



### About the Lesson

In this activity, students will explore various properties of cyclic quadrilaterals. As a result, students will:

- Discover that opposite angles of cyclic quadrilaterals are supplementary.
- Discover properties of angles created by the diagonals of a cyclic quadrilateral.

### Vocabulary

- cyclic quadrilaterals

### Teacher Preparation and Notes

- Before beginning the activity, students should transfer the Cabri™ Jr. files *CYCLIC1*, *CYCLIC2*, and *CYCLIC3* to their graphing calculators.
- Before beginning the activity, make sure that students have the Cabri Jr. app installed on their graphing calculators.

### Activity Materials

- Compatible TI Technologies:

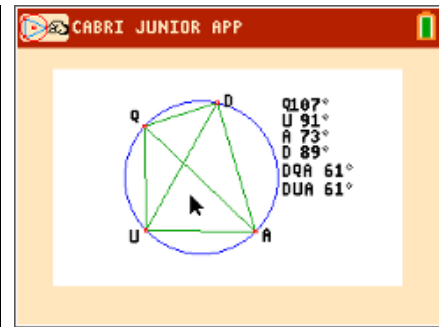
TI-84 Plus\*

TI-84 Plus Silver Edition\*

TI-84 Plus C Silver Edition

TI-84 Plus CE

\* with the latest operating system (2.55MP) featuring MathPrint™ functionality.



### Tech Tips:

- This activity includes screen captures taken from the TI-84 Plus CE. It is also appropriate for use with the rest of the TI-84 Plus family. Slight variations to these directions may be required if using other calculator models.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at <http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials>
- Any required calculator files can be distributed to students via handheld-to-handheld transfer.

### Lesson Files:

- Running\_Circles\_Around\_Quads\_Student.pdf
- Running\_Circles\_Around\_Quads\_Student.doc
- CYCLIC1.8xv
- CYCLIC2.8xv
- CYCLIC3.8xv

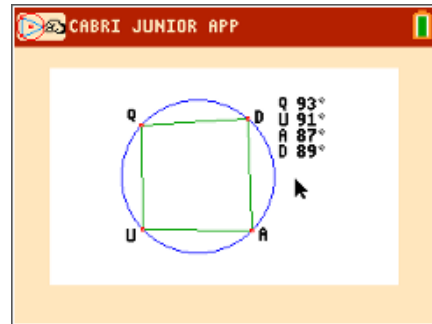


**Tech Tip:** Before beginning the activity, the files CYCLIC1.8xv, CYCLIC2.8xv, and CYCLIC3.8xv need to be transferred to the students' calculators via handheld-to-handheld transfer or transferred from the computer to the calculator via TI-Connect™ CE Software.

### Problem 1 – Properties of Cyclic Quadrilaterals

Students will begin this activity by looking at properties of cyclic quadrilaterals. They will discover that opposite angles are supplementary.

Students will be asked to collect data when point Q is on the circle and then be asked to collect data when point Q is not a point on the circle.



1. Drag point Q to four different positions and collect data in the table below.

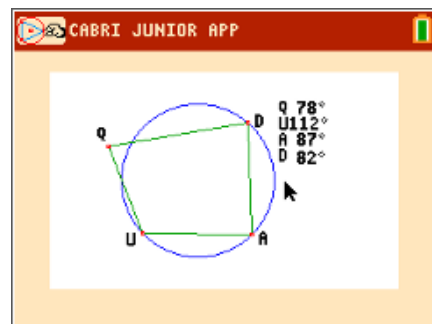
#### Sample Answers:

Position	$\angle Q$	$\angle U$	$\angle A$	$\angle D$
1	$91^\circ$	$89^\circ$	$89^\circ$	$91^\circ$
2	$91^\circ$	$107^\circ$	$89^\circ$	$73^\circ$
3	$91^\circ$	$119^\circ$	$89^\circ$	$61^\circ$
4	$91^\circ$	$54^\circ$	$89^\circ$	$126^\circ$

2. What do you notice about the opposite angles of a cyclic quadrilateral?

**Answer:** Opposite angles are supplementary.

Finally, students will be asked several always-sometimes-never questions. Students should use the properties of opposite angles to select the correct choice.





3. Open the file *CYCLIC2*. This file shows quadrilateral *QUAD* and the measures of angles *Q*, *U*, *A*, and *D*. Drag point *Q* to two points inside and two points outside the circle and collect data in the table below.

**Sample Answers:**

Position	$\angle Q$	$\angle U$	$\angle A$	$\angle D$
1	73°	107°	89°	91°
2	76°	95°	89°	100°
3	81°	78°	89°	112°
4	117°	65°	89°	88°

4. What do you notice about the opposite angles of a quadrilateral that is not necessarily cyclic?

**Answer:** No relationship exists.

Answer the following questions with always, sometimes, or never. Use what you know about the opposite angles of special quadrilaterals (parallelogram, rectangle, kite, trapezoid, etc.) and what you know about the opposite angles of cyclic quadrilaterals.

5. A kite is \_\_\_\_\_ a cyclic quadrilateral.

**Answer:** sometimes

6. A trapezoid is \_\_\_\_\_ a cyclic quadrilateral.

**Answer:** sometimes

7. An isosceles trapezoid is \_\_\_\_\_ a cyclic quadrilateral.

**Answer:** always

8. A parallelogram is \_\_\_\_\_ a cyclic quadrilateral.

**Answer:** sometimes



9. A rectangle is \_\_\_\_\_ a cyclic quadrilateral.

**Answer:** always

10. A square is \_\_\_\_\_ a cyclic quadrilateral.

**Answer:** always

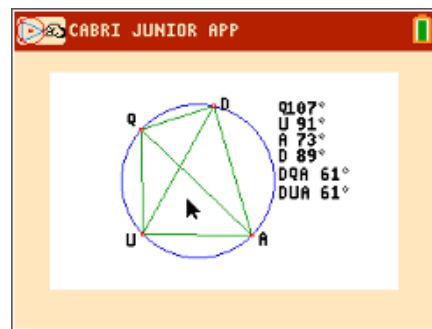
11. A rhombus is \_\_\_\_\_ a cyclic quadrilateral.

**Answer:** sometimes

### Problem 2 – Properties of Angles

In Problem 2, students can discover properties of angles created by the diagonals of a cyclic quadrilateral.

In file *CYCLIC*, students are given the measure of angles  $Q$ ,  $U$ ,  $A$ ,  $D$ ,  $DQA$ , and  $DUA$ . Students should move point  $Q$  to four different points and collect data in the table on the accompanying worksheet.



12. Open the file *CYCLIC3*. This file shows the measures of angles  $Q$ ,  $U$ ,  $A$ ,  $D$ ,  $DQA$ , and  $DUA$ . Move point  $D$  between  $Q$  and  $A$  to four different points and collect data in the table below.

### Sample Answers:

Position	$\angle Q$	$\angle U$	$\angle A$	$\angle D$	$\angle DQA$	$\angle DUA$
1	102°	95°	78°	85°	51°	51°
2	94°	95°	106°	105°	43°	43°
3	72°	95°	108°	105°	21°	21°
4	130°	95°	50°	85°	79°	79°

13. What do you notice about the measure of angles  $DQA$  and  $DUA$ ?

**Answer:** They are congruent.