35. Use the guidelines of curve sketching to sketch the curve.

$$y = \frac{1}{2}x - \sin x\,, 0 < x < 3\pi$$

Domain: Given.

Intercepts: We cannot set *x*=0 because the domain excludes *x*.

x-int.: This is difficult to find at this stage. So, we will wait to see if it is needed.

Symmetry: This function would be odd if we could include negative *x* values. But, the domain excludes such values.

Asymptotes: There are no asymptotes at the endpoints because our function would be defined. It would be continuous if we were to go beyond the points 0 and 3π. So, there are no vertical asymptotes. There are no horizontal asymptotes because we cannot let a *x* go to positive or negative infinity due to the limited domain.

Decreasing/Increasing Intervals:

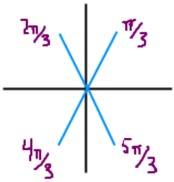
$f'(x) = \frac{1}{2} - \cos(x)$

{Find points where the function equals zero to find critical points.}

$f'(x) = 0 \Rightarrow \frac{1}{2} = \cos(x)$

Find where cos is 1/2 between 0 and 3π.

arccos of $\frac{1}{2} = \pi/3$



cos is positive in the first and fourth quadrants.
Note that the interval goes to 3π.

$\cos x = 1/2$ @ $\pi/3$, $5\pi/3$, $7\pi/3$

Int.	Test Value	Sign f′	Inc./Dec. of f
$(0, \pi/3)$	$f'(.5)$	$-$	↘
$(\pi/3, 5\pi/3)$	$f'(4)$	$+$	↗
$(5\pi/3, 7\pi/3)$	$f'(6)$	$-$	↘
$(7\pi/3, 3\pi)$	$f'(8)$	$+$	↗

Local Min./Max.:

Loc. min.:

$$\left(\frac{\pi}{3}, f\left(\frac{\pi}{3}\right)\right) = \left(\frac{\pi}{3}, -0.34\right)$$

$$\left(\frac{7\pi}{3}, f\left(7\frac{\pi}{3}\right)\right) = \left(\frac{7\pi}{3}, 2.80\right)$$

Loc. max.:

$$\left(\frac{5\pi}{3}, f\left(\frac{5\pi}{3}\right)\right) = \left(\frac{5\pi}{3}, 3.48\right)$$

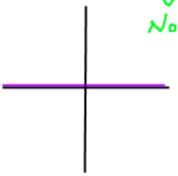
Concavity:

$$f''(x) = 0 + \sin(x)$$
$$= \sin(x)$$

$$f''(x) = 0 = \sin(x)$$
$$\arcsin(0) = 0$$

$$\sin(x) = 0 \text{ @ } \cancel{0}, \pi, 2\pi$$

Not in Domain.



Int	Test Value	Sign of f''	Concavity
$(0, \pi)$	$f''(2)$	$+$	$\cup$
$(\pi, 2\pi)$	$f''(4)$	$-$	$\cap$
$(2\pi, 3\pi)$	$f''(7)$	$+$	$\cup$

Inflection Points:

$$(\pi, f(\pi)) = \left(\pi, \frac{\pi}{2}\right)$$

$$(2\pi, f(2\pi)) = (2\pi, \pi)$$

Graph: