

Exploration 6-3a: Tangent and Secant Graphs

Date: _____

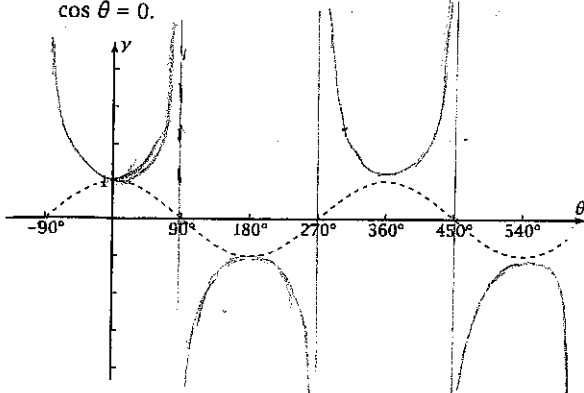
Objective: Discover what the tangent and secant function graphs look like and how they relate to sine and cosine.

No graphers allowed for Problems 1-7.

1. The reciprocal property states that

$$\sec \theta = \frac{1}{\cos \theta}$$

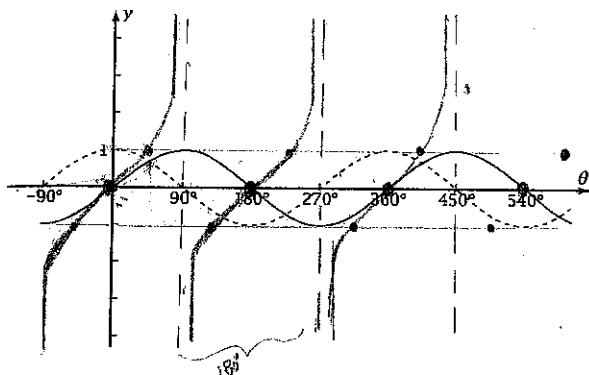
Without your grapher, use this property to sketch the graph of $y = \sec \theta$ on the same axes as the graph of the parent function $y = \cos \theta$. In particular, show what happens to the secant graph wherever $\cos \theta = 0$.



2. Write the quotient property expressing $\tan \theta$ as a quotient of two other trigonometric functions.

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

3. The next figure shows the parent functions $y = \sin \theta$ and $y = \cos \theta$. Based on your answer to Problem 2, determine where the asymptotes are for the graph of $y = \tan \theta$, and mark them on the figure.



$$\frac{\frac{\sqrt{2}}{2}}{\frac{\sqrt{2}}{2}} = 1$$

$$90 + n(180)$$

4. Based on the quotient property, find out where the θ -intercepts are for the graph of $y = \tan \theta$. Mark these intercepts on the figure in Problem 3.

$$y = 0 + n(180)$$

5. At $\theta = 45^\circ$, $\sin \theta$ and $\cos \theta$ are equal. Based on this fact, what does $\tan 45^\circ$ equal? Mark this point on the graph in Problem 3. Mark all other points where $|\sin \theta| = |\cos \theta|$.

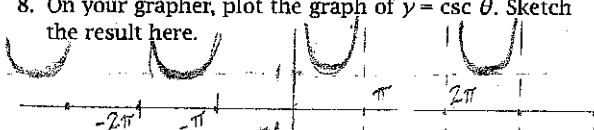
$$\tan 45^\circ = 1$$

6. Use the points and asymptotes you have marked to sketch the graph of $y = \tan \theta$ on the figure in Problem 3. (No graphers allowed!)

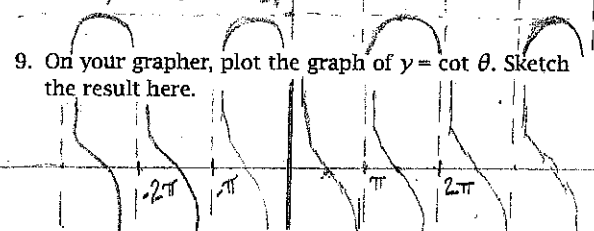
7. Check your graphs with your instructor.

Graphers allowed for the remaining problems.

8. On your grapher, plot the graph of $y = \csc \theta$. Sketch the result here.



9. On your grapher, plot the graph of $y = \cot \theta$. Sketch the result here.



10. At what values of θ are the points of inflection for $y = \tan \theta$? Explain why the tangent function has no critical points.

$$\theta = 0^\circ + 180^\circ n = 0 + \pi n$$

$\tan \theta$: constantly increasing } except for jumps from high to low
 $\cot \theta$: " decreasing }

11. Explain why the graph of $y = \sec \theta$ has no points of inflection, even though the graph goes from concave up to concave down at various places.

goes from concave up to concave down discontinuously

12. What did you learn as a result of doing this exploration that you did not know before?

Exploration 6-3b: Transformed Tangent and Secant Graphs

Date: _____

Objective: Sketch transformed tangent, cotangent, secant, and cosecant graphs, and find equations from given graphs.

$$4 = \frac{360}{P} \quad P = \frac{360}{4} = 90^\circ$$

1. For $y = 3 + \frac{1}{2} \tan 5(\theta - 7^\circ)$, state

The horizontal dilation: $\frac{1}{5}$

The period: 36°

The horizontal translation: $Rt 7^\circ$

The vertical dilation: $\frac{1}{2}$

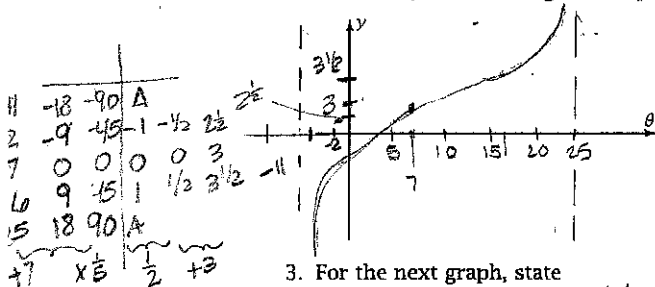
The vertical translation: $+3$

2. Sketch the graph of $y = 3 + \frac{1}{2} \tan 5(\theta - 7^\circ)$, showing vertical asymptotes, horizontal axis, points of inflection, and other significant points.

$$B = \frac{180}{b}$$

$$5 = \frac{180}{b}$$

$$b = \frac{180}{5} = 36$$



3. For the next graph, state

The horizontal dilation: $\frac{1}{6}$

The period: 30°

The horizontal translation (for cotangent): -9°

The vertical dilation: 2

The vertical translation: -1

