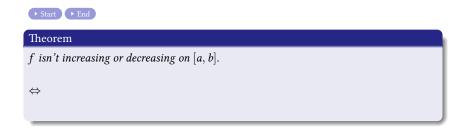
함수가 증가 또는 감소가 아니다. (A function isn't increasing or decresing.)





Theorem



▶ Start ▶ End

Theorem

$$\Leftrightarrow \exists x_1, x_2, x_3$$



Theorem

$$\Leftrightarrow \exists x_1, x_2, x_3 \in (a, b)$$



Theorem

$$\Leftrightarrow \exists x_1, x_2, x_3 \in (a, b) \text{ s.t}$$



Theorem



Theorem

$$\Leftrightarrow \exists x_1, x_2, x_3 \in (a, b) \text{ s.t.}$$
 $\begin{bmatrix} x_1 < x_2 < x_3 \\ and \end{bmatrix}$

$$< x_2 < x_3$$
 and



Theorem

f isn't increasing or decreasing on
$$[a, b]$$
.

$$\Leftrightarrow \exists x_1, x_2, x_3 \in (a, b) \text{ s.t.}$$

$$\Leftrightarrow \exists x_{1}, x_{2}, x_{3} \in (a, b) \text{ s.t.} \begin{bmatrix} x_{1} < x_{2} < x_{3} \\ and \\ f(x_{2}) \notin \left(\min \{(x_{1}), f(x_{3})\}, \max \{f(x_{1}), f(x_{3})\}\right) \end{bmatrix}$$



Theorem

$$\Leftrightarrow \exists x_1, x_2, x_3 \in (a, b) \text{ s.t.}$$

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-





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▶ Start ▶ End

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f isn't increasing or decreasing on [a, b].

$$\Leftrightarrow \exists x_1, x_2, x_3 \in (a, b) \text{ s.t.} \begin{bmatrix} x_1 < x_2 < x_3 \\ and \\ f(x_2) \notin \left(\min\{(x_1), f(x_3)\}, \max\{f(x_1), f(x_3)\}\right) \end{bmatrix}$$

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 $\vee \{f(x_2) > f(x_3) \land f(x_1) < f(x_2)\} \lor \{f(x_2) > f(x_3) \land f(x_2) < f(x_3)\}\$

 \Leftrightarrow



$$\begin{split} & \neg \left\{ f(x_1) < f(x_2) < f(x_3) \lor f(x_1) > f(x_2) > f(x_3) \right\} \\ & \Leftrightarrow \neg \left\{ f(x_1) < f(x_2) < f(x_3) \right\} \land \neg \left\{ f(x_1) > f(x_2) > f(x_3) \right\} \\ & \Leftrightarrow \neg \left\{ f(x_1) < f(x_2) \land f(x_2) < f(x_3) \right\} \land \neg \left\{ f(x_1) > f(x_2) \land f(x_2) > f(x_3) \right\} \\ & \Leftrightarrow \left\{ f(x_1) \ge f(x_2) \lor f(x_2) \ge f(x_3) \right\} \land \left\{ f(x_1) \le f(x_2) \lor f(x_2) \le f(x_3) \right\} \\ & \Leftrightarrow \left\{ f(x_1) \ge f(x_2) \land f(x_1) \le f(x_2) \right\} \lor \left\{ f(x_1) \ge f(x_2) \land f(x_2) \le f(x_3) \right\} \\ & \lor \left\{ f(x_2) \ge f(x_3) \land f(x_1) \le f(x_2) \right\} \lor \left\{ f(x_2) \ge f(x_3) \land f(x_2) \le f(x_3) \right\} \\ & \Leftrightarrow \left\{ f(x_1) = f(x_2) \right\} \end{split}$$



