Trigonometry
Graphing Trig Functions: Trig Parent Graphs – Activity

A. Tabular Data

Use your calculator to fill in the table below with the values of sine and cosine for each angle. Give each answer to the nearest <u>tenth</u>:

θ	$\sin\theta$	$\cos\theta$
0, 0°		
$\pi/6$, 30°		
$\pi/4$, 45°		
$\pi/3$, 60°		
$\pi/2$, 90°		
$2\pi/3$, 120°		
$3\pi/4$, 135°		
$5\pi/6$, 150°		
π, 180°		
$7\pi/6$, 210°		
$5\pi/4$, 225°		
$4\pi/3$, 240°		
$3\pi/2$, 270°		
$5\pi/3$, 300°		
$7\pi/4$, 315°		
$11\pi/6$, 330°		
2π, 360°		

What is the lowest value of sin x; the highest value of sin x? _____

What is the lowest value of cos x; the highest value of cos x? _____

What will happen if you continue the table past 2π or 360°? _____

_____

Use your calculator to fill in the table below with the values of tangent for each angle. Give each answer to the nearest <u>tenth</u>:

θ	$\tan\theta$	θ	$\tan\theta$
0, 0°		π, 180°	
$\pi/6$, 30°		$7\pi/6$, 210°	
$\pi/4$, 45°		$5\pi/4$, 225°	
$\pi/3$, 60°		$4\pi/3$, 240°	
70°		250°	
75°		255°	
80°		260°	
85°		265°	
89°		269°	
$\pi/2$, 90°		$3\pi/2$, 270°	
91°		271°	
95°		275°	
100°		280°	
105°		285°	
110°		290°	
$2\pi/3$, 120°		$5\pi/3$, 300°	
$3\pi/4$, 135°		$7\pi/4$, 315°	
$5\pi/6$, 150°		$11\pi/6$, 330°	
		2π, 360°	

For what values of θ is tangent undefined? _____

What happens as θ approaches these values? _____

_____

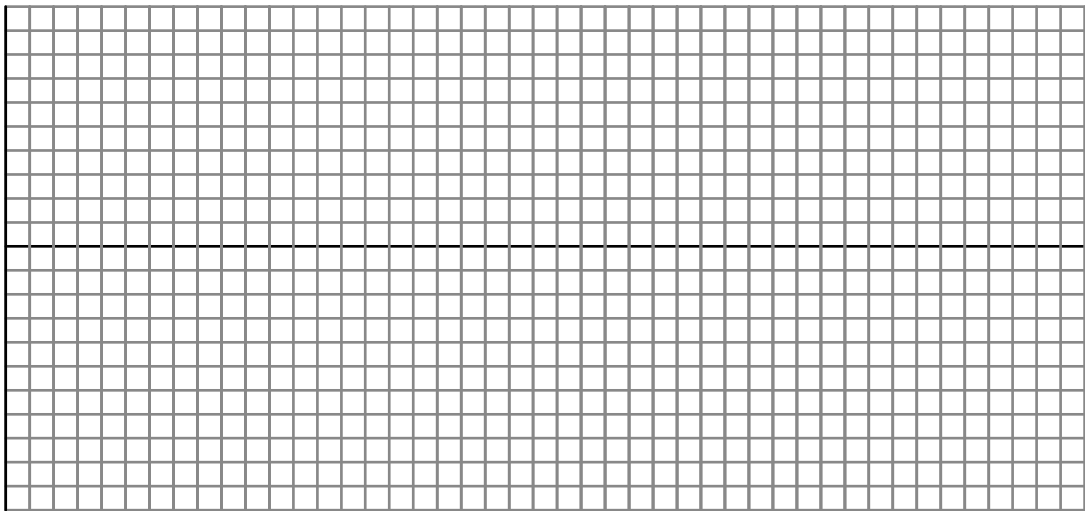
B. Graphing the Data

On the grids below, carefully scale the axes as follows:

The horizontal axis should go from $\theta = 0$ to 2π (360°), intervals of $\pi/12$ (15°).

