Lesson Plan 7 Phase Shift, Other Trig Functions Math 48C Mitchell Schoenbrun

1) Attendance
2) Announce Quiz on Thursday section 8.4 and 8.5
3) Questions about homework?
4) Hand in Homework

Note that the sine function can be expressed in terms of the cosine function:

$$\sin(x) = \cos\left(x + \frac{3\pi}{2} + 2\pi n\right) n \in \{\ldots, -2, -1, 0, 1, 2, \ldots\}$$

We now introduce 4 more functions that are built from these two functions:

Tangent: $\tan(x)$ $\qquad \frac{\sin(x)}{\cos(x)}$

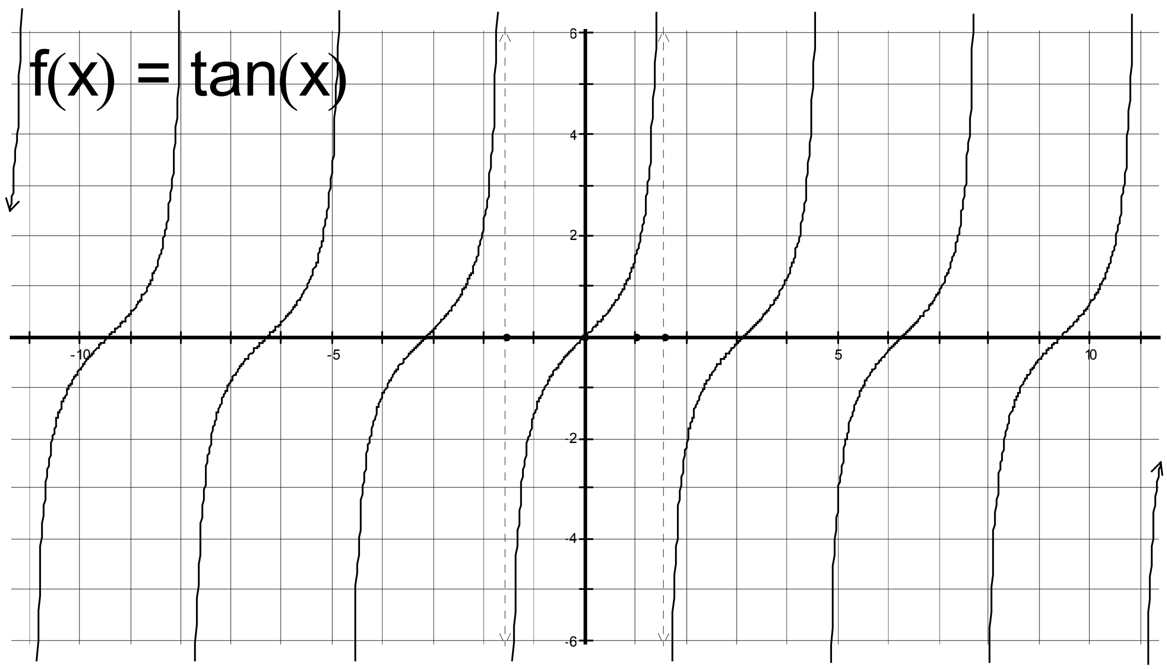
Cotangent: $\cot(x) \, or \, ctn(x)$ $\qquad \frac{\cos(x)}{\sin(x)}$

Secant: $\sec(x)$ $\qquad \frac{1}{\cos(x)}$

Cosecant: $\csc(x)$ $\qquad \frac{1}{\sin(x)}$

$$\tan(x) = \frac{\sin(x)}{\cos(x)}$$

Let's look at a graph of this function:



The two dashed lines are at $-\frac{\pi}{2}$ and $\frac{\pi}{2}$. What happens to the function at that x value?

These vertical lines are called asymptotes. What is an asymptotes?