$$\begin{split} & \neg \left\{ f(x_1) < f(x_2) < f(x_3) \lor f(x_1) > f(x_2) > f(x_3) \right\} \\ & \Leftrightarrow \neg \left\{ f(x_1) < f(x_2) < f(x_3) \right\} \land \neg \left\{ f(x_1) > f(x_2) > f(x_3) \right\} \\ & \Leftrightarrow \neg \left\{ f(x_1) < f(x_2) \land f(x_2) < f(x_3) \right\} \land \neg \left\{ f(x_1) > f(x_2) \land f(x_2) > f(x_3) \right\} \\ & \Leftrightarrow \left\{ f(x_1) \ge f(x_2) \lor f(x_2) \ge f(x_3) \right\} \land \left\{ f(x_1) \le f(x_2) \lor f(x_2) \le f(x_3) \right\} \\ & \Leftrightarrow \left\{ f(x_1) \ge f(x_2) \land f(x_1) \le f(x_2) \right\} \lor \left\{ f(x_1) \ge f(x_2) \land f(x_2) \le f(x_3) \right\} \\ & \lor \left\{ f(x_2) \ge f(x_3) \land f(x_1) \le f(x_2) \right\} \lor \left\{ f(x_2) \ge f(x_3) \land f(x_2) \le f(x_3) \right\} \\ & \Leftrightarrow \left\{ f(x_1) = f(x_2) \right\} \lor \end{split}$$



$$\Leftrightarrow \exists x_{1}, x_{2}, x_{3} \in (a, b) \text{ s.t.} \begin{bmatrix} x_{1} < x_{2} < x_{3} \\ and \\ f(x_{2}) \notin \left(\min \{(x_{1}), f(x_{3})\}, \max \{f(x_{1}), f(x_{3})\}\right) \end{bmatrix}$$

$$\neg \{f(x_1) < f(x_2) < f(x_3) \lor f(x_1) > f(x_2) > f(x_3)\}
\Leftrightarrow \neg \{f(x_1) < f(x_2) < f(x_3)\} \land \neg \{f(x_1) > f(x_2) > f(x_3)\}
\Leftrightarrow \neg \{f(x_1) < f(x_2) \land f(x_2) < f(x_3)\} \land \neg \{f(x_1) > f(x_2) \land f(x_2) > f(x_3)\}
\Leftrightarrow \{f(x_1) \ge f(x_2) \lor f(x_2) \ge f(x_3)\} \land \{f(x_1) \le f(x_2) \lor f(x_2) \le f(x_3)\}
\Leftrightarrow \{f(x_1) \ge f(x_2) \land f(x_1) \le f(x_2)\} \lor \{f(x_1) \ge f(x_2) \land f(x_2) \le f(x_3)\}
\lor \{f(x_2) \ge f(x_3) \land f(x_1) \le f(x_2)\} \lor \{f(x_2) \ge f(x_3) \land f(x_2) \le f(x_3)\}
\Leftrightarrow \{f(x_1) = f(x_2)\} \lor [f(x_2) < \min \{f(x_1), f(x_3)\}]$$



f isn't increasing or decreasing on [a, b]. $\Leftrightarrow \exists \ x_1, x_2, x_3 \in (a, b) \ s.t. \left[\begin{array}{c} x_1 < x_2 < x_3 \\ and \\ f(x_2) \notin \left(\min \left\{ (x_1), f(x_3) \right\}, \max \left\{ f(x_1), f(x_3) \right\} \right) \end{array} \right]$

$$\begin{split} &\neg \left\{ f(x_1) < f(x_2) < f(x_3) \lor f(x_1) > f(x_2) > f(x_3) \right\} \\ &\Leftrightarrow \neg \left\{ f(x_1) < f(x_2) < f(x_3) \right\} \land \neg \left\{ f(x_1) > f(x_2) > f(x_3) \right\} \\ &\Leftrightarrow \neg \left\{ f(x_1) < f(x_2) \land f(x_2) < f(x_3) \right\} \land \neg \left\{ f(x_1) > f(x_2) \land f(x_2) > f(x_3) \right\} \\ &\Leftrightarrow \left\{ f(x_1) \ge f(x_2) \lor f(x_2) \ge f(x_3) \right\} \land \left\{ f(x_1) \le f(x_2) \lor f(x_2) \le f(x_3) \right\} \\ &\Leftrightarrow \left\{ f(x_1) \ge f(x_2) \land f(x_1) \le f(x_2) \right\} \lor \left\{ f(x_1) \ge f(x_2) \land f(x_2) \le f(x_3) \right\} \\ &\lor \left\{ f(x_2) \ge f(x_3) \land f(x_1) \le f(x_2) \right\} \lor \left\{ f(x_2) \ge f(x_3) \land f(x_2) \le f(x_3) \right\} \\ &\Leftrightarrow \left\{ f(x_1) = f(x_2) \right\} \lor \left[f(x_2) \le \min \left\{ f(x_1), f(x_3) \right\} \right] \\ &\lor \end{split}$$

