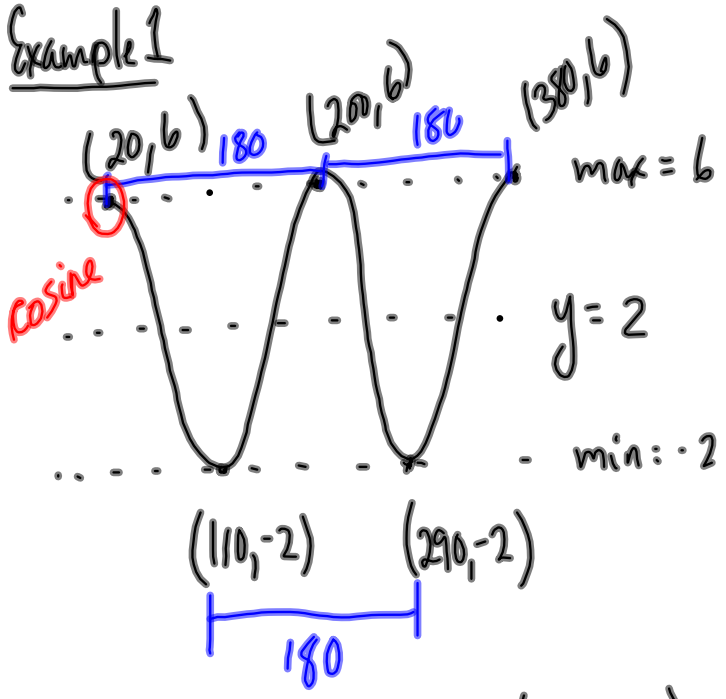
Example 1



Amp: 4

SA: $y = 2$

Period: 180°

PS: 20°

$$\frac{1}{Amp}(y - SA) = \cos\left(\frac{360}{per}(x - PS)\right)$$

$$\frac{1}{4}(y - 2) = \cos\left(\frac{360^\circ}{180^\circ}(x - 20^\circ)\right)$$

transformational form

$$\frac{1}{4}(y - 2) = \cos\left(2(x - 20^\circ)\right)$$

$$(y - 2) = 4\cos\left(2(x - 20^\circ)\right)$$

functional form

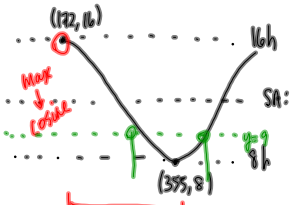
$$y = 4\cos\left(2(x - 20^\circ)\right) + 2$$

Example 2:

In Atlantic Canada the hours of sunlight vary sinusoidally:

Day 355: 8h (low)

Day 172: 16h (high)



Amp: 4

SA: 12

Period: 183×2=366

PS: 172 (cos)

355 - 172

183

$\frac{1}{Amp}(y-SA) = \cos\left(\frac{360}{per}(x-PS)\right)$

transformational form $\frac{1}{4}(y-12) = \cos\left(\frac{360}{366}(x-172)\right)$

functional form $y = 4\cos\left(\frac{360}{366}(x-172)\right)+12$

How many hours of sunlight are on day 294?

x = # days
y = # hours.

$y = 4\cos\left(\frac{360}{366}(294-172)+12\right)$

$y = 4\cos\left(\frac{360}{366}(122)+12\right)$

$y = 10h$ ← There will be 10h of sunlight on Day 294.

For how many days will there be less than 9h?

$9 = 4\cos\left(\frac{360}{366}(x-172)\right)+12$

let $z = \frac{360}{366}(x-172)$

$9 = 4\cos z + 12$

$-3 = 4\cos z$

$-\frac{3}{4} = \cos z$

$z = \cos^{-1}\left(-\frac{3}{4}\right)$

$z_1 = 138.6°$ | $z_2 = 360 - 138.6$

$z_2 = 221.4°$

$\frac{360}{366}(x-172) = 138.6°$ | $\frac{360}{366}(x-172) = 221.4°$

$x - 172 = 140.9$ | $x - 172 = 225.1$

$x = 312.9$ | $x = 397.1$

$x \doteq 313$ | $x \doteq 397$

397 - 313 = 84 days with 9h or less sunlight

Example: Sketch $-\frac{1}{3}(y+5) = \sin\left(\frac{1}{2}(x-100)\right)^\circ$

Amp: 3

SA: $y=-5$

period: $\frac{1}{2} = \frac{360}{per}$

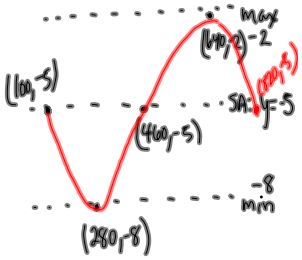
$per = 720^\circ$

$\left(\therefore jump = \frac{720^\circ}{4} = 180^\circ\right)$

PS: $+100^\circ$

Reflection: yes.

(starting on SA going down)



Example: Solve for all solutions:

a) $3\cos(4x) + 2 = 5$ let $z = 4x$

$3\cos z + 2 = 5$

$3\cos z = 3$

$\cos z = \frac{3}{3}$

$\cos z = 1$

$z = \cos^{-1}(1)$

$z_1 = 0^\circ$ $z_2 = 360^\circ$

$4x = 0$ $4x = 360^\circ$

$x = 0$ $x = 90^\circ$

$\frac{360}{per} = 4$ $per = \frac{360}{4} = 90^\circ$

$x = \left\{ \begin{matrix} 0^\circ + 90k \\ \cancel{90^\circ + 90k} \end{matrix} \right\}$ where $k \in \mathbb{Z}$

b) $4\sin(2x) + 1 = 3$ let $z = 2x$

$4\sin z + 1 = 3$

$4\sin z = 2$

$\sin z = \frac{1}{2}$

$z = \sin^{-1}\left(\frac{1}{2}\right)$

$z_1 = 30^\circ$ $z_2 = 150^\circ$

$2x = 30^\circ$ $2x = 150$

$x = 15^\circ$ $x = 75^\circ$

period $= \frac{360}{2}$

180°

$x = \left\{ \begin{matrix} 15^\circ + 180^\circ k \\ 75 + 180^\circ k \end{matrix} \right\} k \in \mathbb{Z}$

x_1 x_2 period