Where is this function not defined? ___________________

What is the functions period? _________________

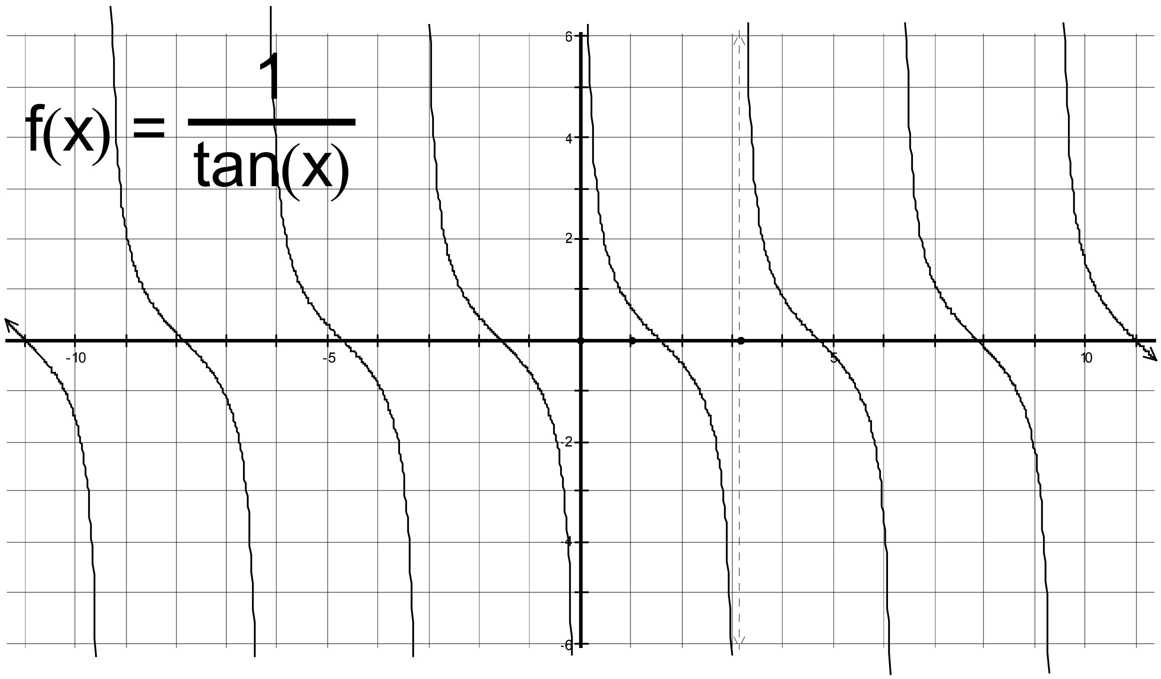
What is the functions Domain: _________________

What is the functions Range: _________________

What is the functions Amplitude? __________________(trick question)

$$\cot(x) = \frac{\cos(x)}{\sin(x)} = \frac{1}{\tan(x)}$$

Let's look at a graph of this function:



How does this compare with the tangent function?

Where is this function not defined? ___________________

Where are the vertical asymptotes

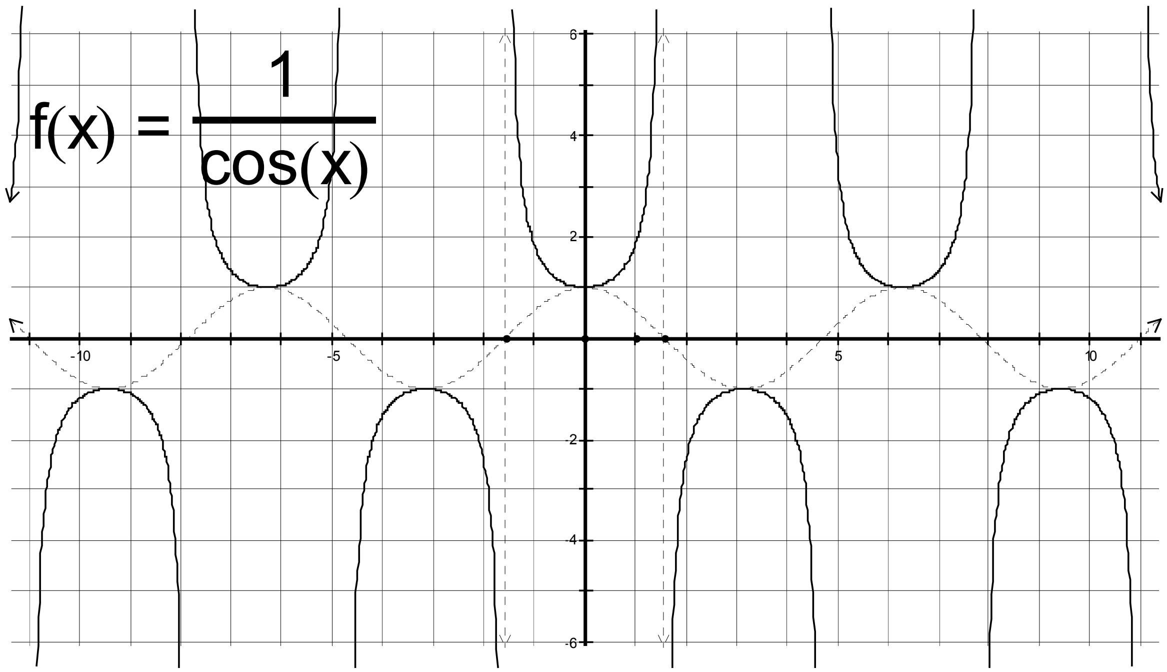
What is the functions period? _________________

What is the functions Domain: _________________

What is the functions Range: _________________

$$\sec(x) = \frac{1}{\cos(x)}$$

Let's look at a graph of this function:



How does this compare with the cosine function?

