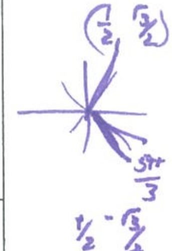
Consider the function below to find each limit. If a limit does not exist, state why.

$$G(x)=\begin{cases}2x^2+3x, & x<-2\\ -\frac{1}{2}x+1, & x>-2\end{cases}$$

a) $\lim\limits_{x\to -2^-} G(x)$ b) $\lim\limits_{x\to -2^+} G(x)$ c) $\lim\limits_{x\to -2} G(x)$

Find each of the following limits analytically. Show your algebraic analysis.

a.	$\lim\limits_{x\to e}\frac{\ln x}{2x} = \frac{\ln e}{2e} = \frac{1}{2e}$
b.	$\lim\limits_{x\to 5^-}\left(\frac{2}{5}x^2+2x\right) = \frac{2}{5}(5)^2+2(5) = \frac{2}{\cancel{5}_1}(\cancel{25}^5)+10 = 10+10 = 20$
c.	$\lim\limits_{\theta\to\pi}\left(\sin^2\theta+2\cos\theta\right) = (\sin\pi)^2+2\cos\pi = 0^2+2(-1) = -2$
d.	$\lim\limits_{\alpha\to\frac{5\pi}{3}}\frac{\tan\alpha}{\alpha^2} = \frac{\tan\frac{5\pi}{3}}{\left(\frac{5\pi}{3}\right)^2} = \frac{-\sqrt{3}}{\frac{25\pi^2}{9}} = \cancel{-\frac{3\sqrt{3}}{5\pi}}$ $\quad \frac{-9\sqrt{3}}{25\pi^2}$
e.	$\lim\limits_{x\to -2}\frac{x^2-x-6}{2x+4} = \lim\limits_{x\to -2}\frac{(x-3)\cancel{(x+2)}}{2\cancel{(x+2)}} = \lim\limits_{x\to -2}\frac{x-3}{2} = \frac{-2-3}{2} = -5/2$



f. $\lim_{x\to 3}\frac{x+5}{x^2-9} = \lim_{x\to 3}\frac{x+5}{(x+3)(x-3)}$ $\quad \lim_{x\to 3}$

$\to$ D.N.E

$a^3-b^3=(a-b)(a^2+ab+b^2)$

g. $\lim_{x\to \frac{3}{2}}\frac{8x^3-27}{2x-3} = \lim_{x\to 3/2}\frac{\cancel{(2x-3)}(4x^2-6x+9)}{\cancel{2x-3}} = \lim_{x\to 3/2} 4x^2-6x+9$

$a=2x \quad b=3$

$=4(\frac{3}{2})^2-\cancel{6}^{3}(\frac{3}{\cancel{2}})+9 = 4(\frac{9}{4})+9+9 = 9+9+9 = 27$

h. $\lim_{x\to -2}\frac{\sqrt{2x+5}-1}{x+2}\cdot\frac{\sqrt{2x+5}+1}{\sqrt{2x+5}+1} = \lim_{x\to -2}\frac{2x+5-1}{(x+2)(\sqrt{2x+5})+1}$

$=\lim_{x\to -2}\frac{2x+4}{(x+2)(\sqrt{2x+5}+1)} \quad \lim_{x\to -2}\frac{2\cancel{(x+2)}}{\cancel{(x+2)}(\sqrt{2x+5}+1)} = \lim_{x\to -2}\frac{2}{\sqrt{2x+5}+1}$

$=\frac{2}{\sqrt{2(-2)+5}+1} = \frac{2}{\sqrt{\cancel{-4+5}}+1} = \frac{2}{2} = 1$

i. $\lim_{x\to 1}\frac{1-\sqrt{2x^2-1}}{x-1}\cdot\frac{(1+\sqrt{2x^2-1})}{1+\sqrt{2x^2-1}} = \lim_{x\to 1}\frac{1-(2x^2-1)}{(x-1)(1+\sqrt{2x^2-1})}$

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

$=\frac{-2(1-1)}{1+\sqrt{2(1)^2-2}} = \frac{0}{1+\sqrt{0}} = 0$

j. $\lim_{x\to 0}\frac{\frac{1}{x+2}+\frac{1}{x}}{x} = \lim_{x\to 0}\frac{\frac{x}{x(x+2)}+\frac{x+2}{x(x+2)}}{x} = \lim_{x\to 0}\frac{\frac{x+x+2}{x(x+2)}}{\frac{x}{1}}$

$\lim_{x\to 0}\frac{2x+2}{x(x+2)}\cdot\frac{1}{x} = \lim_{x\to 0}\frac{2x+2}{x^2(x+2)} \to$ DNE

k. $\lim_{x\to 2^+}\frac{3x^2+7x+2}{x^2-4} = \lim_{x\to 2^+}\frac{(3x+1)\cancel{(x+2)}}{\cancel{(x+2)}(x-2)} = \lim_{x\to 2^+}\frac{3x+1}{x-2}$

if $x = 2.1 \to \frac{3(2.1)+1}{2.1-2} = \frac{7.3}{2} \to \frac{+}{+}$

so: $\lim_{x\to 2^+}\frac{3x+1}{x-2} = \infty$

l. $\lim_{x\to 3^+}\frac{2x+5}{x-3} \to$ TRY $x = 3.1$

$\frac{2(3.1)+5}{3.1-3} = \frac{+}{+}$

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

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

$x = 2.9$

$\frac{2(2.9)+5}{2.9-3} = \frac{+}{-}$

If $f(x) = 2x^2 - 3x + 4$, find $\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$.