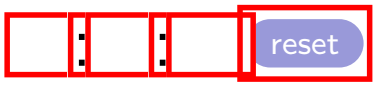
Bellwork 9/26

Find the limits:

$$\lim_{x\to\infty} \frac{\sqrt{1+4x^6}}{2-x^3} \text{ and } \lim_{x\to-\infty} \frac{\sqrt{1+4x^6}}{2-x^3}$$



Bellwork 9/26 - Solution, Part 1

Bellwork 9/26 - Solution, Part 2

Exercise 1

$$f(x) = \frac{1}{x+1}$$

$$f'(2) = ?$$

Exercise 1 - Solution

$$f'(2) = \lim_{x \to 2} \left[\frac{f(x) - f(2)}{x - 2} \right]$$

$$\implies f'(2) = \lim_{x \to 2} \left(\frac{\frac{1}{x+1} - \frac{1}{2+1}}{x - 2} \right) = \lim_{x \to 2} \left[\frac{\frac{3-(x+1)}{3(x+1)}}{x - 2} \right]$$

$$= \lim_{x \to 2} \left[\frac{-\cancel{(x-2)}}{3(x+1)\cancel{(x-2)}} \right] = \lim_{x \to 2} \left[\frac{-1}{3(x+1)} \right] = \boxed{-\frac{1}{9}}$$

Exercise 2

$$f(x) = \sqrt{2x + 1}$$

$$f'(4) = ?$$

Exercise 2 - Solution

$$f'(4) = \lim_{x \to 4} \left[\frac{f(x) - f(4)}{x - 4} \right]$$

$$\implies f'(4) = \lim_{x \to 4} \left(\frac{\sqrt{2x+1} - \sqrt{2 \cdot 4 + 1}}{x - 4} \right)$$

$$= \lim_{x \to 4} \left(\frac{\sqrt{2x+1} - 3}{x - 4} \right) = \lim_{x \to 4} \left[\frac{(\sqrt{2x+1} - 3)}{(x - 4)} \cdot \frac{(\sqrt{2x+1} + 3)}{(\sqrt{2x+1} + 3)} \right]$$

$$= \lim_{x \to 4} \left[\frac{2x + 1 - 9}{(x - 4)\sqrt{2x+1} + 3(x - 4)} \right] = \lim_{x \to 4} \left[\frac{2\cancel{(x - 4)}}{\cancel{(x - 4)}\sqrt{2x+1} + 3\cancel{(x - 4)}} \right]$$

$$= \lim_{x \to 4} \left[\frac{2}{\sqrt{2x+1} + 3} \right] = \lim_{x \to 4} \left[\frac{2}{\sqrt{2x+1} + 3} \right] = \boxed{\frac{1}{3}}$$