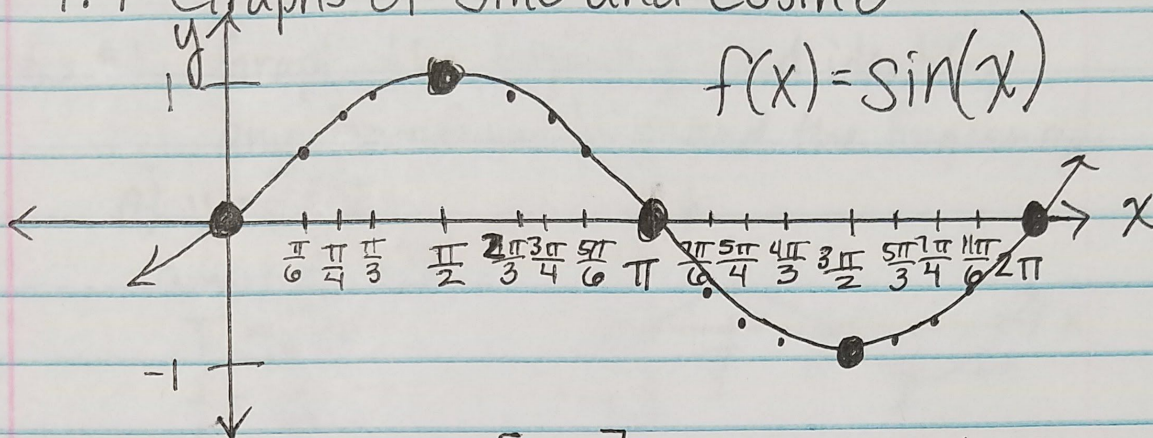


4.4 Graphs of Sine and Cosine



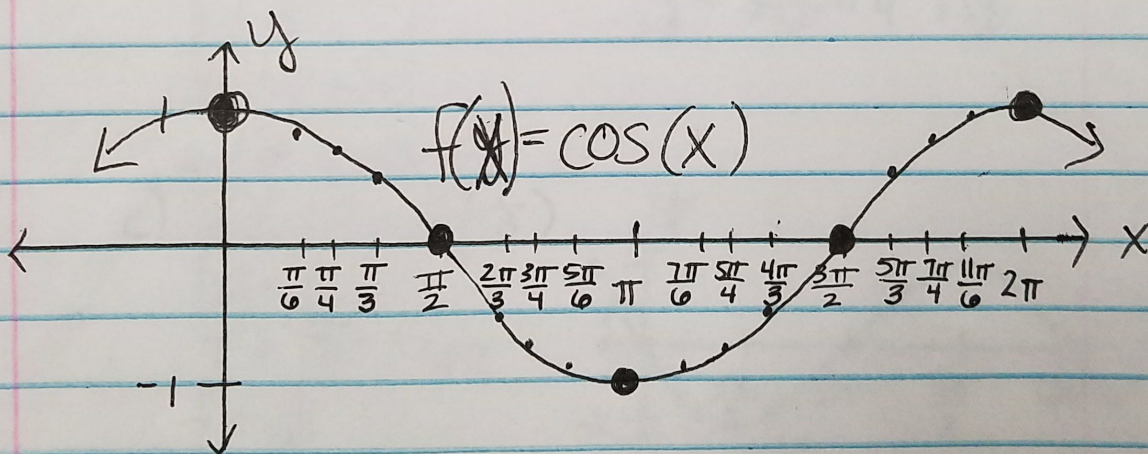
D: $(-\infty, \infty)$ R: $[-1, 1]$ Bounded

Odd Function Con't Function No HA/VA

Increases & Decreases periodically Abs. min is -1

$\lim_{x \rightarrow \infty} f(x)$ DNE $\lim_{x \rightarrow -\infty} f(x)$ DNE Abs. max is 1

Oscillates between -1 & 1 $T = 2\pi$



Same as above, except cosine is even.

$$f(x) = A \sin(B(x-c)) + D$$

$|A|$ = amplitude

height from the center up/down

$\frac{2\pi}{|B|}$ = period of the function = T

length of one full cycle

C = phase shift

horizontal shift / where wave starts

D = midline

vertical shift / move wave up/down

$\frac{|B|}{2\pi}$ = frequency = f

of complete cycles the wave completes

Ex #1 Graph the following and identify any transformations and the frequency.

