Math 1316: 4-5 Worksheet

April 5, 2022

For this in-class exercise we're going to use the Desmos online graphing calculator to look at graphs of sine and cosine waves: https://desmos.com/calculator. What I want you to get out of this is an intuitive feel for how various parameters affect the behavior of sine waves. As normal for in-class worksheets, I'm not asking you to turn anything in for this.

1. To start, graph the basic $f(x) = \sin(x)$, by typing `sin(x)` in the box. Try this also with $\cos(x)$.
2. Next, let's change the amplitude. Try graphing $A\sin(x)$ for different values of A.
3. Desmos has a nice feature where you can add a slider for a constant. Type `A sin(x)` and an "add slider" button for A will pop up. What happens when you increase A? Decrease it? Make it negative?
4. Next let's look at period. Try graphing $\sin(Bx)$, adding a slider for B. What happens when you increase B? Decrease it? Make it negative?
5. Next let's look at vertical shifts. Graph $\cos(x) + C$, adding a slider for C. What happens when you change the value for C?
6. We can also consider horizontal shifts (also called *phase shifts*). Graph $\sin(x + D)$, adding a slider for D. What happens when you change the value for D.
7. Over the top of your graph of $\sin(x + D)$, also graph $\cos(x)$. Can you find a value for D which makes the two graphs overlap exactly?
8. You can also have multiple parameters, with multiple sliders, for one function, e.g. looking at $A\sin(Bx + D) + C$. To see how they interact, press the play button on the slider for D, and then manually move B to different values. What do you observe?
9. Time permitting, do some further investigations. First, try plotting $\sin(x)\cos(x)$, and then compare it to $A\sin(Bx)$ for various values of A and B. What do you observe about $\sin(x)\cos(x)$? Can you find values for A and B to make the graphs overlap?
10. Next, try plotting $\sin(x) + \cos(x)$, then compare it to $A\sin(X + D)$. Can you find values for A and D to make the graphs overlap?
11. Lest you be misled into thinking everything is a basic sine wave, graph $\sin(Ax)\cos(Bx)$, and look at different values for A and B. Compare the graphs you can get for this to what you can get for $\sin(Cx) + \cos(Dx)$ for different values of C and D.