BC 1 Homework Name: Owen

Get help, figure these out, and make sure that you understand these.
Use correct notation.

(1) Find each limit. No work required.

$\lim_{x\to\infty}\frac{x^3-2}{1-3x^3}$

$-\frac{1}{3}$

$\lim_{x\to 2^-}[3x-1]$

4

$\lim_{x\to\infty}\frac{2x^3-6x+1}{5x^4+x^2+3}$

0

$\lim_{x\to -2^+}\frac{x(x-1)}{x+2}$

$+\infty$

$\lim_{x\to 4}\frac{x^2-4x}{x-4}$

4

$\lim_{x\to 3^-}\frac{x+1}{x^2-3x}$

$-\infty$

$\lim_{x\to -\infty}\frac{3x^5-4x+7}{2x^4+5x^2-1}$

$-\infty$

$\lim_{x\to 2} f(x)$ if $f(x)=\begin{cases}3x-1, & x<2\\ x+3, & x>2\end{cases}$

$=5$

(2) Let $f(x)=\begin{cases}x^2-1, & x<2\\ 2, & x=2\\ 4x-5, & x>2\end{cases}$. Is f continuous at $x=2$? Show/justify clearly using the definition of continuity.

$f(2)=2$ (exists)

$\lim_{x\to 2^-}(x^2-1)=3$

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

$\therefore \lim_{x\to 2} f(x)=3$ exists

but $\lim_{x\to 2} f(x)\neq f(2)$

$\therefore$ not continuous at $x=2$

(3) Find each limit. Do/show analytic work.

$$\lim_{x\to\infty}\frac{2x^4-5x+1}{6x^2+2}\cdot\frac{\frac{1}{x^2}}{\frac{1}{x^2}}=\lim\frac{2x^2-\frac{5}{x}+\frac{1}{x^2}}{6+\frac{2}{x^2}}=\lim\frac{2x^2}{6}=+\infty$$

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

$$\lim_{x\to6}\frac{\sqrt{x+3}-3}{x-6}\cdot\frac{\sqrt{x+3}+3}{\sqrt{x+3}+3}=\lim\frac{x+3-9}{(x-6)(\sqrt{x+3}+3)}=\lim\frac{1}{\sqrt{x+3}+3}=\frac{1}{6}$$

(4) In plain English, explain the IVT.

If a function f is continuous on a closed interval $[a,b]$, then f must hit all y-values in the interval from $f(a)$ to $f(b)$.

(5) Draw a graph of a function f for which $f(1)$, $\lim_{x\to1^-}f(x)$, and $\lim_{x\to1^+}f(x)$ all exist but are all different.