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

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

$f' \exists \forall x$

$f'(x) = 0 \rightarrow x = 1$ or $x = 5$

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

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

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

4

-4

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

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

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

f has a local min of $-\frac{5}{2}$ at $x = -\frac{\sqrt{10}}{2}$
because $f''(-\frac{\sqrt{10}}{2}) = 4 > 0 \Rightarrow f$ is C.U.

f has a local max of $\frac{5}{2}$ at $x = \frac{\sqrt{10}}{2}$
because $f''(\frac{\sqrt{10}}{2}) = -4 < 0 \longrightarrow f$ is C.D.

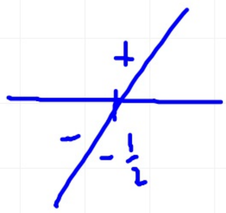
Find IPs (if any) of $f(x) = 2x^3 + 3x^2 - 12x + 1$

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

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

$f'' \exists \ \forall x$

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



f has IP at $\left(-\frac{1}{2}, \frac{15}{2}\right)$ because

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

$f''(x) > 0$ on $\left(-\frac{1}{2}, \infty\right)$ and $f\left(-\frac{1}{2}\right) = \frac{15}{2}$.

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

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

$f' \exists \forall x$

30

-30

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

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

f has a rel min of -11 at $x = -1$ because

$f''(-1) = 30 > 0 \rightarrow f$ is C.U.

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

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