Arroyo P.6 5/11/22

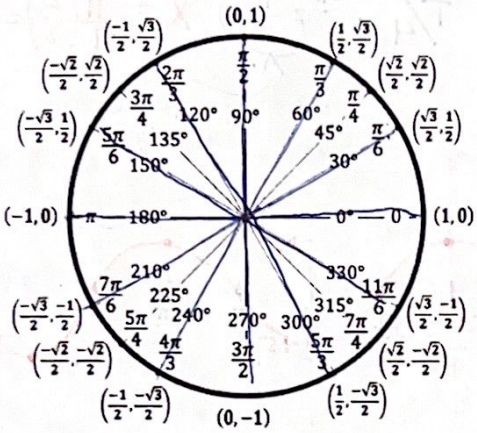
A72: Transformations with Sine and Cosine

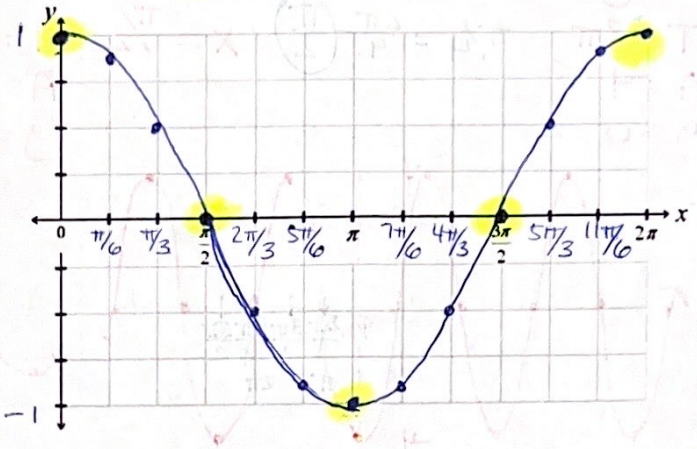
Notes: 34.3 Cosine Graph

Note: $\frac{\sqrt{3}}{2} = .86$

"Unwrapping" Cosine from the Unit Circle:

On the Unit Circle: $x = \cos\theta$ & $y = \sin\theta$ On the Cosine Graph: $x = \theta$ from Unit Circle & $y = \cos\theta$ from Unit Circle





Period: $T = 2\pi$ Amplitude: $A = 1$ Midline: $y = 0$

Key Points for Cosine: $(0, 1)$ $(\frac{\pi}{2}, 0)$ $(\pi, -1)$ $(\frac{3\pi}{2}, 0)$ $(2\pi, 1)$

Amplitude and Period (Vertical stretch/shrink and Horizontal stretch/shrink):

- $y = A\cos(Bx)$
- Amplitude: the distance from the midline to the top (or midline to the bottom) is A OR multiply the y-values by A
- Period: the length of one full cycle (or period) is $T = \frac{2\pi}{B}$ OR multiply the x-values by $\frac{1}{B}$

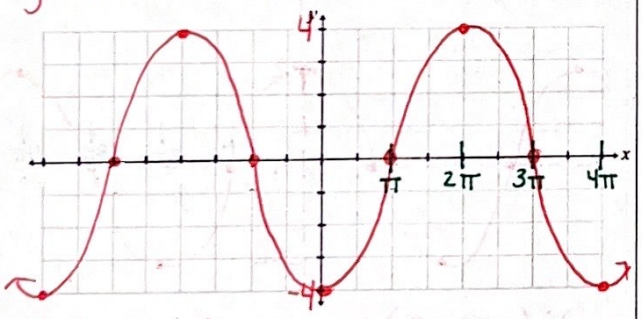
Identify the period, amplitude, and midline, then graph. Identify the domain and range.

1. $y = -4\cos\left(\frac{1}{2}x\right)$

$T = \frac{2\pi}{1/2} = 2\pi\left(\frac{2}{1}\right) = 4\pi$

$A = 4$ $\frac{T}{4} = \pi$

$y = 0$



D: $(-\infty, \infty)$

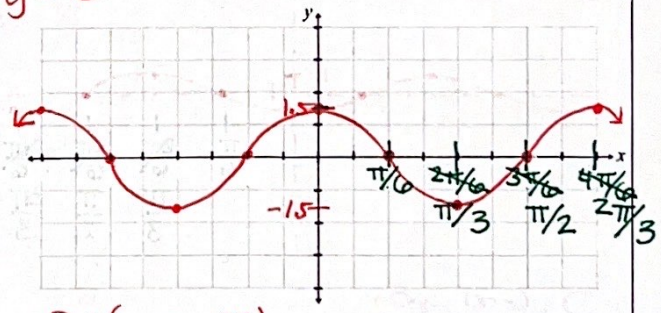
R: $[-4, 4]$

2. $y = \frac{3}{2}\cos(3x)$

$T = \frac{2\pi}{3}$ $\frac{T}{4} = \frac{2\pi}{3}/4 = \frac{2\pi}{3}\left(\frac{1}{4}\right) = \frac{2\pi}{12} = \frac{\pi}{6}$

$A = 1.5$

$y = 0$



D: $(-\infty, \infty)$

R: $[-1.5, 1.5]$

Phase Shift (Horizontal shift/left-right movement):

- $y = A\cos(B(x - C))$
- Phase shift: the new "beginning/start" of the period is $x = C$ OR move the graph C units left/right

Identify the period, amplitude, and midline, then graph. Identify the domain and range.

