click on each of the 3 points and choose Show Label. Double click on a label to modify the label. Label the three points A, B and V as in the diagram.
- Use the *Line Segment Tool* to construct Angle AVB.
- Use the *Marker* tool: Place marker at the vertex of angle AVB and click and drag to “mark” the angle. Then use the selector tool to select the angle and use Measure > Angle to measure Angle AVB.  
(OR: Select the three points defining Angle AVB and then use Measure > Angle to measure Angle AVB.)
- Copy your figure (circle, inscribed angle construction) and angle measurement at least twice so you have at least three copies of your construction (once you do the first circle/angle/measurement, you can copy and paste the whole set). Then move point V to a different location in each copy.

#### Demonstration 1

Demonstrate what happens in this case by moving Point V to three different locations for the three different circles.

#### Question 1

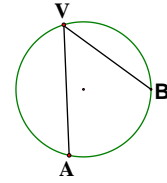
If Point A and Point B are the endpoints of a diameter of the circle, what can be said about the measure of the Inscribed Angle AVB as Point V moves to different locations on the circumference of the circle, but A and B remain fixed? (Use text box to answer **after** you do the construction & demonstration)

#### Answer for 1

Give your answer by using the *Text Tool* and directly typing your answer into your GSP worksheet.

## 2. Inscribed Angles on a Circle (Tab 2)

Points, A, V, B, are any three points the circumference of a circle.



### Construction Directions 2

- Use the *Circle Tool* to create a circle. Add two additional points to the circle. Be sure no two points are diameter endpoints.
- Label the three points A, B and V.
- Use the *Line Segment Tool* to construct Angle AVB.
- Measure Angle AVB.
- **SET A** Copy your figure (circle, inscribed angle construction) and angle measurement at least twice so you have at least three copies of your construction. Then move point V to a different location in each copy.
- **SET B** Make a fourth copy of your figure and angle measurement, then move Points A and B to a different location, and make two more copies of this new figure. Then move point V to a different location in each copy.

### Demonstration 2

Demonstrate what happens in this case, for both Set A and for Set B by moving Point V to three different locations for the three different circles. Make sure you have moved Point V to both “sides” of Points A and B.

### Question 2

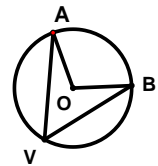
If Points A, B and V are any three points on the circumference of circle, what can be said about the measure of the Inscribed Angle AVB as Point V moves to different locations on the circumference of the circle, but A and B remain fixed?

### Answer for 2

Give you answer by using the *Text Tool* and directly typing your answer into your GSP worksheet. Be sure to describe what happens generally and consider the two cases where V is on “one side” or on the “other side” of Points A and B.

## 3. Central and Inscribed Angles on a Circle (Tab 3)

Points, A, V, B, are any three points the circumference of a circle and Point O is the center of the circle. Angle AOB is called a **Central Angle**.



### Construction Directions 3

- Use the *Circle Tool* to create a circle. Add two additional points to the circle. Be sure no two points are diameter endpoints.
- Label the three points on the circle A, B and V and label the circle center O.
- Use the *Line Segment Tool* to construct Angle AVB and to construct Angle AOB.
- Measure Angle AVB and measure Angle AOB.
- Compare angle measurements: Select both angle measurements and select Number > Calculate to open the GSP calculator. Notice under the Values menu in the calculator, your two angle measurements will show. You can select them, add, subtract, multiply and divide them to see if there is any fixed relationship between them even though you are moving A, B and / or V.
- Copy your figure (circle, inscribed and central angle constructions), angle measurements and the angle measurement calculation (if you like) at least three times so you have at least four copies of your construction. In each copy move the points A,B and V to different point on the circle.

### Demonstration 3

Demonstrate what happens in this case by moving Points A, B and V to different locations for the different circles.

### Question 3a

Is there a relationship between a central and inscribed angle as illustrated in the diagram? What can be said about the measure of the Inscribed Angle AVB and the Central Angle AOB as Point V moves to different locations on the circumference of the circle and Points A and B remain fixed? What if you move Points A and B?

### Question 3b

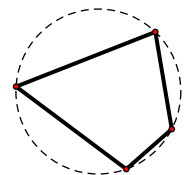
What can be said about the measure of the Inscribed Angle AVB and the Central Angle AOB if Point V moves "between" Point A and Point B (to the other side)?

### Answer for 3ab

Give you answer to questions 3a and 3b by using the *Text Tool* and directly typing your answer into your GSP worksheet. Be sure to describe what happens generally.

### 4. Quadrilaterals on a Circle (Tab 4)

Four points on the circumference of a circle are used to create a quadrilateral.



### Construction Directions 4

- Use the *Circle Tool* to create a circle.
- Add three additional points to the circle for a total of four points on the circumference of the circle.
- Label the points A, B, C and D.
- Use the *Line Segment Tool* to construct Quadrilateral ABCD.
- Measure all four vertex angles.
- Select your angle measures and use Number > Calculate to compare the angles.

- Copy your circle, quadrilateral and measurements at least three times to make at least four copies of the circle and quadrilateral.

#### **Demonstration 4**

Demonstrate what happens in this case by moving Points A, B, C and D around for the four different circles.

#### **Question 4**

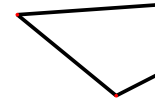
If four points on the circumference of a circle are used as the vertices of a quadrilateral, is there a relationship between the measures of the pairs of opposite angles of the quadrilateral?

#### **Answer for 4**

Give you answer by using the *Text Tool* and directly typing your answer into your GSP worksheet. Be sure to describe what happens generally; do your conjectures hold for every quadrilateral constructed on a circle like this?

#### **5. Quadrilaterals Not on a Circle (Tab 5)**

Four random points are connected to create a quadrilateral.



#### **Construction Directions 5**

- Use the Polygon tool (with no interior) to create a quadrilateral.  
(OR: Use the *Point Tool* to add four points to your workspace. Then use the *Line Segment Tool* to construct the Quadrilateral)
- Label the points on your quadrilateral A, B, C and D.
- Measure all four vertex angles.
- Select your angle measures and use Number > Calculate to compare the angles.
- Copy your quadrilateral and measurements at least three times to make at least four copies of the quadrilateral.

#### **Demonstration 5**

Demonstrate what happens in this case by moving Points A, B, C and D around for the four different quadrilaterals.

#### **Question 5**

If four random points, not on the circumference of a circle, are used as the vertices of a quadrilateral, is there a relationship between the measures of the pairs of opposite angles of the quadrilateral?

#### **Answer for 5**

Give you answer by using the *Text Tool* and directly typing your answer into your GSP worksheet. Be sure to describe what happens generally; are their any opposite angles relationships for non-specific quadrilaterals like this?