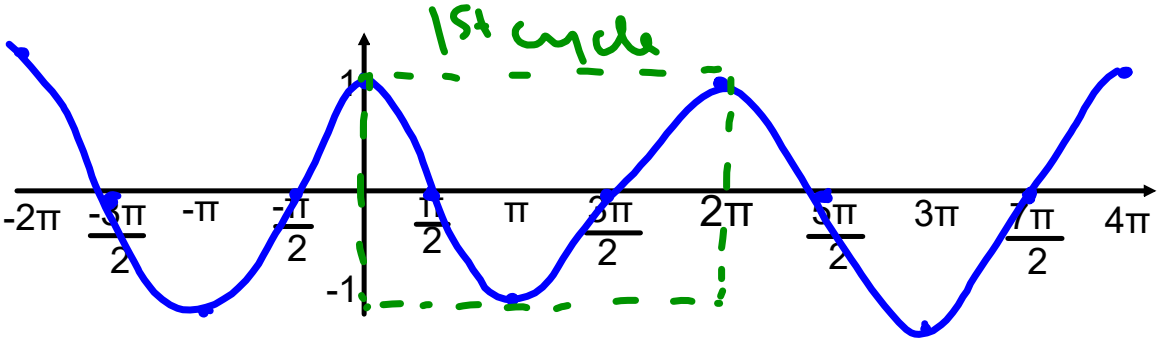
Cosine Function

Basic Cosine Function

t	-2π	$\frac{-3\pi}{2}$	$-\pi$	$\frac{-\pi}{2}$	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π	$\frac{5\pi}{2}$	3π	$\frac{7\pi}{2}$	4π
cost	1	0	-1	0	1	0	-1	0	1	0	-1	0	1



Domain: $\mathbb{R}$ Range: $[-1, 1]$ A = 1

Zeros (over [0,2π]): $\{\pi/2, 3\pi/2\}$

Sign (over [0,2π]):

$f(x) \geq 0$ over : $[0, \pi/2] \cup [3\pi/2, 2\pi]$

$f(x) \leq 0$ over : $[\pi/2, 3\pi/2]$

Variation: (over [0,2π]):

$f \uparrow [\pi, 2\pi]$ $f \downarrow [0, \pi]$

Compare the graphs of y=sin x and y=cos x.
How can you alter y=sin x and get y=cos x?

Phase shift to the left of π/2

Solve: $\cos\theta = \frac{\sqrt{3}}{2}$

i) $[0,2\pi[$: $\left\{\frac{\pi}{6}, \frac{11\pi}{6}\right\}$

ii) R: $\left\{\frac{\pi}{6}+2\pi n, \frac{11\pi}{6}+2\pi n\right\}$ where $n \in \mathbb{Z}$

Cosine Function: $y= a \cos b(x-h) + k$

$P = \frac{2\pi}{b}$ $A = |a|$ Domain: R Range: [k-A, k +A]

Drawing $y= a \cos b(x-h) + k$

- Determine (h,k)
- Draw a rectangle Height: 2A Length: P
- Draw one cycle inside the rectangle

  If a>0 ⟶ decreasing start (h,k+A)

  If a<0 ⟶ increasing start (h, k-A)
- Continue outside the rectangle in either direction for the desired length.

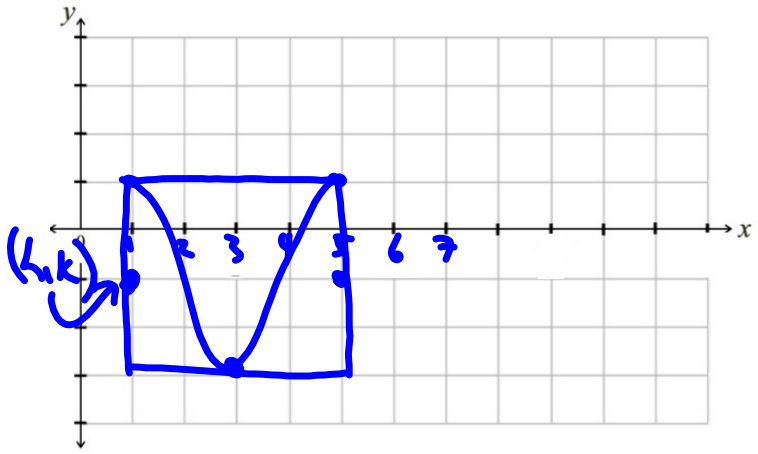
Sketch: $y= 2 \cos \frac{\pi}{2}(x-1) - 1$

*Center of the box

$(h,k) \rightarrow (1,-1)$

$P = \frac{2\pi}{\frac{\pi}{2}} = 2\pi \cdot \frac{2}{\pi} = 4$

$a = 2 \quad (a>0)$



Finding the Zeros

Find the zeros of: $y = 2\cos\frac{\pi}{3}(x-1)+1$

i) over the interval [1,7]

ii) over the Reals

$P = \frac{2\pi}{\frac{\pi}{3}} = 6$

i) $2\cos\frac{\pi}{3}(x-1)+1 = 0$

$2\cos\frac{\pi}{3}(x-1) = -1$

$\cos\frac{\pi}{3}(x-1) = -\frac{1}{2}$

$\frac{\pi}{3}(x-1) = \frac{2\pi}{3}$ $\quad$ $\frac{\pi}{3}(x-1) = \frac{4\pi}{3}$

$x-1 = 2$ $\quad$ $x-1 = 4$

$x = 3$ $\quad$ $x = 5$

$S = \{3, 5\}$

ii) $x \in \{3+6n, 5+6n\} n \in \mathbb{Z}$