MATH 14210: WORKSHEET FOR 3/8

Graphs of waves

(1) Using a graphing calculator graph the function
$$f(x) = A\sin(B(x-D)) + C,$$
where A, B, C, D are parameters. (Desmos will let you give them names, and then add sliders to control their values.) Vary the values of these parameters and see the effect they have on the graph. Then do the same but with cos instead of sin.

(2) The function $w(t) = -2\sin(\frac{\pi}{180}t) + 2$ models a wave. Determine the amplitude, period, vertical shift, maximum, and minimum of the wave. Use this information to sketch a graph of one full period of the wave. Check your work using a graphing calculator

(3) A wave has an amplitude of 3 and a period of 20π, with no vertical nor horizontal shift. If the wave starts out in the middle going upward, write a function which describes the wave. [Hint: you need to find the values of the parameters A, B, and C in pattern $h(t) = A\mathsf{trig}(Bt) + C$, where trig is one of the trig functions.]

(4) A weight on a spring oscillates between a minimum height of 2 inches off the ground to 8 inches above the ground. If it takes 5 seconds to make a complete cycle from bottom to top to bottom again, and if the weight's initial location is at the bottom of its cycle, then write a sine or cosine function which describes the height of the weight as a function of time. After you find the function, graph it with a graphing calculator to check your work. [Hint: you need to find the values of the parameters A, B, and C in pattern $h(t) = A\mathsf{trig}(Bt) + C$, where trig is one of the trig functions.]

Other trig functions

To understand the graph of the function $\tan x$, you want to think of it as $\tan x = \frac{\sin x}{\cos x}$.

(1) Using this way of thinking of $\tan x$, figure out where $\tan x = 0$ and where $\tan x$ has an asymptote. [Hint: it is enough to look at what happens on the interval $[0, 2\pi]$, since the function repeats after a full revolution of the circle.]
(2) Next, figure out where $\tan x$ is positive/negative, where it is increasing/decreasing, and where it is concave up/down.
(3) Given this information, sketch a graph of $\tan x$. Check your work with a graphing calculator.
(4) Looking at the graph, what does it look like is the period of $\tan x$? Can you explain why?

You can understand the graph of $\cot x$ in a similar way, except that $\cot x = \frac{\cos x}{\sin x}$. Do these same steps to sketch a graph of $\cot x$, and check your work with a graphing calculator.

For $\sec x$ and $\csc x$, you could do a similar thing. Or you could think about them as coming from the reciprocals of $\cos x$ and $\sin x$. Here's what you'd do for $\sec x$:

(1) Graph $\cos x$ on the interval $[0, 2\pi]$.
(2) Knowing where $\cos x = 0$, use that info to determine where the asymptotes of $\sec x$ are.
(3) Knowing where $\cos x$ is positive/negative, determine where $\sec x$ is positive/negative.
(4) Knowing where $\cos x$ has maximums/minimums, use that info to determine where $\sec x$ has its maximums/minimums, and what their values are.
(5) Put all this together to sketch a graph of $\sec x$. Check your work with a graphing calculator.

For the graph of $\csc x$, do the same thing but with $\sin x$.