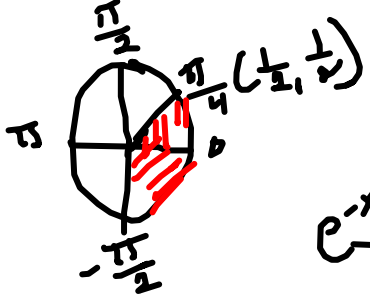
1. Let f be the function defined by $f(x) = (\sin x)e^{-x}$ on the interval $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$. On which of the following open intervals is f increasing?

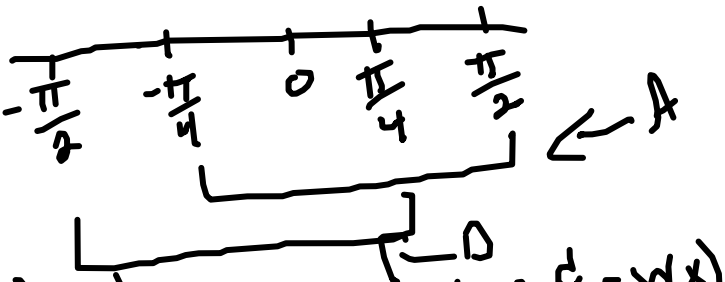
(A) $\left(-\frac{\pi}{4}, \frac{\pi}{2}\right)$

(B) $\left(0, \frac{\pi}{2}\right)$ only

(C) $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$ only

(D) $\left(-\frac{\pi}{2}, \frac{\pi}{4}\right)$





$f'(x) = \frac{d}{dx}(e^{-x}) \cdot \sin x + e^{-x} \cdot \frac{d}{dx}\sin(x)$

$e^{-x} \cdot -1 \cdot \sin(x) + e^{-x} \cdot \cos x$

$e^{-x}\{-\sin x + \cos x$

$e^{-x}(\sin x - \cos x = 0$

e^{-x} | I | II

2. Let f be the function with derivative given by $f'(x) = x^2 - a^2 = (x - a)(x + a)$, where a is a positive constant. Which of the following statements is true?

$x - a = 0$ $x + a$

$x = a$ $x = -a$

(A) ✓ f is decreasing for $-a < x < a$ because $f'(x) < 0$ for $-a < x < a$.

(B) f is decreasing for $x < -a$ and $x > a$ because $f'(x) < 0$ for $x < -a$ and $x > a$.

(C) f is decreasing for $x < 0$ because $f'(x) < 0$ for $x < 0$.

(D) f is decreasing for $x < 0$ because $f''(x) < 0$ for $x < 0$. X

4. Let f be the function with derivative given by $f'(x) = \sin x + x\cos x$ for $0 \le x \le \pi$. On which of the following intervals is f increasing?

(A) $[0, 1.077]$ only

(B) $[0, 2.029]$

(C) $[1.077, \pi]$

(D) $[2.029, \pi]$ only

$\sin(x) + x \cdot \cos(x)$