▶ Start ▶ End



Theorem

$$\begin{split} &\neg \left\{ f(x_1) < f(x_2) < f(x_3) \lor f(x_1) > f(x_2) > f(x_3) \right\} \\ &\Leftrightarrow \neg \left\{ f(x_1) < f(x_2) < f(x_3) \right\} \land \neg \left\{ f(x_1) > f(x_2) > f(x_3) \right\} \\ &\Leftrightarrow \neg \left\{ f(x_1) < f(x_2) \land f(x_2) < f(x_3) \right\} \land \neg \left\{ f(x_1) > f(x_2) \land f(x_2) > f(x_3) \right\} \\ &\Leftrightarrow \left\{ f(x_1) \ge f(x_2) \lor f(x_2) \ge f(x_3) \right\} \land \left\{ f(x_1) \le f(x_2) \lor f(x_2) \le f(x_3) \right\} \\ &\Leftrightarrow \left\{ f(x_1) \ge f(x_2) \land f(x_1) \le f(x_2) \right\} \lor \left\{ f(x_1) \ge f(x_2) \land f(x_2) \le f(x_3) \right\} \\ &\lor \left\{ f(x_2) \ge f(x_3) \land f(x_1) \le f(x_2) \right\} \lor \left\{ f(x_2) \ge f(x_3) \land f(x_2) \le f(x_3) \right\} \\ &\Leftrightarrow \left\{ f(x_1) = f(x_2) \right\} \lor \left[f(x_2) \le \min \left\{ f(x_1), f(x_3) \right\} \right] \\ &\lor \left[f(x_2) \ge \max \left\{ f(x_1), f(x_3) \right\} \right] \end{split}$$



$$\begin{split} &\neg \left\{ f(x_1) < f(x_2) < f(x_3) \lor f(x_1) > f(x_2) > f(x_3) \right\} \\ &\Leftrightarrow \neg \left\{ f(x_1) < f(x_2) < f(x_3) \right\} \land \neg \left\{ f(x_1) > f(x_2) > f(x_3) \right\} \\ &\Leftrightarrow \neg \left\{ f(x_1) < f(x_2) \land f(x_2) < f(x_3) \right\} \land \neg \left\{ f(x_1) > f(x_2) \land f(x_2) > f(x_3) \right\} \\ &\Leftrightarrow \left\{ f(x_1) \ge f(x_2) \lor f(x_2) \ge f(x_3) \right\} \land \left\{ f(x_1) \le f(x_2) \lor f(x_2) \le f(x_3) \right\} \\ &\Leftrightarrow \left\{ f(x_1) \ge f(x_2) \land f(x_1) \le f(x_2) \right\} \lor \left\{ f(x_1) \ge f(x_2) \land f(x_2) \le f(x_3) \right\} \\ &\lor \left\{ f(x_2) \ge f(x_3) \land f(x_1) \le f(x_2) \right\} \lor \left\{ f(x_2) \ge f(x_3) \land f(x_2) \le f(x_3) \right\} \\ &\Leftrightarrow \left\{ f(x_1) = f(x_2) \right\} \lor \left[f(x_2) \le \min \left\{ f(x_1), f(x_3) \right\} \right] \\ &\lor \left[f(x_2) \ge \max \left\{ f(x_1), f(x_3) \right\} \right] \lor \end{split}$$



$$\begin{split} &\neg \left\{ f(x_1) < f(x_2) < f(x_3) \lor f(x_1) > f(x_2) > f(x_3) \right\} \\ &\Leftrightarrow \neg \left\{ f(x_1) < f(x_2) < f(x_3) \right\} \land \neg \left\{ f(x_1) > f(x_2) > f(x_3) \right\} \\ &\Leftrightarrow \neg \left\{ f(x_1) < f(x_2) \land f(x_2) < f(x_3) \right\} \land \neg \left\{ f(x_1) > f(x_2) \land f(x_2) > f(x_3) \right\} \\ &\Leftrightarrow \left\{ f(x_1) \ge f(x_2) \lor f(x_2) \ge f(x_3) \right\} \land \left\{ f(x_1) \le f(x_2) \lor f(x_2) \le f(x_3) \right\} \\ &\Leftrightarrow \left\{ f(x_1) \ge f(x_2) \land f(x_1) \le f(x_2) \right\} \lor \left\{ f(x_1) \ge f(x_2) \land f(x_2) \le f(x_3) \right\} \\ &\lor \left\{ f(x_2) \ge f(x_3) \land f(x_1) \le f(x_2) \right\} \lor \left\{ f(x_2) \ge f(x_3) \land f(x_2) \le f(x_3) \right\} \\ &\Leftrightarrow \left\{ f(x_1) = f(x_2) \right\} \lor \left[f(x_2) \le \min \left\{ f(x_1), f(x_3) \right\} \right] \\ &\lor \left[f(x_2) \ge \max \left\{ f(x_1), f(x_3) \right\} \right] \lor \left\{ f(x_2) = f(x_3) \right\} \end{split}$$

