Increasing and decreasing functions

4.2.1

(a)

$$f'(x) = 2 - 8x = -8\left(x - \tfrac{1}{4}\right)$$

$$f' \quad + \quad \underset{\frac{1}{4}}{|} \quad -$$

increasing on $\left(-\infty, \tfrac{1}{4}\right]$

decreasing on $\left[\tfrac{1}{4}, +\infty\right)$

(b)

$$f'(x) = 3x^2 - 6x - 9 = 3(x^2 - 2x - 3) = 3(x+1)(x-3)$$

$$f' \quad + \quad \underset{-1}{|} \quad - \quad \underset{3}{|} \quad +$$

increasing on $(-\infty, -1]$

decreasing on $[-1, 3]$

increasing on $[3, +\infty)$

(c)

$$f'(x) = 2e^{2x} - e^x = e^x(2e^x - 1)$$

$e^x > 0$ always

$2e^x - 1 > 0$ when $e^x > \frac{1}{2}$ or $x > \ln\frac{1}{2}$

$2e^x - 1 < 0$ when $x < \ln\frac{1}{2}$

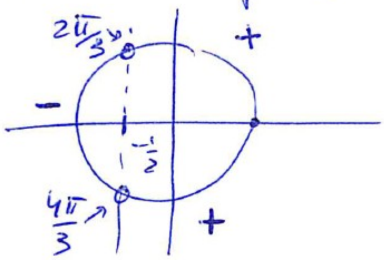
Answer:

decreasing on $\left(-\infty, \ln\tfrac{1}{2}\right]$, increasing on $\left[\ln\tfrac{1}{2}, \infty\right)$

(d)

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

need to compare $\cos x$ with $-\frac{1}{2}$ in $[0, 2\pi]$



Answer:

increasing on $\left[0, \frac{2\pi}{3}\right]$ and on $\left[\frac{4\pi}{3}, 2\pi\right]$

decreasing on $\left[\frac{2\pi}{3}, \frac{4\pi}{3}\right]$