Where is this function not defined? ___________________

Where are the vertical asymptotes

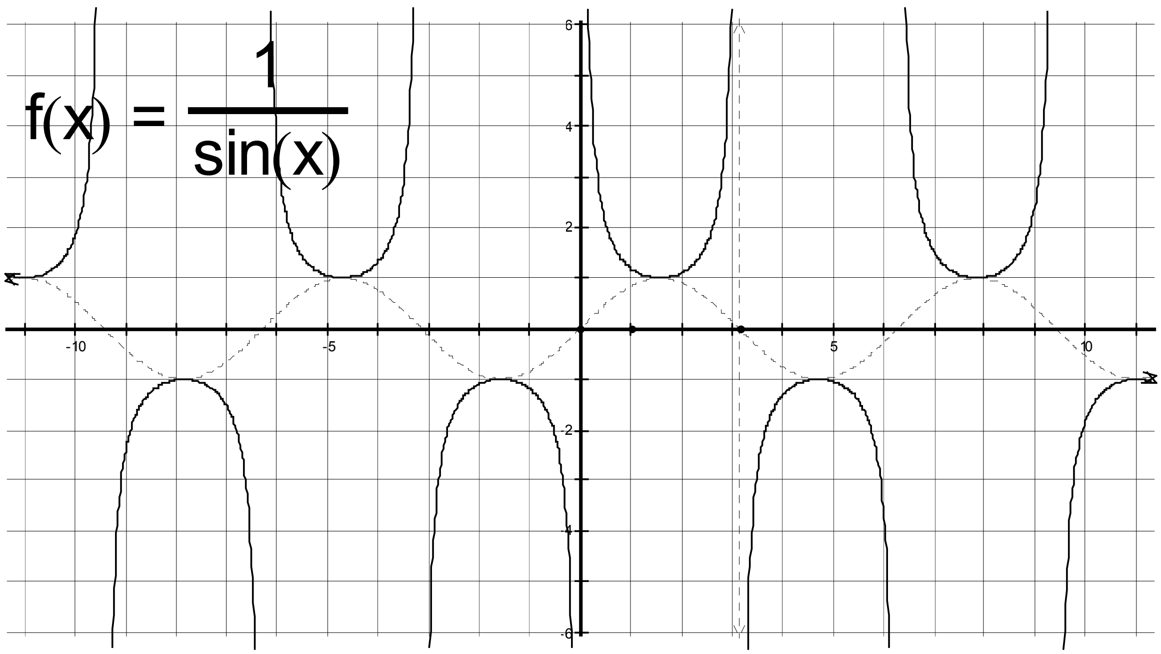
What is the functions period? _________________

What is the functions Domain: _________________

What is the functions Range: _________________

$$\csc(x) = \frac{1}{\sin(x)}$$

Let's look at a graph of this function:



How does this compare with the sine function?