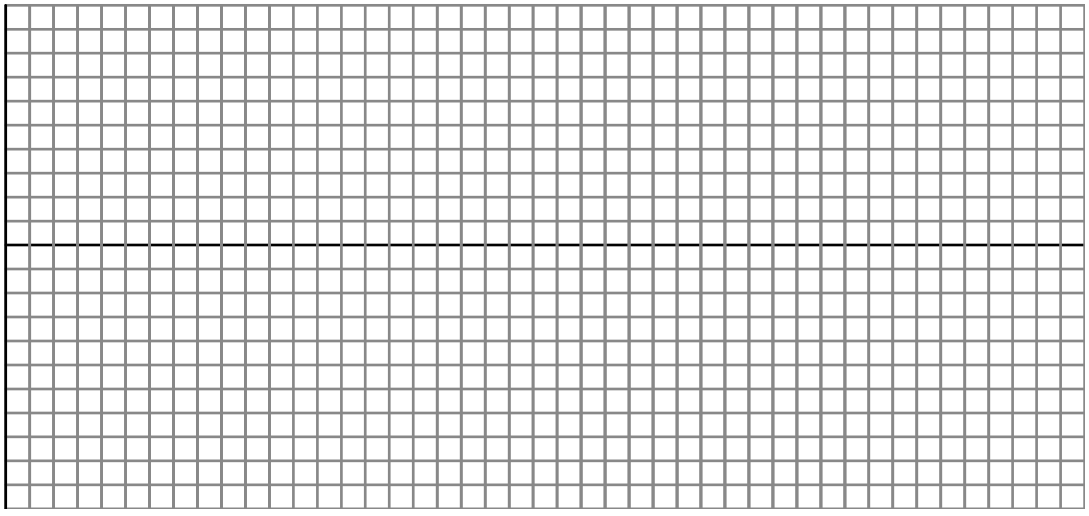
The vertical axis should go from $y = -1$ to 1 , intervals of 0.1

1) Plot the points for $y = \sin\theta$ from the table.



- What happens after $\theta = 2\pi$? _____
- Can θ be less than 0 ? _____
- What is the <u>domain</u> of the function $y = \sin\theta$? _____
- What is the <u>range</u> of the function $y = \sin\theta$? _____

2) Plot the points for $y = \cos\theta$ from the table.

