2.2 Infinite Limits

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Type 1: $\lim_{x \to \pm\infty} f(x) = L$

Type 2: $\lim_{x \to c} f(x) = \pm\infty$

$\lim_{x \to 0^+} \frac{1}{x} = \frac{1}{\text{small}} = \infty$

$\lim_{x \to \infty} \frac{1}{x} = \frac{1}{\text{HUGE}} = 0$

degree - the value of the greatest exponent

Case 1: Degree Numerator < Degree Denominator (BOTTOM-HEAVY)

$$\lim_{x \to \infty} \frac{11x + 2}{2x^3 - x + 4} = 0$$

ex $\lim_{x \to 4} \frac{3}{x-4} = \cancel{\infty}$ OR $\cancel{-\infty}$ OR DNE

① Try subst ∴
② Try F/C ∴
③ Try Conj. ∴
④ Type 1 ∴
} ⑤ Type 2

Case 2: Degree Numerator = Degree Denominator (BALANCED)

$$\lim_{x \to -\infty} \frac{5x^2 + 8x - 3}{3x^2 + 2} = \frac{5}{3}$$

$\lim_{x \to 4^-} \frac{3}{x-4} = \frac{3}{3-4} = \frac{3}{-1} = -3 \to -\infty$ (negative #)

$\lim_{x \to 4^+} \frac{3}{x-4} = \frac{3}{5-4} = \frac{3}{1} = 3 \to \infty$ (positive #)

NOT SAME ↓

Case 3: Degree Numerator > Degree Denominator (TOP-HEAVY)

$$\lim_{x \to \infty} \frac{-4x^3 + 7x}{2x^2 - 3x - 10} = \cancel{\infty} \text{ OR } -\infty$$

∞ then x = positive #

-∞ then x = negative #

negative #

$$\frac{-4x^3}{2x^2} \to \frac{-4(2)^3}{2(2)^2} \to \frac{-32}{8} \to -4$$