Math 1300 **Name:** Champ
Fall 2025
Quiz 3

1. (6 points) Consider the function

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

(a) (2 points) Find the horizontal asymptote(s), if they exist.

Expanded: $\dfrac{3x^3+4x^2+x-6x^2-8x-2}{x^3-4x+x^2-4} = \dfrac{3x^3-2x^2-7x-2}{x^3+x^2-4x-4}$

Answer: $\boxed{y=3}$

(b) (2 points) Find the vertical asymptote(s), if they exist.

Factored: $\dfrac{(3x+1)\cancel{(x+1)}\cancel{(x-2)}}{\cancel{(x+1)}\cancel{(x-2)}(x+2)}$

Answer: $\boxed{x=-2}$

(c) (2 points) Determine whether $f(x)$ has any removable discontinuities (holes). If so, express each as an ordered pair in the form (x, y).

Simplified: $y = \dfrac{3x+1}{x+2}$

When $x=-1$, $y=\dfrac{-2}{1}$

when $x=2$, $y=\dfrac{7}{4}$

Answer: $\boxed{(-1,-2) \text{ and } (2, 7/4)}$

2. (4 points) Use the limit definition of the derivative to find $f'(10)$, where

$$f(x) = \sqrt{x-1}.$$

$$f'(10) = \lim_{h\to 0} \frac{f(10+h) - f(10)}{h} = \lim_{h\to 0} \frac{\sqrt{10+h-1} - \sqrt{10-1}}{h}$$

$$= \lim_{h\to 0} \frac{\sqrt{9+h} - 3}{h} \cdot \frac{\sqrt{9+h}+3}{\sqrt{9+h}+3}$$

$$= \lim_{h\to 0} \frac{9+h-9}{h(\sqrt{9+h}+3)}$$

$$= \lim_{h\to 0} \frac{\cancel{h}}{\cancel{h}(\sqrt{9+h}+3)}$$

$$= \lim_{h\to 0} \frac{1}{\sqrt{9+h}+3}$$

$$= \frac{1}{\sqrt{9}+3}$$

$$= \frac{1}{6}$$