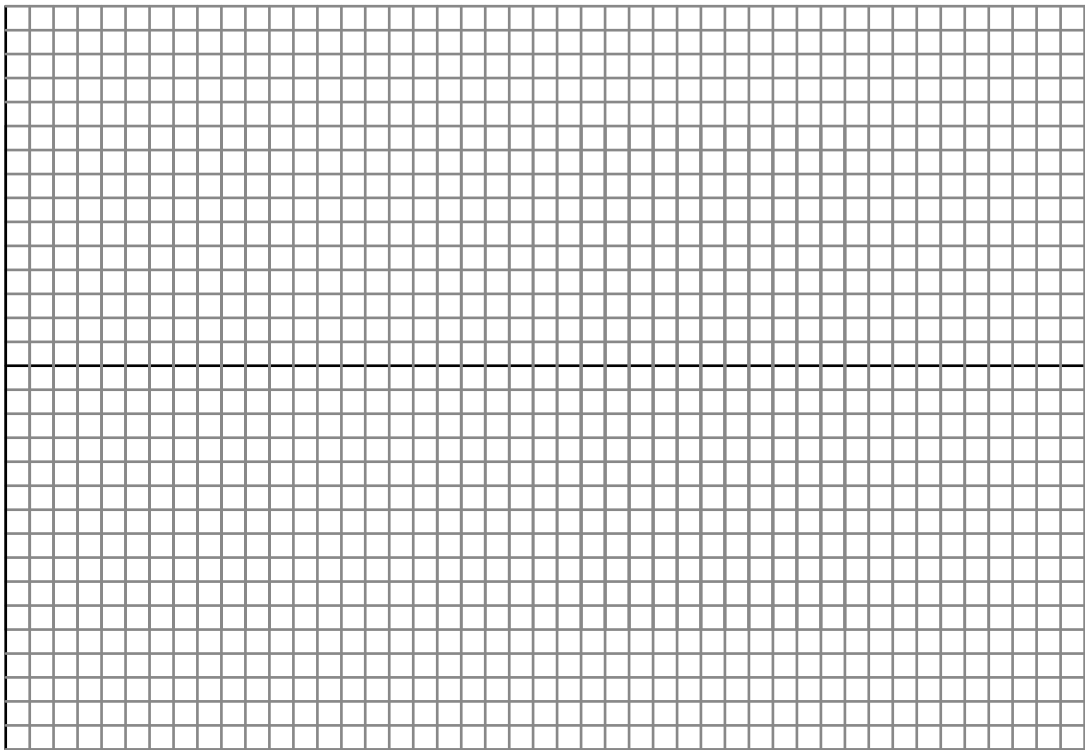


- How does the graph of $y = \cos\theta$ compare to the graph of $y = \sin\theta$?

_____

On the grid below, carefully scale the axes as follows:
The horizontal axis should go from $\theta = 0$ to 2π (360°), intervals of $\pi/12$ (15°).
The vertical axis should go from $y = -15$ to 15 , intervals of 1.

3) Plot the points for $y = \tan\theta$ from the table.



- What happens when tangent is undefined? _____
- How often does this happen? _____
- Is there a limit to how large tangent can be? _____
- What is the <u>domain</u> of the function $y = \tan\theta$? _____
- What is the <u>range</u> of the function $y = \tan\theta$? _____

C. Essential Vocabulary

Periodic Function A function is periodic if, for some real number $\boldsymbol{a}$, $f(x+\alpha) = f(x)$ for each $\boldsymbol{x}$ in the domain of f.

Period of a Function The least positive value of α for which $f(x) = f(x+\alpha)$ is the period of the function.

D. Graphs of the Other Three Trig Functions

The other three trig functions, sec x, csc x and cot x, also have *periodic* graphs. We could make table values for them, but let's use Sketchpad to demonstrate their graphs instead. Open the file **"Trig_Graphs.gsp"** (on the Trig website) and follow these directions.

* As you click on each trig function, click the button "SLOW" and watch as a point moves around the circle (the value of the angle θ is displayed on the screen in terms of π, the program only shows values of θ from $-\pi$ to π). As the point moves on the unit circle, its trig value is graphed to the right. Let's see them one at a time:

a) *SINE*
As the point moves around the circle, the value of SINE is shown as a red segment (the y-value of the point). Describe the shape of this graph.

b) *COSINE*
As the point moves around the circle, the value of COSINE is shown as a red segment (the x-value of the point). How is this different from the sine graph?

c) TANGENT
As the point moves around the circle, the value of TANGENT is shown as a blue segment. For what values of θ is cotangent undefined? How is this expressed on a graph? Describe the graph.

d) COTANGENT
As the point moves around the circle, the value of COTANGENT is shown as a blue segment. For what values of θ is cotangent undefined? How is this expressed on a graph? How is the graph of cotangent different from tangent?

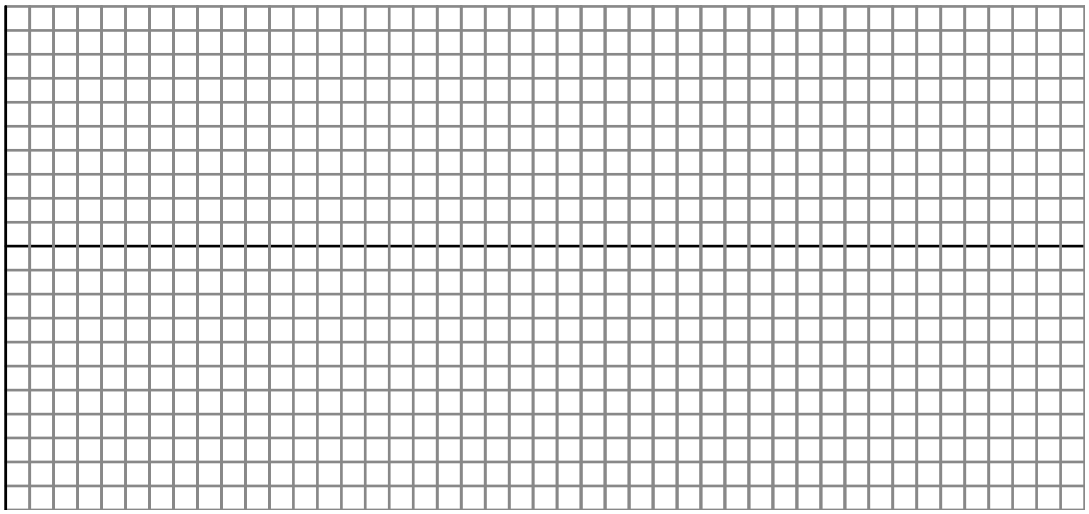
e) COSECANT
As the point moves around the circle, the value of COSECANT is shown as a green segment. For what values of θ is cosecant undefined? How is this shown on the graph? Describe the graph. Remember, cosecant is the reciprocal of sine, do you see a connection between the two graphs?