Where is this function not defined? ___________________

Where are the vertical asymptotes

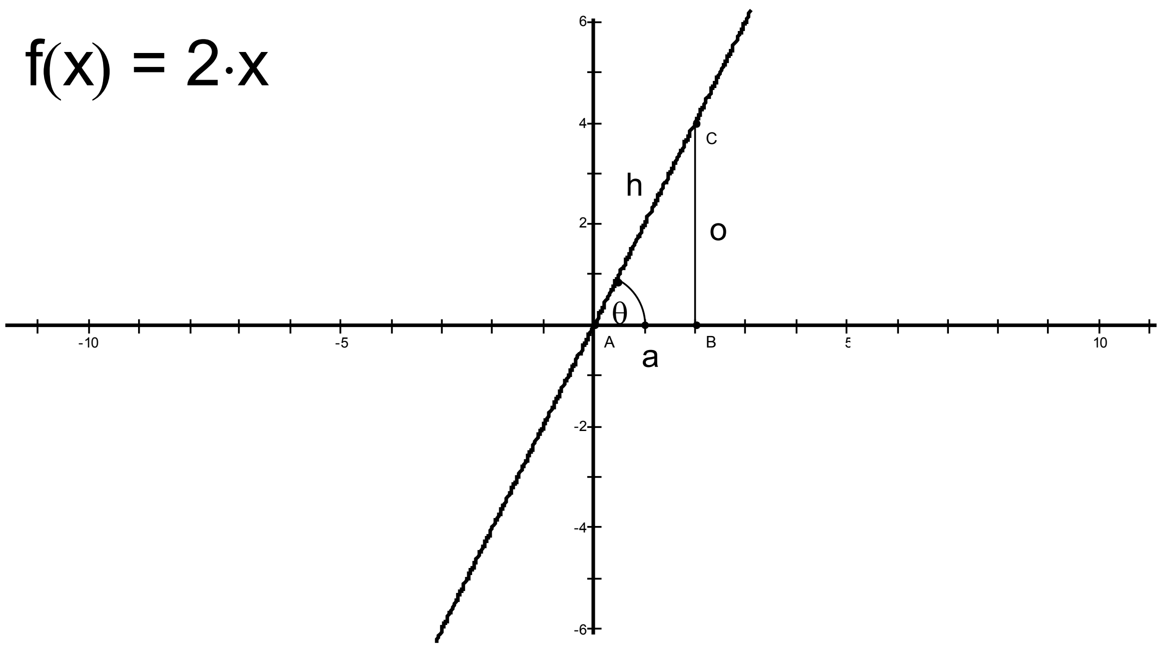
What is the functions period? _________________

What is the functions Domain: _________________

What is the functions Range: _________________

A special property of the tangent function:

Take a linear equation going through the origin (0,0)



Note that:

$$\sin(\theta) = \frac{o}{h}$$

$$\cos(\theta) = \frac{a}{h}$$

$$\tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)} = \frac{\frac{o}{h}}{\frac{a}{h}} = \frac{o}{a}$$

But

$$\frac{\Delta y}{\Delta x} = \frac{o}{a} = \tan(\theta)$$

So the tangent function gives us the slope of a line!

Graphing the other Trigonometric functions:

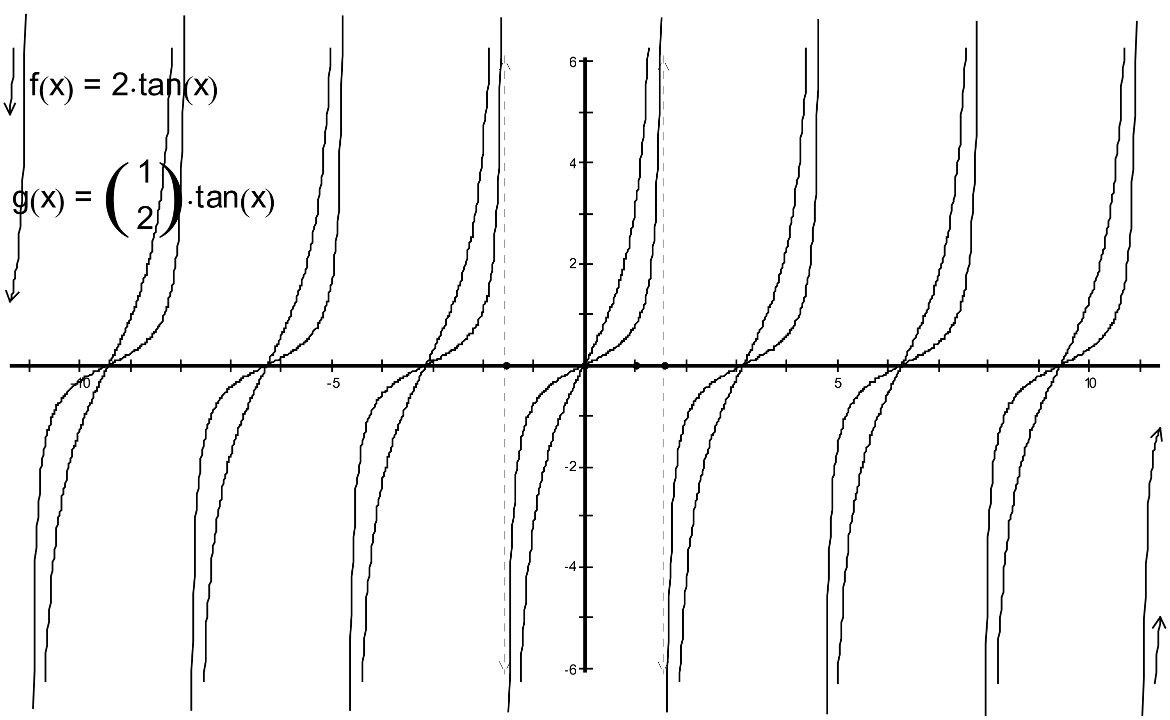
Example: $f(x) = 2\tan\left(2\left(x - \frac{\pi}{2}\right)\right) + 3$

