Limits to Infinity (Horizontal Asymptotes)

p. 128 - 137 (2.5) BOBO BOTU BETC

Analytically, finding limits to infinity of *rational polynomial functions*:

a. If degree of numerator = degree of denominator, then limit is the ratio of coefficients of the highest degree.
b. If degree of numerator < degree of denominator, then limit = 0.
c. If degree of numerator > degree of denominator, then limit DNE.

Reminder: After finding any holes (common factors) of a rational function, a vertical asymptote occurs where the denominator = 0.

Special Note: Limits to negative infinity of square root functions are treated differently

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Find the a) limits and b) horizontal asymptotes for 1 - 3.

**1. $\lim_{n \to \infty} \dfrac{4n^2}{n^2 + 10{,}000n}$ =4

2. $\lim_{x \to -\infty} \dfrac{\sqrt{2x+5}}{\sqrt{3x+1}}$ $\frac{\sqrt{2}}{\sqrt{3}}$ or $\frac{\sqrt{6}}{3}$

3. $\lim_{x \to \infty} \dfrac{2x^5 - 7}{-5x^2 + 9}$ DNE

**4. If the graph of $y = \dfrac{ax+b}{x+c}$ has a horizontal asymptote $y = 2$ and a vertical asymptote $x = -3$, then $a + c =$ _____?

$a = 2$

$C = 3$

$-3 + c = 0$

**5. For $x \geq 0$, the horizontal line $y = 2$ is an asymptote for the graph of the function f. Which of the statements below must be true?

(A) $f(0) = 2$ (B) $f(x) \neq 2$ for all $x \geq 0$ (C) $f(2)$ is undefined

(D) $\lim_{x \to 2} (f(x) = \infty)$ (E) $\lim_{x \to \infty} (f(x) = 2)$