a) $y = \frac{1}{2} \sin x$

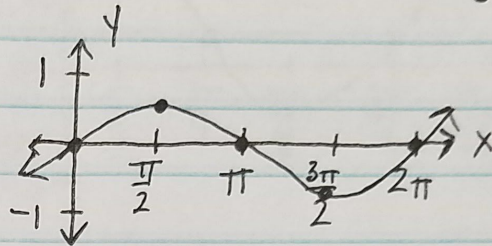
amp: $\frac{1}{2} = |A|$

$T = 2\pi$

$f = \frac{1}{2\pi}$

$C = 0$ on x-axis

$D \Rightarrow y = 0$



b) $y = 3 \sin(-2x)$

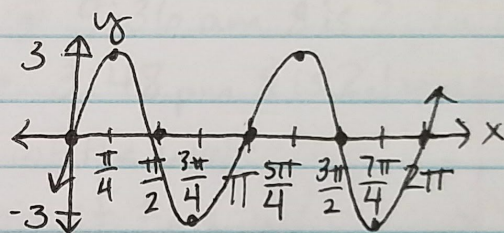
$|A| = 3$

$T = \frac{2\pi}{|B|} = \frac{2\pi}{|-2|} = \pi$

$f = \frac{1}{\pi}$

start @ $x = 0$

mid @ $y = 0$



c) $y = -2 \sin\left(\frac{x}{3}\right)$

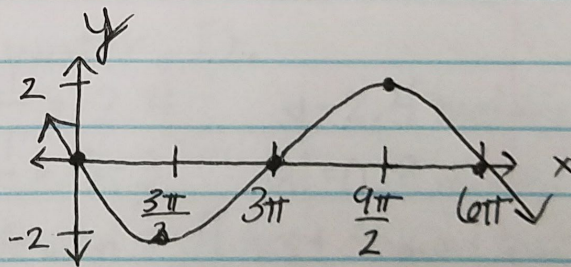
$|A| = 2$

$T = \frac{2\pi}{|1/3|} = 6\pi$

$f = \frac{1}{6\pi}$

start @ $x = 0$

~~mid~~ @ $y = 0$



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

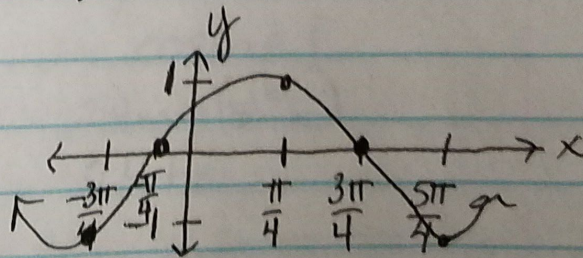
$|A| = 1$

$T = 2\pi$

$f = \frac{1}{2\pi}$

start @ $x = -\frac{3\pi}{4}$

mid @ $y = 0$



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

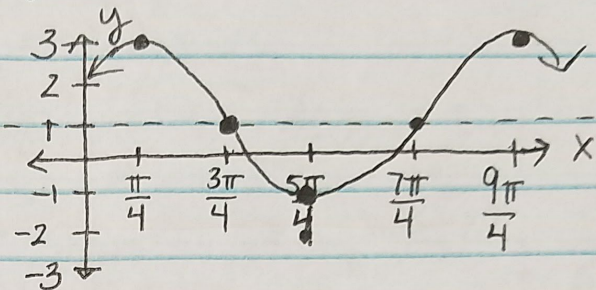
$$|A| = 2$$

$$T = 2\pi$$

$$f = \frac{1}{2\pi}$$

$$\text{starts @ } x = \frac{\pi}{4}$$

$$\text{mid @ } y = 1$$



$$f) y = \sin \left(x - \frac{\pi}{2} \right) + 4$$

EX#2 High tide occurs @ 9:36 am & is 2.7m deep.

Low tide occurs @ 3:48 pm & is 2.1m deep.

Assume the depth of the water is a

sinusoidal function of time w/ a ^{hrs} ^{min} period of half a lunar day ($\sim 12:24$).

Write an equation that models the depth of the water, D .

midline $y = \frac{2.7+2.1}{2} = 2.4$ $y = 2.4$ meters

amplitude $|A| = \frac{2.7-2.1}{2} = 0.3$ $|A| = 0.3$ meters

phase shift $9 \text{ hrs} + 36 \text{ min} = 9 \text{ hrs} + 36 \text{ min} \left(\frac{1 \text{ hr}}{60 \text{ min}} \right)$
 $= 9 \text{ hrs} + 0.6 \text{ hrs}$
 $= 9.6 \text{ hrs}$

since ~~the~~ the highest point is @

9.6 hrs, use cosine!

period $T = 12 \text{ hrs} + 24 \text{ min} \left(\frac{1 \text{ hr}}{60 \text{ min}} \right)$

$$T = 12 \text{ hrs} + 0.4 \text{ hr}$$

$$\frac{2\pi}{|B|} = 12.4 \text{ hrs}$$

$$|B| = \frac{2\pi}{12.4} \text{ hrs}$$

$$D = 0.3 \cos \left(\frac{2\pi}{12.4} (x - 9.6) \right) + 2.4$$

meters