f) SECANT
As the point moves around the circle, the value of COSECANT is shown as a green segment. For what values of θ is secant undefined? How is this shown on the graph? Describe the graph. Remember, secant is the reciprocal of cosine, do you see a connection between the two graphs?

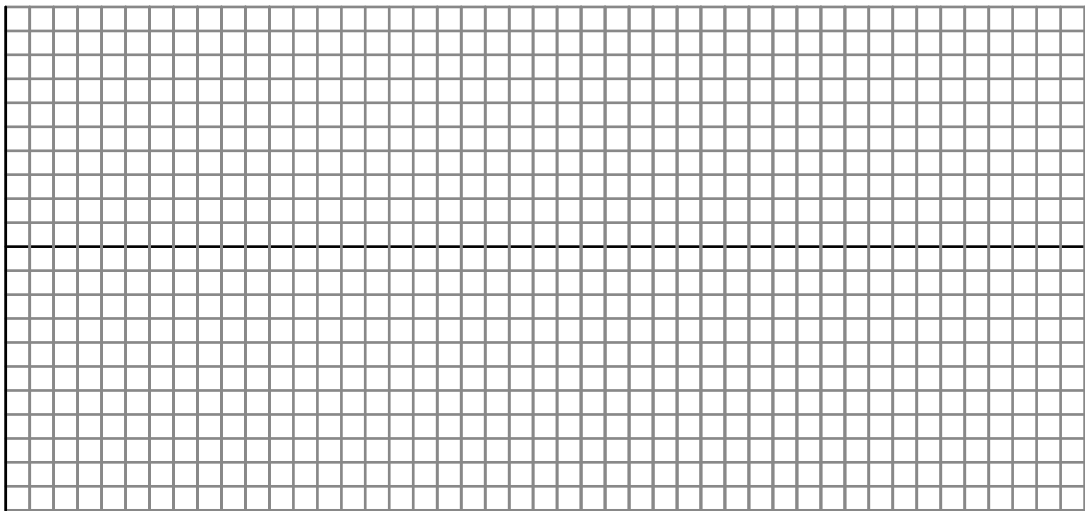
E. Continue the Graphs

Some of these problems require you to graph more than one period. Scale the x-axis in intervals of π/6 or 30°.