▶ Start ▶ End

Theorem

$$\Leftrightarrow \exists \ x_{1}, \ x_{2}, \ x_{3} \in (a, b) \ s.t. \begin{bmatrix} x_{1} < x_{2} < x_{3} \\ and \\ f(x_{2}) \notin \left(\min \left\{(x_{1}), f(x_{3})\right\}, \max \left\{f(x_{1}), f(x_{3})\right\}\right) \end{bmatrix}$$

$$\begin{split} & \neg \left\{ f(x_1) < f(x_2) < f(x_3) \lor f(x_1) > f(x_2) > f(x_3) \right\} \\ & \Leftrightarrow \neg \left\{ f(x_1) < f(x_2) < f(x_3) \right\} \land \neg \left\{ f(x_1) > f(x_2) > f(x_3) \right\} \\ & \Leftrightarrow \neg \left\{ f(x_1) < f(x_2) \land f(x_2) < f(x_3) \right\} \land \neg \left\{ f(x_1) > f(x_2) \land f(x_2) > f(x_3) \right\} \\ & \Leftrightarrow \left\{ f(x_1) \ge f(x_2) \lor f(x_2) \ge f(x_3) \right\} \land \left\{ f(x_1) \le f(x_2) \lor f(x_2) \le f(x_3) \right\} \\ & \Leftrightarrow \left\{ f(x_1) \ge f(x_2) \land f(x_1) \le f(x_2) \right\} \lor \left\{ f(x_1) \ge f(x_2) \land f(x_2) \le f(x_3) \right\} \\ & \lor \left\{ f(x_2) \ge f(x_3) \land f(x_1) \le f(x_2) \right\} \lor \left\{ f(x_2) \ge f(x_3) \land f(x_2) \le f(x_3) \right\} \\ & \Leftrightarrow \left\{ f(x_1) = f(x_2) \right\} \lor \left[f(x_2) \le \min \left\{ f(x_1), f(x_3) \right\} \right] \\ & \lor \left[f(x_2) \ge \max \left\{ f(x_1), f(x_3) \right\} \right] \lor \left\{ f(x_2) = f(x_3) \right\} \end{split}$$



$$\begin{split} & \neg \left\{ f(x_1) < f(x_2) < f(x_3) \lor f(x_1) > f(x_2) > f(x_3) \right\} \\ & \Leftrightarrow \neg \left\{ f(x_1) < f(x_2) < f(x_3) \right\} \land \neg \left\{ f(x_1) > f(x_2) > f(x_3) \right\} \\ & \Leftrightarrow \neg \left\{ f(x_1) < f(x_2) \land f(x_2) < f(x_3) \right\} \land \neg \left\{ f(x_1) > f(x_2) \land f(x_2) > f(x_3) \right\} \\ & \Leftrightarrow \left\{ f(x_1) \ge f(x_2) \lor f(x_2) \ge f(x_3) \right\} \land \left\{ f(x_1) \le f(x_2) \lor f(x_2) \le f(x_3) \right\} \\ & \Leftrightarrow \left\{ f(x_1) \ge f(x_2) \land f(x_1) \le f(x_2) \right\} \lor \left\{ f(x_1) \ge f(x_2) \land f(x_2) \le f(x_3) \right\} \\ & \lor \left\{ f(x_2) \ge f(x_3) \land f(x_1) \le f(x_2) \right\} \lor \left\{ f(x_2) \ge f(x_3) \land f(x_2) \le f(x_3) \right\} \\ & \Leftrightarrow \left\{ f(x_1) = f(x_2) \right\} \lor \left[f(x_2) \le \min \left\{ f(x_1), f(x_3) \right\} \right] \\ & \Leftrightarrow f(x_2) \notin \left(\min \left\{ (x_1), f(x_3) \right\}, \max \left\{ f(x_1), f(x_3) \right\} \right) \end{split}$$

Github:

https://min7014.github.io/math20240228001.html

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