Answer on Question #80056 – Math – Calculus

Question

k(x)=(x^3+5x^2)/(x^2+4x-5)

limit of k(x) as x approaches -5 from the right

limit of k(x) as x approaches 1

limit of k(x) as x approaches -infinity

Solution

limit of k(x) as x approaches -5 from the right:

$$k(-5)=\frac{0}{0}$$

at -5, the k(x) has an uncertainty of the form 0/0.

Solution version 1:

$$\lim_{x\to-5^+}\frac{x^3+5x^2}{x^2+4x-5}=\lim_{x\to-5^+}\frac{x^2(x+5)}{(x-1)(x+5)}=\lim_{x\to-5^+}\frac{x^2}{(x-1)}=\frac{(-5)^2}{-5-1}=-\frac{25}{6}$$

Solution version 2: use L'Hospital's rule

$$\lim_{x\to-5^+}\frac{x^3+5x^2}{x^2+4x-5}=\left\{\lim k(x)=\lim k'(x)\right\}=\lim_{x\to-5^+}\frac{3x^2+10x}{2x+4}=\frac{3(-5)^2+10(-5)}{2(-5)+4}==-\frac{25}{6}$$

limit of k(x) as x approaches 1:

$$\lim_{x\to1}\frac{x^3+5x^2}{x^2+4x-5}=\frac{1^3+5\cdot1^2}{1^2+4\cdot1-5}=\frac{6}{0}=\infty$$

limit of k(x) as x approaches –infinity:

$$\lim_{x\to-\infty}\frac{x^3+5x^2}{x^2+4x-5}=\{divide\ by\ x^3\}=\lim_{x\to-\infty}\frac{1+5\frac{1}{x}}{\frac{1}{x}+4\frac{1}{x^2}-5\frac{1}{x^3}}=\{let\ y=1/x\}$$

$$=\lim_{y\to0^+}\frac{1+5y}{y+4y^2-5y^3}=\frac{1+0}{0+4\cdot0^2-5\cdot0^3}=-\infty$$

Answer:

$$\lim_{x\to-5^+}\frac{x^3+5x^2}{x^2+4x-5}=-\frac{25}{6},\qquad \lim_{x\to1}\frac{x^3+5x^2}{x^2+4x-5}=\infty,\qquad \lim_{x\to-\infty}\frac{x^3+5x^2}{x^2+4x-5}=-\infty$$

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