

Trigonometric Patterns

ID: 12436

Time required
15 minutes

Activity Overview

Students will use the unit circle to examine patterns in the six trigonometric functions.

Topic: Trigonometry

- *Unit Circle*
- *Right Triangle Trigonometry*

Teacher Preparation and Notes

- *The angle measures may vary from the values in the answer tables due to rounding. Make students aware that they may need to use the closest angle measure possible for some values.*
- *The questions in the document are starting points for discussions about the patterns in the values of trig functions. Teachers should be prepared to discuss patterns beyond the ones in the document.*
- ***To download the student TI-Nspire document (.tns file) and student worksheet, go to education.ti.com/exchange and enter "12436" in the quick search box.***

Associated Materials

- *TrigPatterns_Student.doc*
- *TrigPatterns.tns*

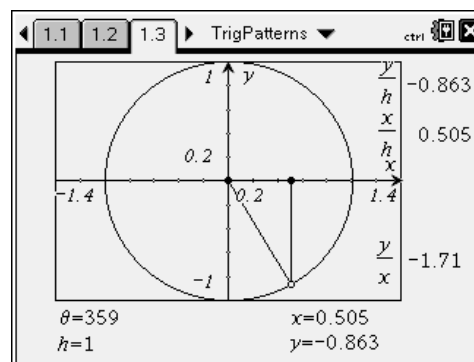
Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *An Interesting Circle (TI-Nspire technology) — 11176*
- *Graphs of Sine, Cosine, and Tangent (TI-Nspire technology) — 8314*
- *Graphs of Tangent, Cotangent, Secant, and Cosecant (TI-Nspire technology) — 9432*
- *Ferris Wheel Ride (TI-Nspire technology) — 10088*
- *Trigonometric Ratios (TI-Nspire technology) — 9535*

Searching for Patterns

Students will move the triangle on the unit circle to find the angle measures listed in the table on the student worksheet. To aid with calculations, students can use the **Text** tool to type the formulas from page 1.2 and the **Calculate** tool to calculate for the values of x , y , and h . Students will record the values and then answer questions about patterns in the results.

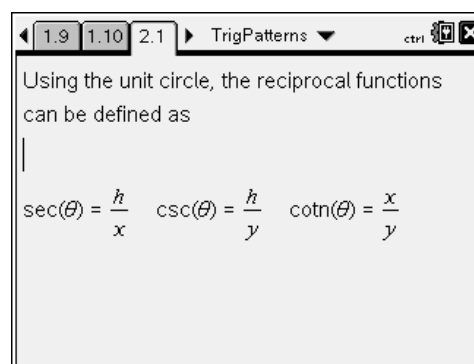


Discussion Questions

- What happens at 90° , 180° , 270° , and 360° ?
- Why is the tangent function undefined for some angle measures?

Extension – Patterns in reciprocal functions

In this problem, students will repeat the activity for the co-trigonometric functions. Again, the **Text** and **Calculate** tools can be utilized. Students will record the values and then have an open-ended exploration for determining patterns in the results.



Discussion Questions

- Are any of the functions undefined? For what values?
- Do any of the patterns match the patterns from the functions in the activity?

Student Solutions

θ	$\sin \theta$	$\cos \theta$	$\tan \theta$
30°	0.5	0.866	0.577
45°	0.707	0.707	1
60°	0.866	0.5	1.732
90°	1	0	Undefined
120°	0.866	-0.5	-1.732
135°	0.707	-0.707	-1
150°	0.5	-0.866	-0.577
180°	0	-1	0
210°	-0.5	-0.866	0.577
225°	-0.707	-0.707	1
240°	-0.866	-0.5	1.732
270°	-1	0	Undefined
300°	-0.866	0.5	-1.732
315°	-0.707	0.707	-1
330°	-0.5	0.866	-0.577
360°	0	1	0

- $0^\circ < \theta < 180^\circ$
- $180^\circ < \theta < 270^\circ$
- Positive $0^\circ < \theta < 90^\circ$, $180^\circ < \theta < 270^\circ$ because sine and cosine have same sign
Negative $90^\circ < \theta < 180^\circ$, $270^\circ < \theta < 360^\circ$ because sine and cosine have different signs
- $\cos(330^\circ)$
- Possible response: $\cos(45^\circ) = \cos(315^\circ)$; $\cos(60^\circ) = \cos(300^\circ)$
- $\tan(225^\circ)$
- Possible response: $\tan(60^\circ) = \tan(240^\circ)$, $\tan(30^\circ) = \tan(210^\circ)$
- Answers will vary. Sample response: The values in the first quadrant are repeated in the other quadrants, but have different signs.
- Answers will vary. Sample response: The values of sine and cosine switch within a quadrant, such as $\sin(30^\circ) = \cos(60^\circ)$, but the signs may be opposite in some quadrants.

Extension

θ	$\sin \theta$	$\cos \theta$	$\tan \theta$
30°	1.155	2	1.732
45°	1.414	1.414	1
60°	2	1.155	0.577
90°	Undefined	1	0
120°	-2	1.155	-1.732
135°	-1.414	1.414	-1
150°	-1.155	2	-1.732
180°	-1	Undefined	Undefined
210°	-1.155	-2	1.732
225°	-1.414	-1.414	1
240°	-2	-1.155	0.577
270°	Undefined	-1	0
300°	2	-1.155	-0.577
315°	1.414	-1.414	-1
330°	1.144	-2	-1.732
360°	1	Undefined	Undefined