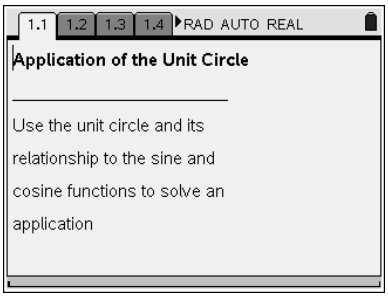
Application of the Unit Circle

STUDENT ACTIVITY

In this activity, you will use the unit circle and its relationship to the sine and cosine functions to solve a real-world application.



- **Open the TI-Nspire document *Application_of_the_Unit_Circle*.**
- **Press ctrl ▶ to move to page 1.2 and begin the activity.**

Suppose you work in a factory that manufactures cogwheels. The machine that makes the cogwheels uses the coordinate system to determine the placement of the teeth that will be machined into the rim of the cogwheel. Your job is to input the diameter of the cogwheel and the ordered pairs that represent the position of the teeth. You are creating a cogwheel with a 2-inch diameter. The teeth are to be positioned at 15-degree intervals around the rim.

- **Move to page 1.6.**

On page 1.6 is the diagram of the unit circle and its relationship to the sine function. Use the up and down arrows to change the position of point *P* on the circumference of the circle.

1. How many teeth will be machined around the cogwheel?

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2. The angle measures on page 1.6 are given in radians. Determine all the degree measures of the angles where the teeth will be positioned around the cogwheel. Record the angle measures in degrees and radians in the table below. (table continued on next page)

Angle Measure (in Degrees)	Angle Measure (in Radians)	*x*-Coordinate	*y*-Coordinate

Angle Measure (in Degrees) (continued)	Angle Measure (in Radians) (continued)	*x*-Coordinate (continued)	*y*-Coordinate (continued)

3. The diagram on page 1.6 shows the relationship between the unit circle and the sine function. How can the sine function help determine the ordered pairs of point *P* for each angle?

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4. On the graph on page 1.6, use the **Coordinates and Equations** tool (**MENU > Actions > Coordinates and Equations**) to find the *y*-coordinates for each ordered pair for point *P*. Record your findings (to three decimal places) in the table for Question 2.

➢ **Move to page 2.2.**

On page 2.2 is the diagram of the unit circle and its relationship to the cosine function. Use the up and down arrows to change the position of point *P* on the circumference of the circle.

5. The diagram on page 2.2 shows the relationship between the unit circle and the cosine function. How can the cosine function help determine the ordered pairs of point *P* for each angle?

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6. On the graph on page 2.2, use the **Coordinates and Equations** tool to find the *x*-coordinates for each ordered pair for point *P*. Record your findings (to three decimal places) in the table for Question 2.

7. Now that you have the measurements, you input them into the cogwheel machine. However, you notice the measurements are not quite right. The teeth are not exactly evenly spaced around the wheel. Why would that be?

8. Use your knowledge of a 30°-60°-90° triangle to check your results for the 30° angle. Show your work in the space below.

9. Use your knowledge of a 45°-45°-90° triangle to check your results for the 45° angle. Show your work in the space below.