

On what interval(s) is $f(x) = x^3 - 9x^2 + 15x - 5$ increasing?

$$f'(x) = 3x^2 - 18x + 15$$

$$f' \geq 0 \quad \forall x$$

$$f'(x) = 0 \Rightarrow x = 1 \text{ or } x = 5$$

f is incr. on $(-\infty, 1) \cup (5, \infty)$

because $f'(x) > 0$ on $(-\infty, 1) \cup (5, \infty)$.

Find the local ext. of $f(x) = x\sqrt{5-x^2}$

$$f'(x) = \frac{5-2x^2}{\sqrt{5-x^2}}$$

$$f' \neq 0 \text{ on } (-\infty, -\sqrt{5}] \cup [\sqrt{5}, \infty)$$

$$f'(x) = 0 \rightarrow x = -\frac{\sqrt{10}}{2} \text{ or } x = \frac{\sqrt{10}}{2}$$

$$f''(x) = \frac{2x^3 - 15x}{\sqrt{(5-x^2)^3}}$$

f has a rel min of $-\frac{5}{2}$ at $x = -\frac{\sqrt{10}}{2}$

because $f''(-\frac{\sqrt{10}}{2}) = 4 > 0 \rightarrow f \text{ C.U.}$

f has a rel max of $\frac{5}{2}$ at $x = \frac{\sqrt{10}}{2}$

because $f''(\frac{\sqrt{10}}{2}) = -4 < 0 \rightarrow f \text{ C.D.}$

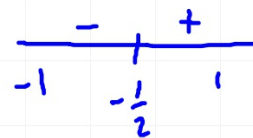
Find IPs (if any) of $f(x) = 2x^3 + 3x^2 - 12x + 1$

$$f'(x) = 6x^2 + 6x - 12$$

$$f''(x) = 12x + 6$$

$$f'' \neq 0 \forall x$$

$$f''(x) = 0 \rightarrow x = -\frac{1}{2}$$



f has an IP at $(-\frac{1}{2}, \frac{13}{2})$ because

$f''(x) < 0$ on $(-\infty, -\frac{1}{2})$ and

$f''(x) > 0$ on $(-\frac{1}{2}, \infty)$ and $f(-\frac{1}{2}) = \frac{13}{2}$.

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Use SDT to find relext. of $f(x) = -4x^3 + 3x^2 + 18x$

$$f'(x) = -12x^2 + 6x + 18$$

$$f' \exists \forall x$$

$$f'(x) = 0 \rightarrow x = -1 \text{ or } x = \frac{3}{2}$$

$$f''(x) = -24x + 6$$

f has relmin of -11 at $x = -1$

because $f''(-1) = 30 > 0 \rightarrow f$ C.V.

f has a relmax of $\frac{81}{4}$ at $x = \frac{3}{2}$

because $f''(\frac{3}{2}) = -30 < 0 \rightarrow f$ is C.D.