

HW 18 #3

$$f(x) = x^4 e^{-x}$$

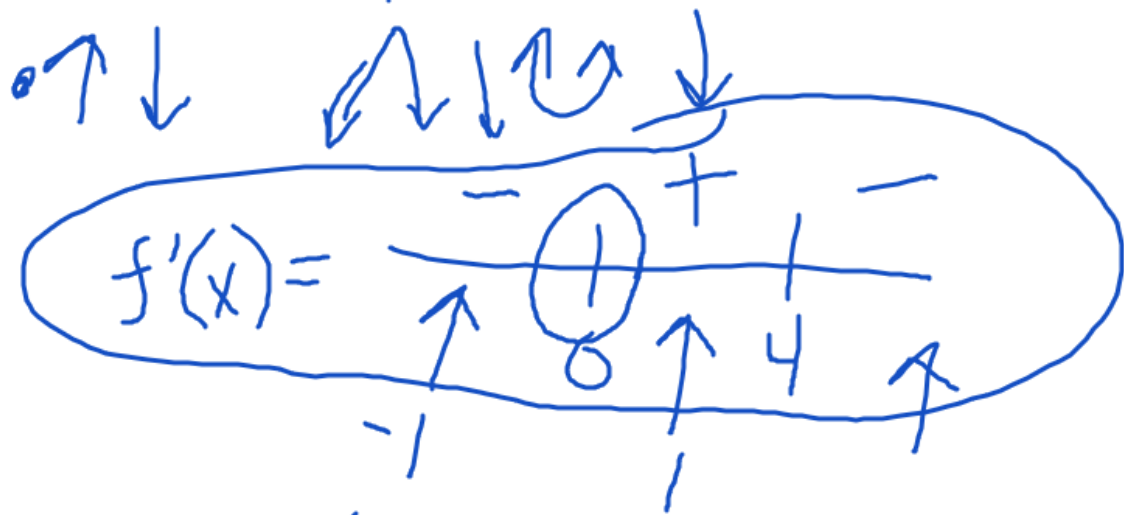
$$f'(x) = 4x^3 e^{-x} - x^4 e^{-x}$$

$$0, \text{ and } = x^3 e^{-x} (4-x)$$

$$\rightarrow 0 = \frac{x^3 (4-x)}{e^x}$$

$$0 = x^3 (4-x) \text{ crit. pts.}$$

$$\rightarrow \boxed{x=0, x=4} \checkmark$$



$$f'(-1) = (-1)^3 (e^1) (4+1) = -5e < 0$$

$$f'(1) = (1)^3 (e^{-1}) (4-1) = \frac{3}{e} > 0$$

$$f'(5) = (5)^3 (e^{-5}) (4-5) = -\frac{125}{e^5} < 0$$



$$f'(x) = 4x^3 e^{-x} - x^4 e^{-x}$$

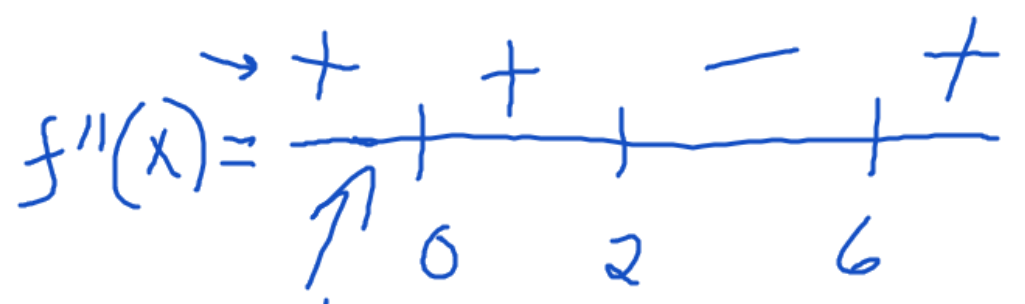
$$f''(x) = 12x^2 e^{-x} - 4x^3 e^{-x} - 4x^3 e^{-x} + x^4 e^{-x}$$

$f(x) \uparrow \uparrow (-\infty, 0) \cup (0, 2) \cup (6, \infty) \leftarrow$
 $f(x) \downarrow \downarrow (2, 6)$

$$= 12x^2 e^{-x} - 8x^3 e^{-x} + x^4 e^{-x}$$

$$0, \text{ and } = x^2 (12 - 8x + x^2) \leftarrow$$

$$e^x \leftarrow +$$



$$0 = x^2 (x^2 - 8x + 12)$$

$$0 = x^2 (x-6)(x-2)$$

pot. inflection points.

$x = 0, 6, 2$

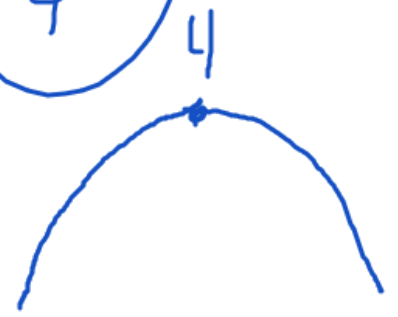
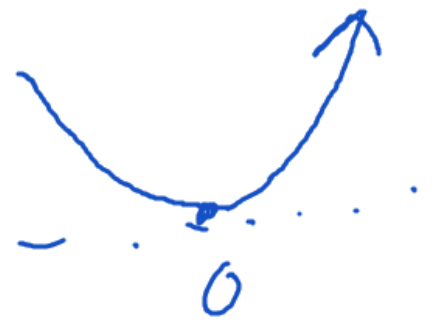
$$f''(-1) = (-1)^2 (12 + 8 + 1) > 0$$

$$f''(1) = (1)^2 (12 - 8 + 1) > 0$$

$$f''(3) = (9)(12 - 24 + 9) < 0$$

$$f''(7) \approx 12 - 56 + 49 > 0$$

$$f'(x) = \frac{\begin{array}{c} \downarrow \quad \downarrow \\ - \quad + \\ | \quad | \\ 0 \quad 4 \end{array}}{\quad}$$



