Poll Q - Use the second-derivative test to classify each critical number as a local (relative) min, local max, or neither.

$$f(x) = \frac{x^2 - x + 5}{x + 4}$$

Solution: $f(x) = \dfrac{x^2 - x + 5}{x + 4}$

Use quotient rule to find $f'(x)$:

$$f'(x) = \frac{(x^2 - x + 5)' \cdot (x+4) - (x^2 - x + 5) \cdot (x+4)'}{(x+4)^2}$$

$$f'(x) = \frac{(2x-1)(x+4) - (x^2 - x + 5)(1)}{(x+4)^2}$$

$$= \frac{2x^2 + 8x - x - 4 - x^2 + x - 5}{(x+4)^2} = \frac{x^2 + 8x \overset{9 \quad -1}{-9}}{(x+4)^2}$$

$$= \frac{(x+9)(x-1)}{(x+4)^2}$$

First-order critical numbers: $\underbrace{f'(x)=0 \text{ or DNE}}_{f(c) \text{ is defined}}$

$$f'(x) = \frac{(x+9)(x-1)}{(x+4)^2} = 0 \text{ or DNE} \left.\right\} \begin{array}{l} x=-9,\ 1 \\ x=-4 \text{ is x-coord. of V.A.} \end{array}$$

f is undef at $x=-4$!

Second-order critical numbers: $\underbrace{f''(x)=0 \text{ or DNE}}_{f(c) \text{ is defined}}$

$$f''(x) = \left(\frac{x^2+8x-9}{(x+4)^2}\right)'$$

use quotient rule again

chain rule

$$f''(x) = \frac{(2x+8)(x+4)^2 - (x^2+8x-9)\cdot 2(x+4)\cdot 1}{(x+4)^4}$$

$$= \frac{2(x+4)\left[(x+4)^2 - (x^2+8x-9)\right]}{(x+4)^4}$$

$$= \frac{2(x+4)\left[x^2+8x+16-x^2-8x+9\right]}{(x+4)^4}$$

$$= \frac{2(x+4)\cdot 25}{(x+4)^4} = \frac{50}{(x+4)^3} \rightarrow$$

use $x=-4$ in sign chart

sign chart for $f''(x) = \frac{50}{(x+4)^3}$

$x = -9, 1$ (first-order critical #s)

	-9	-4	1
sign of $f''(x)$	$-$		$+$
concave up/down $(f(x))$	∩		∪

since $f''(-9) < 0$ local max at $x = -9$

$f''(1) > 0$ local min at $x = 1$

$x = {}^-4$ is the x-coordinate of V.A.

$x = -4$ is undefined, therefore, there's

NO PoI at $x = {}^-4$