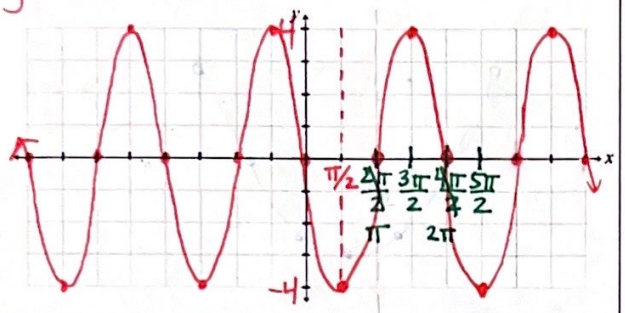
3. $y = -4\cos\left(x - \frac{\pi}{2}\right)$

$T = 2\pi$ $\quad T/4 = \frac{2\pi}{4} = \frac{\pi}{2}$ $\quad x = \pi/2$

$A = 4$

$y = 0$

4 marks



D: $(-\infty, \infty)$

R: $[-4, 4]$

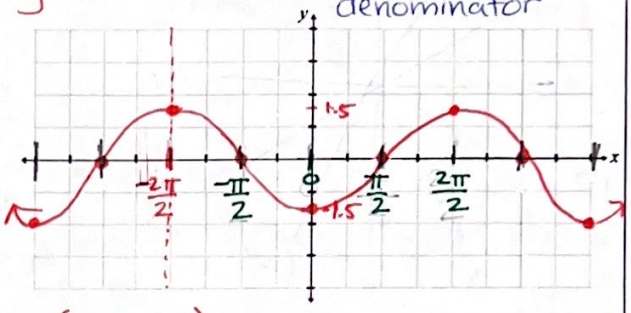
4. $y = \frac{3}{2}\cos(x + \pi)$

$T = 2\pi$ $\quad T/4 = \frac{2\pi}{4} = \frac{\pi}{2}$ $\quad x = -\frac{\pi}{1}\left(\frac{2}{2}\right) = \frac{-2\pi}{2}$

must have the same denominator

$A = 1.5$

$y = 0$



D: $(-\infty, \infty)$

R: $[-1.5, 1.5]$

Midline Changes (vertical shift/up-down movement):

- $y = A\cos(B(x - C)) + D$
- Midline: the line that splits the graph in half horizontally goes through $y = D$ OR move the graph D units up/down

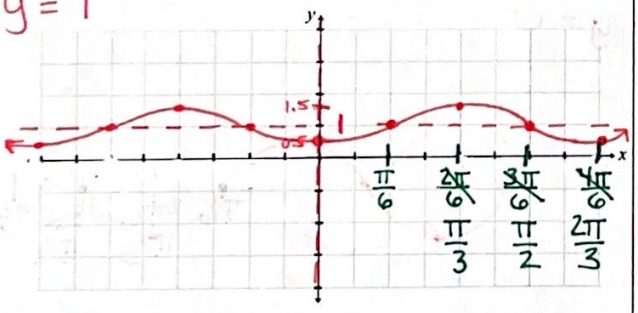
Identify the period, amplitude, and midline, then graph. Identify the domain and range.

5. $y = -\frac{1}{2}\cos(3x) + 1$

$T = \frac{2\pi}{3}$ $\quad T/4 = \frac{2\pi}{3}/4 = \frac{2\pi}{3}\left(\frac{1}{4}\right) = \frac{2\pi}{12} = \frac{\pi}{6}$

$A = \frac{1}{2}$ $\quad x = 0$

$y = 1$



D: $(-\infty, \infty)$

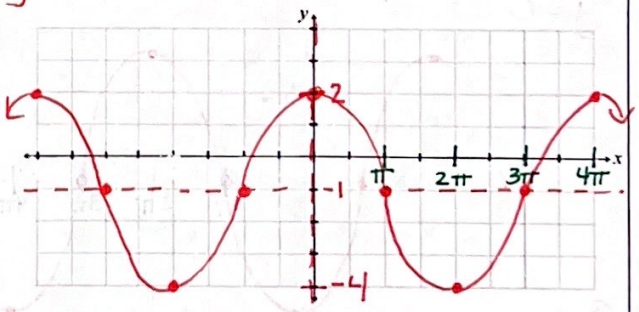
R: $[0.5, 1.5]$

6. $y = 3\cos\left(\frac{1}{2}x\right) - 1$

$T = 4\pi$ $\quad T/4 = \pi$ $\quad x = 0$

$A = 3$

$y = -1$



D: $(-\infty, \infty)$

R: $[-4, 2]$