HW 17 #4

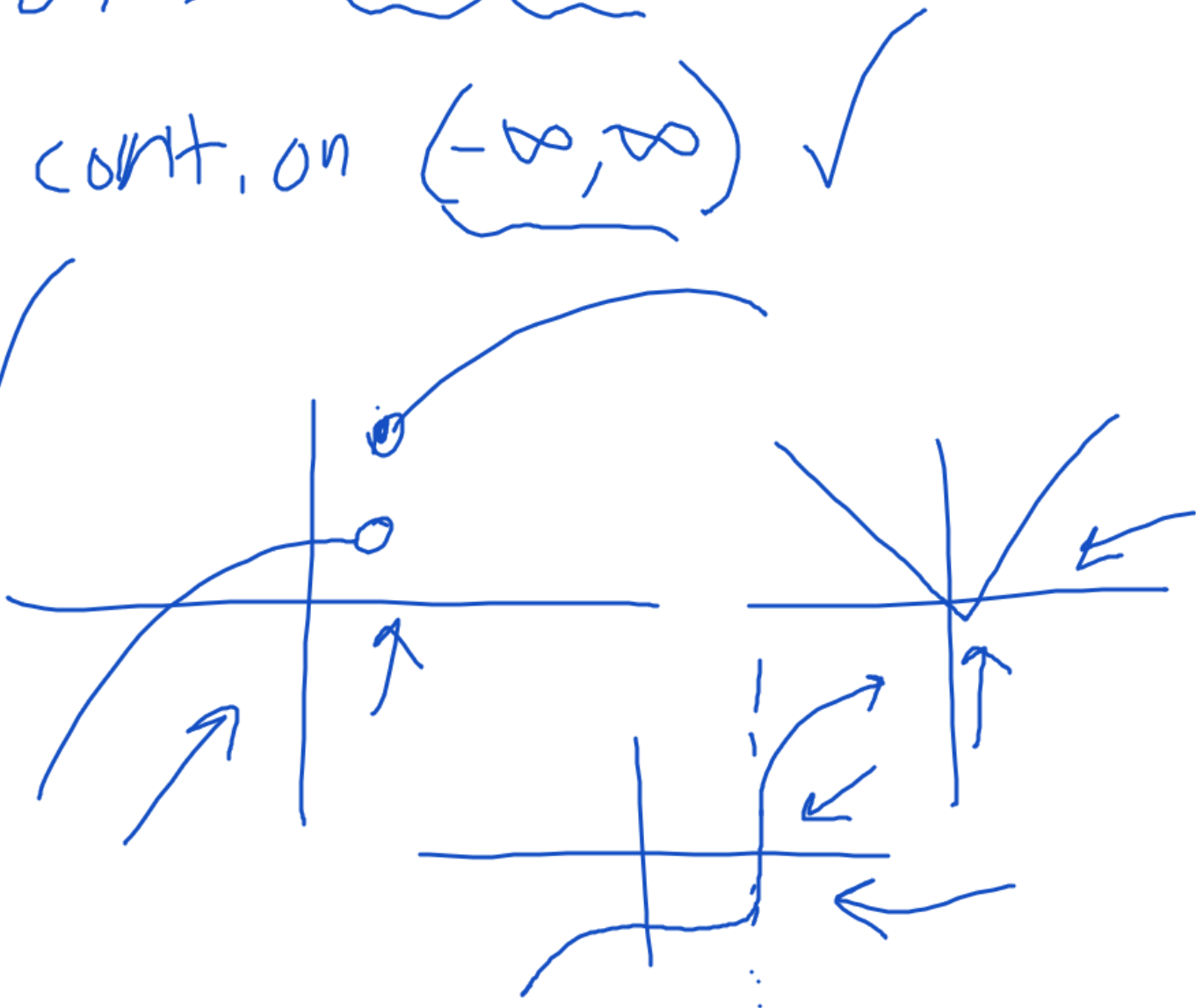
$$f(x) = \sin(x)\cos(x)$$

$[0, \pi]$ Rolle's

① cont on $[0, \pi]$ \leftarrow cont. on $(-\infty, \infty)$ \checkmark

② diff on $(0, \pi)$ \checkmark

③ $f(a) = f(b)$



$$f(x) = \sin(x) \cos(x)$$

$$f'(x) = \cos^2(x) - \sin^2(x)$$

$(0, \pi)$

Rolle's thm holds ✓

$$\left[0, \pi \right]$$

↑ ↑
a b

$$f(0) = \sin(0) \cos(0) = 0 \cdot 1 = 0$$

$$f(\pi) = \sin(\pi) \cos(\pi) = 0 \cdot (-1) = 0$$

$$\left. \begin{array}{l} f(0) = \sin(0) \cos(0) = 0 \cdot 1 = 0 \\ f(\pi) = \sin(\pi) \cos(\pi) = 0 \cdot (-1) = 0 \end{array} \right\} f(a) = f(b) \checkmark$$

HW 17 #10

$$f(x) = e^x + e^{-x}$$

$[0, \ln(2)]$

- cont $[0, \ln(2)]$ ✓

- diff $(0, \ln(2))$ ✓

$$e^x \checkmark + \frac{1}{e^x} \checkmark$$

↑
≠ 0

$$f'(x) = e^x - e^{-x} = e^x - \frac{1}{e^x} \checkmark \neq 0 \checkmark$$

