MTH 30 LECTURE NOTES (Ojakian)

Topic 21: Graphing the trigonometric functions

OUTLINE
(References: 6.1, 6.2)

1. General Points on graphing trig functions
   (a) The input: Angles in radians (all values allowed: 0, negative, positive).
   (b) Strategy: At least calculate every $\pi/2$ step.
2. Basic graphs of sin and cos
   Questions: What do sound and light "look like?" How do we explain difference in pitch of sound? How do we explain color?

   PROBLEM 1. *Graph* $y = \sin(x)$.

   PROBLEM 2. *Graph* $y = \cos(x)$.

   PROBLEM 3. *Make some observations about the* sin *and* cos *graph.*

   (a) What is the domain?
   (b) What are the possible values?
   (c) In what way are the graphs repetitive?
3. Period of a graph
   (Roughly) to find the **period** of a graph (if it exists!):
   (a) Choose a piece of the graph.
   (b) Can you get the whole graph by shifting this piece to the left and right?
   (c) Is this the shortest piece that works?
   (d) Then, the length of this piece is the period of the graph.
4. Graph Transformations on sin and cos
   General Form: $y = A\sin(Bx) + C$ or maybe even: $y = A\sin(B(x-k)) + C$
   (Note: A is amplitude)
   (a) Vertical Shift
   (b) Horizontal Shift
   (c) Vertical Stretch/Compression
   (d) Horizontal Stretch/Compression
   (e) Reflection: Across y axis
   (f) Reflection: Across x axis

5. Trig Graph Terminology

   (a) Rewrite $\sin(Bx - C) = \sin(B(x - \frac{C}{B}))$, i.e. shift amount is $\dfrac{C}{B}$

   (b) Phase Shift: $\frac{C}{B}$ (i.e. the horizontal shift), which can be left or right phase shift.

   (c) Exercises Section 6.1: 15, 16, 17

6. Graphing Tan Function

   Recall: $\tan(x) = \dfrac{\sin(x)}{\cos(x)}$

   (a) New issue: Asymptotes

   (b) Period Change

   (c) Graphing Strategy:

      i. Mark the number line at $\pi/2$ steps

      ii. Put sin on top and cos on bottom

      iii. For each function, mark its zeros and when positive and negative

   (d) Problems: 6.2: 22 - 26

7. Applications of Waves

   (a) Sound waves

      i. Frequency: cycles per second (this measurement is Hertz).

      ii. See:
      `http://www-users.math.umn.edu/~rogness/math1155/soundwaves/`

   (b) Light waves

      i. The frequency of visible light is referred to as color, and ranges from 430 trillion hertz, seen as red, to 750 trillion hertz, seen as violet.

      ii. See:
      `https://science.howstuffworks.com/light4.htm`