49. The function $f(x) = 4\sin^3 x - 6\sin^2 x + 12\sin x + 100$ is strictly

(a) increasing in $\left(\pi, \frac{3\pi}{2}\right)$ (b) decreasing in $\left(\frac{\pi}{2}, \pi\right)$

(c) decreasing in $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ (d) decreasing in $\left(0, \frac{\pi}{2}\right)$

Sol. **(b)** We have, $f(x) = 4\sin^3 x - 6\sin^2 x + 12\sin x + 100$

$\therefore \quad f'(x) = 12\sin^2 x \cdot \cos x - 12\sin x \cdot \cos x + 12\cos x$

$= 12\cos x\,[\sin^2 x - \sin x + 1]$

$= 12\cos x\,[\sin^2 x + (1 - \sin x)]$

Now $1 - \sin x \geq 0$ and $\sin^2 x \geq 0$

$\therefore \sin^2 x + 1 - \sin x > 0$

Hence, $f'(x) > 0$, when $\cos x > 0$ i.e., $x \in \left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$

So, $f(x)$ is increasing when $x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

and $f'(x) < 0$, when $\cos x < 0$ i.e., $x \in \left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$

Hence, $f(x)$ is decreasing when $x \in \left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$

Hence, $f(x)$ is decreasing in $\left(\frac{\pi}{2}, \pi\right)$