Determine the Limit by substitution

7A) $\lim_{x\to -1} 2x^2(5x+2) =$

13A) $\lim_{x\to 30} (x-3)^{1/3} =$

Determine the limit algebraically and support graphically.

20A) $\lim_{x\to 4} \frac{x^2-3x-4}{x^2-16} = \frac{0}{0} \rightarrow \lim_{x\to 4} \frac{\cancel{(x-4)}(x+1)}{(x+4)\cancel{(x-4)}} = \frac{5}{8}$

22A) $\lim_{x\to 0} \frac{\frac{1}{x+3} - \frac{1}{3}}{x} = \frac{\frac{1}{3}-\frac{1}{3}}{0} = \frac{0}{0}$

$\lim_{x\to 0} \frac{\frac{1(3)}{(x+3)(3)} - \frac{1(x+3)}{3(x+3)}}{x} = \frac{\frac{3}{3(x+3)} - \frac{1(x+3)}{3(x+3)}}{x}$

$= \frac{\frac{3-(x+3)}{3(x+3)}}{x}$

$= \frac{\frac{3-x-3}{3(x+3)}}{x}$

$= \frac{\left(\frac{-x}{3(x+3)}\right)}{x}$

$\boxed{\lim_{x\to 0} \frac{-1}{3(x+3)} = -\frac{1}{9}}$

$\frac{\left(\frac{2}{3}\right)}{(2)} = \frac{2}{3} \div 2$

$= \frac{2}{3} \cdot \frac{1}{2}$

$\frac{-x}{3(x+3)} \div x$

$\frac{-x}{3(x+3)} \cdot \frac{1}{x} = \frac{-1}{3(x+3)}$

$\lim_{x\to 0^-} \frac{5(-x)}{\lvert -x\rvert}$ $x=-1$ $\frac{5(-1)}{\lvert -1\rvert}$	Determine the limit by substitution A) $\lim_{x\to 1^-} \frac{5x}{\lvert x\rvert} = \frac{5(1)}{\lvert 1\rvert} = 5$ B) $\lim_{x\to 1^+} \frac{5x}{\lvert x\rvert} = \frac{5(1)}{\lvert 1\rvert} = 5$ C) $\lim_{x\to 0^-} \frac{5x}{\lvert x\rvert} = \frac{0}{0} \to -5$ D) $\lim_{x\to 0^+} \frac{5x}{\lvert x\rvert} = 5$ Determine the limit by substitution and support graphically. 30A) $\lim_{\cancel{x\to 4}} \frac{x^2-4}{x^2-16} = \frac{16-4}{16-16} = \frac{12}{0}$ ← Vertical Asy at $x=4$ Left $x=3.9$ $\frac{3.9^2-4}{3.9^2-16} = \frac{+}{-} = \text{neg}$ Right $x=4.1$ $\frac{4.1^2-4}{4.1^2-16} = \frac{+}{+} = \text{pos}$ $\lim_{x\to 4} \frac{x^2-4}{x^2-16} = \text{DNE}$ Use properties of limits to determine each limit Assume that $\lim_{x\to 1} f(x) = 10$ and $\lim_{x\to 1} g(x) = 5$ A) $\lim_{x\to 1}(f(x)+3) =$ B) $\lim_{x\to 1}(xg(x))$ C) $\lim_{x\to 1}(f^2(x)) =$ D) $\lim_{x\to 1} \frac{f(x)}{g(x)+2}$

What you'll Learn About

- Finite Limits as x approaches positive or negative infinity
- End Behavior Models
- Infinite Limits as x approaches a value

* If the power in the denominator is bigger than the numerator $\lim_{x\to\pm\infty} f(x) = 0$

* Horizontal Asy $\lim_{x\to\pm\infty} f(x) = a$

H.A. $y = a$

* Highest power in numerator $\lim_{x\to\pm\infty} f(x) = \pm\infty$

* powers in numerator and denominator are the same $\lim_{x\to\pm\infty} f(x) = a$

divide the leading coefficients

Find the limit as $x \to \pm\infty$

4A) $\lim_{x\to\infty} \frac{x+3}{3x^3-x+1} = 0 \to$ HA $y=0$

end behavior model: $y = \frac{x}{3x^3} = \frac{1}{3x^2}$

4B) $\lim_{x\to\infty} \frac{3x^3-x+1}{x+3} = \infty$

$y = \frac{3x^3}{x} = 3x^2$

4C) $\lim_{x\to\infty} \frac{3x^3-x+1}{x^3+3} = 3 \to$ HA $y=3$

E.B.M: $y = \frac{3x^3}{x^3} = 3$

4D) $\lim_{x\to-\infty} \frac{5x^2-x+2}{5x^2+10} = 1$

$y = \frac{5x^2}{5x^2} = 1$

H.A $y=1$

4E) $\lim_{x\to-\infty} \frac{x^3+x-1}{x^2-5x+2} = -\infty$

$y = \frac{x^3}{x^2} = x$ $\lim_{x\to-\infty} x$

22A) $\lim_{x\to\infty} \left(\frac{5}{x}+2\right)\left(\frac{8x^2-1}{2x^2}\right)$

$(0+2)(4)$

$2(4)$

8

22B) $\lim_{x\to-\infty} \left(\frac{5}{x}+2\right)\left(\frac{8x^2-1}{2x^2}\right)$

$(0+2)(4)$

8

$\frac{8x^3}{2x^2} = 4x$

22C) $\lim_{x\to\infty} \left(\frac{5}{x}+2\right)\left(\frac{8x^3-1}{2x^2}\right)$

$(0+2)(\infty)$

∞

22D) $\lim_{x\to-\infty} \left(\frac{5}{x}+2\right)\left(\frac{8x^3-1}{2x^2}\right)$

$(0+2)(-\infty)$

$-\infty$