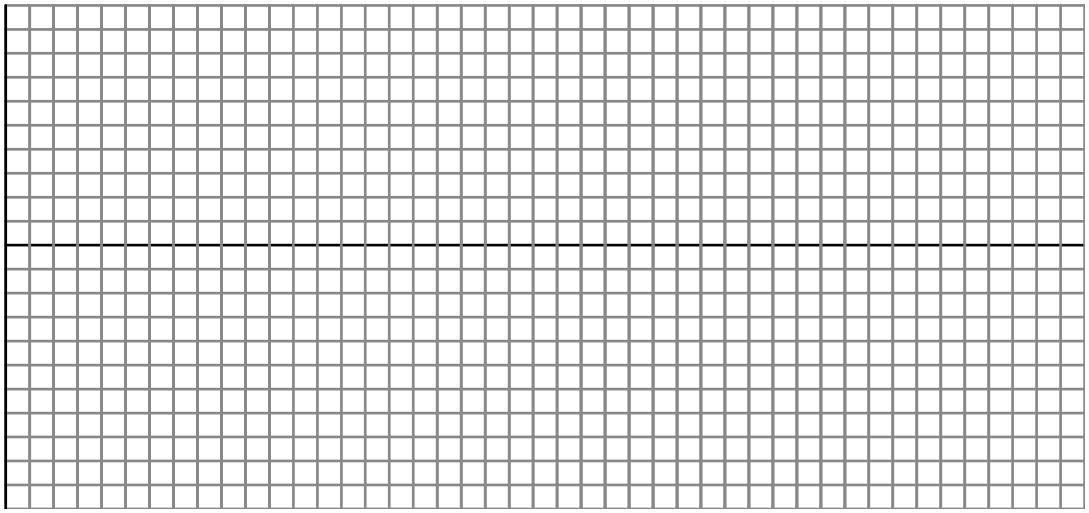
a) Graph the sine curve in the interval $-\pi \le \theta \le 2\pi$.



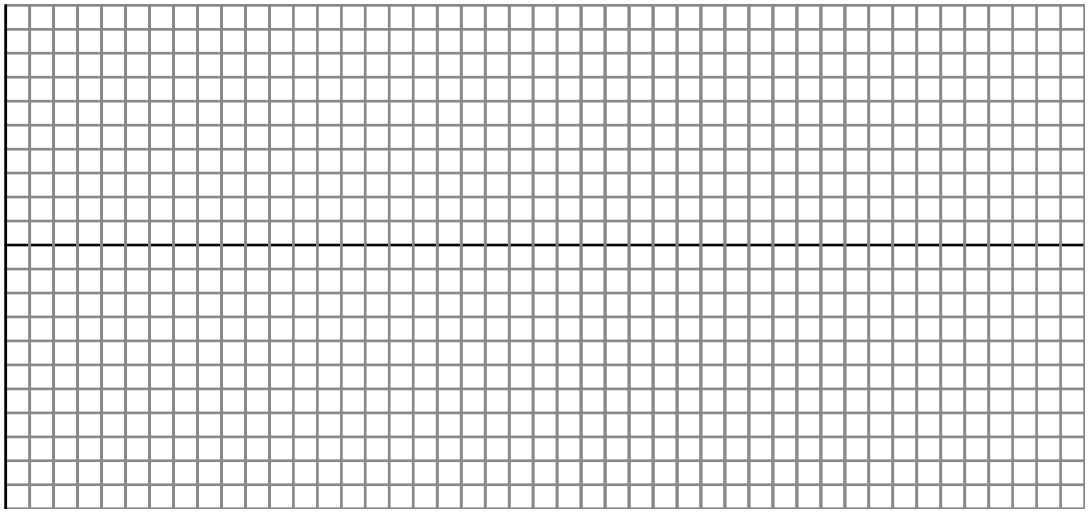
b) Graph the tangent curve in the interval $-\pi \le \theta \le 2\pi$.



c) Graph the cosine curve in the interval $0 \le \theta \le 4\pi$.



d) Graph the secant curve in the interval $0 \le \theta \le 4\pi$.



Summary

- The graphs of the 6 trig functions are all periodic, their values repeat at set intervals.
    - The period of the graphs of SINE, COSINE, COSECANT and SECANT is 2π, that is to say that these graphs repeat their values every 2π radians.
    - The period of the graphs of TANGENT and COTANGENT is π.
- The graphs of TANGENT, COTANGENT, COSECANT and SECANT all have vertical assymptotes because there are angles for which these trig functions are not defined.
    - TANGENT is undefined when $= -\pi/2, \pi/2$, and every π afterwards.
    - COTANGENT is undefined when $= -\pi, 0, \pi$, and every π afterwards.
    - COSECANT is undefined when $= -\pi, 0, \pi$, and every π afterwards.
    - SECANT is undefined when $= -\pi/2, \pi/2$, and every π afterwards.