D=3 still is a vertical shift up

C=$\frac{\pi}{2}$ is still a horizontal shift to the right

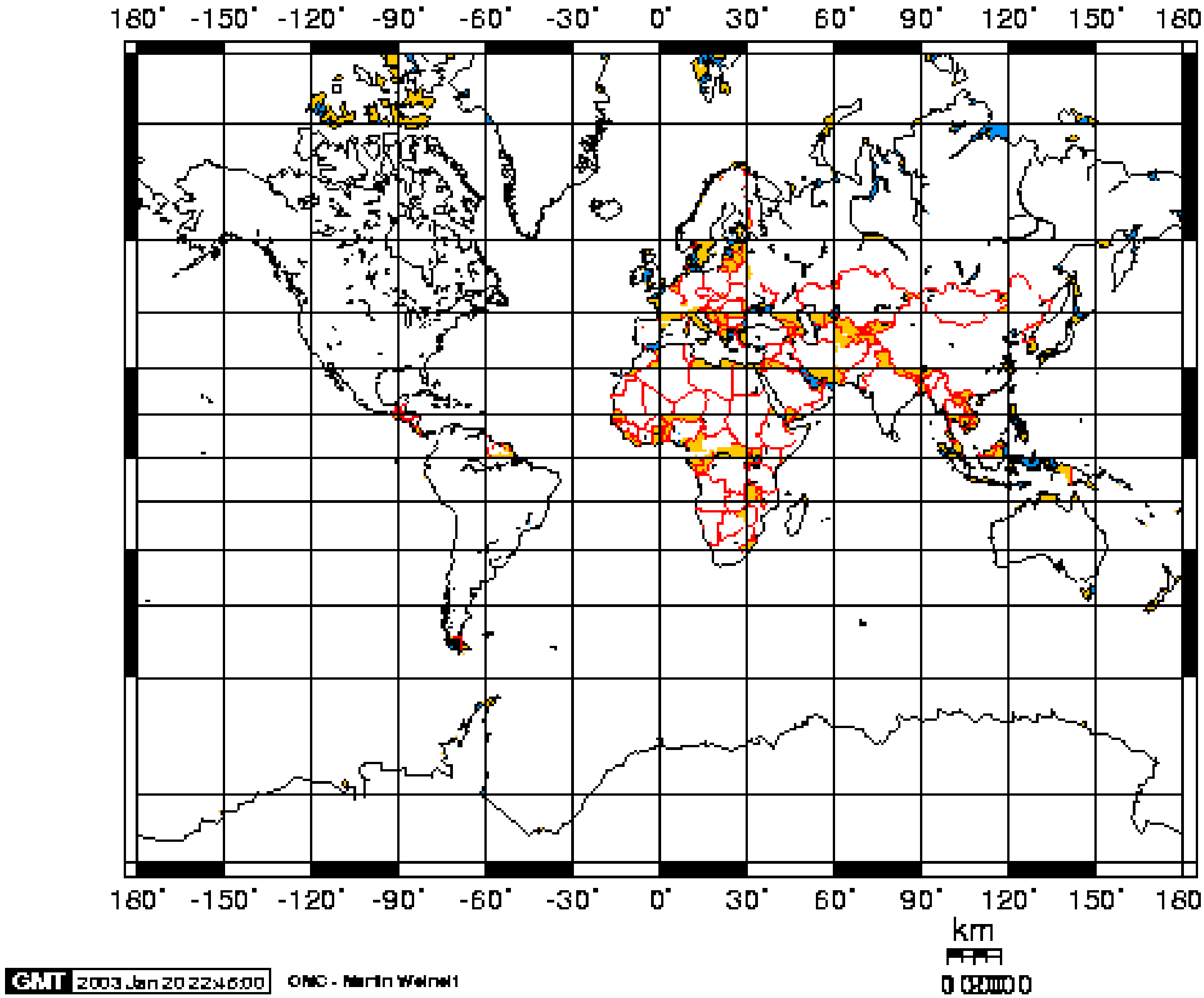
B = 2 still affects the period in the same way $P = \frac{\pi}{|B|}$

How about A?



Class HandOut

Curious property of tangent used in a Mercator projection



Note that the latitude lines are mapped tan(θ) from the center line. That means that the North and South Pole cannot be shown because they are at infinity.

The importance of this projection of a sphere onto a flat surface is that it preserves angles. That means that if you draw a straight line on the map, it really is a straight line or great circle on the map.