

$$f(x) = x^3 - 4x + 1$$

a) Find all Rel. Extr. $\rightarrow f' = 0$ or undef.

b) Find all intervals of Inc & Dec

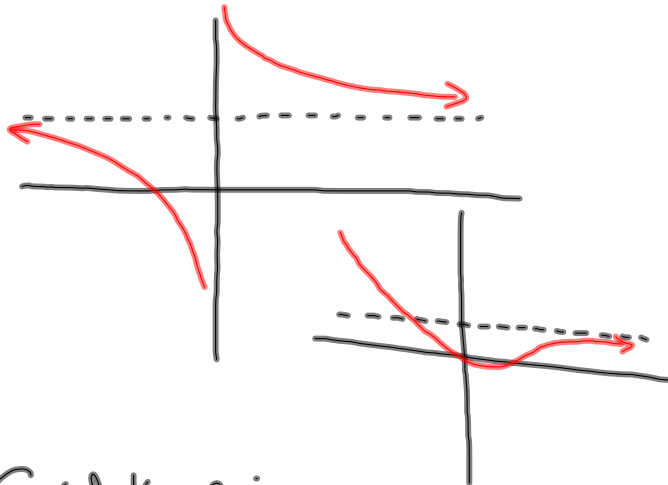
c) Find all P.I.'s

d) Find intervals of concavity $\rightarrow f'' = 0$ or undef.

Limits at Infinity (3.5)

→ a function value as x approaches ∞ or $-\infty$

→ these are horizontal Asymptotes



Guidelines:

Look at the degree of the Numerator & Denominator.

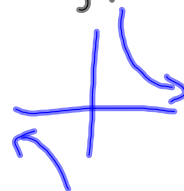
- 1) If deg. of top $>$ deg. of bottom there is NO H.A. (No Limit)
- 2) If deg. of top = deg. of bottom the H.A. = leading coefficient of the top divided by lead. coeff. of bottom.

$$\text{ex) } f(x) = \frac{3x^2 + 7x + 1}{2x^2 + 5}$$

$$\text{H.A. } \boxed{y = \frac{3}{2}}$$

- 3) If deg. top $<$ deg. bottom, then the H.A. is $y = 0$

$$\text{ex) } f(x) = \frac{(3x^2 - 4x + 2)}{(x^4 + 1)}$$



ex1) Find H.A. for

$$HA = \frac{1}{10}$$

$$f(x) = \frac{2x^3 + 3x^2 + 1}{10x^3 - 3x}$$

$$HA = \frac{1}{5}$$

Divide all terms by the highest power of Denom. $\rightarrow x^3$

$$\lim_{x \rightarrow \infty} \frac{\frac{2x^3}{x^3} + \frac{3x^2}{x^3} + \frac{1}{x^3}}{\frac{10x^3}{x^3} - \frac{3x}{x^3}}$$

2) Find all H.A. for

$$f(x) = \frac{3x-2}{\sqrt{2x^2+1}}$$

$$\lim_{x \rightarrow \infty} f(x)$$

$$= \frac{3}{\sqrt{2}}$$

∴

$$\lim_{x \rightarrow -\infty} f(x)$$

$$= -\frac{3}{\sqrt{2}}$$

3) Find HA's

$$\text{for } g(x) = \frac{\sqrt{5x^4 + 2x^2 + 1}}{x^2 - x + 2}$$

$$\lim_{x \rightarrow \infty} g(x) = \frac{+\sqrt{5}}{1}$$

$$\lim_{x \rightarrow -\infty} g(x) = \frac{-\sqrt{5}}{1}$$

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$$\frac{\sqrt{x^3 + 2}}{5x^{3/2}}$$