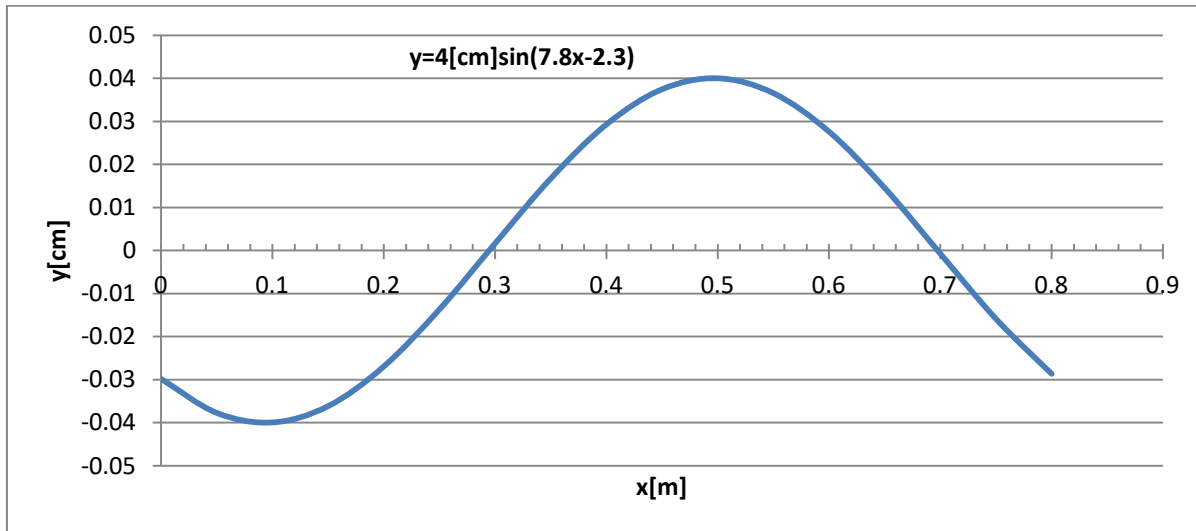


OPERATIONS WITH GRAPHS

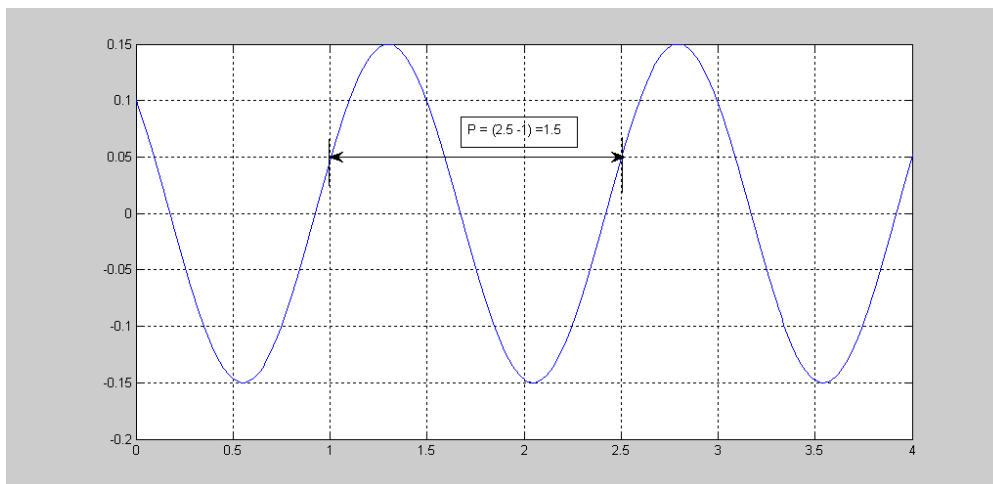
A) Draw the graph of function $y=0.04_{[cm]}\sin(7.8x_{[m]}-2.3)$

- From function expression: $A = 0.04_{[cm]}$; $b = 7.8 [r/m]$; $c = - 2.3[r]$; so, "**period**" $= 2\pi/b = 2\pi/7.8 = 0.8m$
- At $x = 0..$ $y(0) = 0.04_{[cm]} \sin(-2.3) = - 0.0298 \approx - 0.03_{[cm]}$ and $y'(0) = 0.04 * 7.8 * \cos(-2.3) = -0.21..i.e. \text{negative}$.

So, this graph has amplitude 0.04, period 0.8, at $t= 0$ sec starts with $y=-0.03$ and has negative slope. It has 0-values at $7.8x-2.8 = 0$ gives $x_1= 0.295m$ and $7.8x-2.8 = \pi$ gives $x_2 = 0.679m$.With those parameters , one "period" of this graph would be as follows.



B) Find the mathematical expression for the given graph.



Step 1. The general form is $y = A\sin(bx+c).....$ or $y = A\cos(bx+c)$ and no units because no units shown on graph

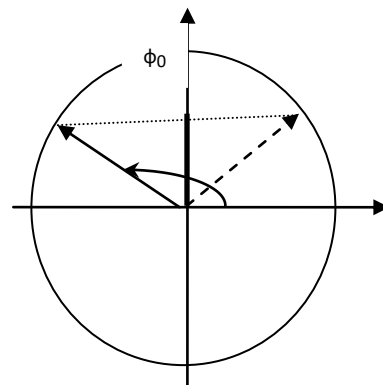
Step 2. From the graph we get $A = 0.15$; " period " $P = 2 - 0.5 = 1.5$; As $P = 2\pi/b$ we get $b = 6.28/P = 6.28/1.5 = 4.19$. So, $A = 0.15$, $b = 4.19$ and $y [cm] = 0.15\sin(4.19x+c)$ $c = ?$

Step 3. To find c value we refer to $x = 0$. From the graph $y[x=0] = 0.1$ So, we get $0.1 = 0.15\sin c$ and $c = \arcsin(0.1/0.15) = \arcsin(0.666) = 0.729\text{rad}$ (from calculator). From trigonometric circle (shown below), it comes out that both c - values 0.729 and $3.14 - 0.729 = 2.411\text{radians}$ have the same sine value.

At the given graph, y -value decreases with the increase of argument " x ". Then, by referring to the trigonometric circle (shown below), one can realize that the right choice for c -value is $c = \phi_0 = 2.411\text{r}$.

So, the function of the given graph is

$$Y = 0.15\sin(4.19x + 2.411)$$



HOMEWORK

A) Draw the graph of the function :

$$y_1 = 10[m] \sin(0.5x - 0.8) \quad x \text{ in meters ;}$$

$$y_2 = 0.5[V] \cos(2x + 6) \quad x \text{ in seconds}$$

$$y_3 = 0.1[mm] \sin(8x - 12) \quad x \text{ in seconds ;}$$

$$y_4 = 0.09[m] \cos(3.14x + 1.57) \quad x \text{ in meters}$$

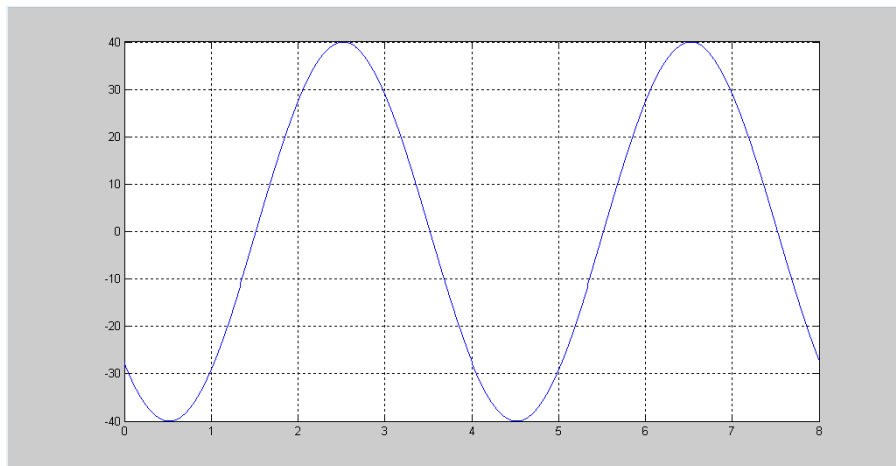
B) Given the recorded graph find the mathematical expression

1] In the given graph the y -component is in [mm] and x -component is in sec. Find the mathematical

expression in the form $y(t) = a [m] \sin(\omega t[s] + \phi_0[r])$

Answer

$$y(t) = 0.04[m] \sin(1.57[r/s]t + 3.91[r])$$



2] For the given graph find the mathematical expression in the form

a) $y(t) = a [m] \cos(bx[cm] + \phi_0[r])$

Answer $y = 0.1[m]\cos(2.51[r/cm]x - 1.98[r])$

b) $y(t) = a [m] \sin(bx[cm] + \phi_0[r])$

Answer $y = 0.1[m]\sin(2.51[r/cm]x - 0.4[r])$

