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MATH-101 Term-131 IN-Class-QUIZ-4, 5

1) Sketch the graph of a function $f(x)$ that satisfies the following conditions:

$\lim_{x\to-\infty} f(x) = 3$ $\lim_{x\to-3} f(x) = +\infty$ $f(-2) = -2$ $\lim_{x\to-1-} f(x) = -2$ $\lim_{x\to0-} f(x) = -2$

$f(2) = 3$ $f'(4) = 0$ $f(2.5) = -5$ $f(4) = -1$

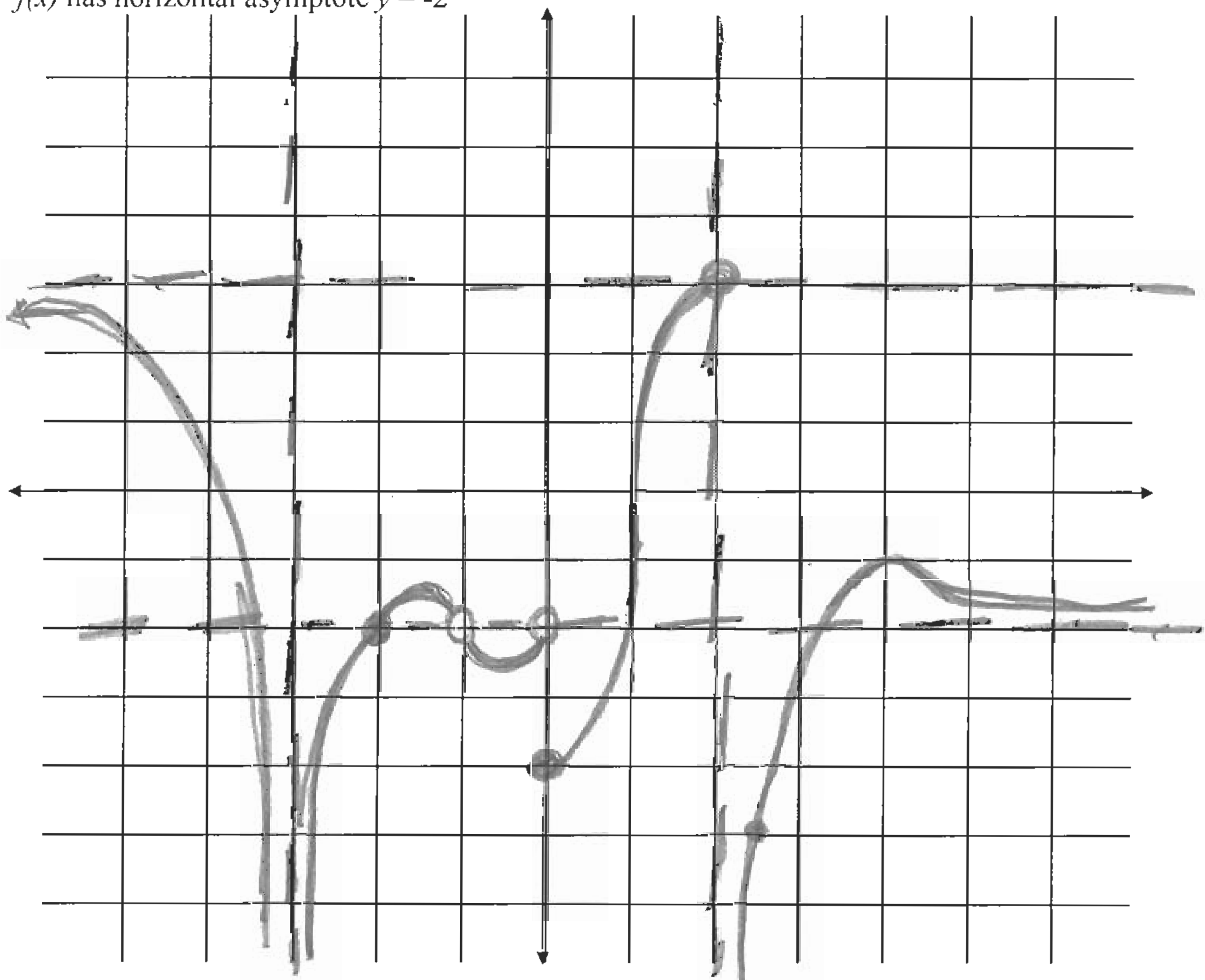
$f(x)$ has removable discount. at $x = -1$

$f(x)$ has jump discount. at $x = 0$

$f(x)$ has vertical tangent at $x = 1$

$f(x)$ has infinite discount at $x = 2$

$f(x)$ has horizontal asymptote $y = -2$



2) Evaluate the limit if it exists.. $\lim_{x\to0}\frac{x^2-1+\cos^2 x}{x-\sin x} = \lim_{x\to0}\frac{x^2-1+1-\sin^2 x}{x-\sin x}$

$= \lim_{x\to0}\frac{x^2-\sin^2 x}{x-\sin x} = \lim_{x\to0}\frac{\cancel{(x-\sin x)}(x+\sin x)}{\cancel{(x-\sin x)}}$

$= \lim_{x\to0}(x+\sin x) = 0+0 = 0$

3) Use the Intermediate Value Theorem to show that the functions $f(x)=2x^5+4x^3$ and $g(x)=x^5+x^3-x^2+4$ intersect over the interval [0, 1].

Let $h(x)=f(x)-g(x)=x^5+3x^3+x^2-4$

$h(x)$ is continuous on the interval $[0,1]$

and $h(0)=-4$, $h(1)=1$

Since $-4=h(0)<0<h(1)=1$, there is a number c in $[0,1]$ such that $h(c)=0$ by IVT.

Thus $f(x)$ and $g(x)$ intersect over the interval $[0,1]$

4) Evaluate the limit if it exists.. $\lim_{x\to-5+}\frac{[\![\,3|x+5|-3\,]\!]}{|x+5|}$ Since $x\to-5+ \Rightarrow |x+5|=x+5$

$$=\lim_{x\to-5+}\frac{[\![3(x+5)-3]\!]}{(x+5)}=\lim_{x\to-5+}\frac{[\![3x+12]\!]}{(x+5)}$$

$$=\left(\lim_{x\to-5+}[\![3x+12]\!]\right)\left(\lim_{x\to-5+}\frac{1}{x+5}\right)$$

$$=(-3)(+\infty)=-\infty$$

5) Use the definition of the limit to Prove that $\lim_{x\to2}(3x-5)=1$.

$f(x)=3x-5$, $a=2$, $L=1$

given $\varepsilon>0$, there is a $\delta>0$ such that

if $0<|x-2|<\delta=\frac{\varepsilon}{3}$ then $|f(x)-1|<\varepsilon$

Finding δ: $|f(x)-L|<\varepsilon$

$|(3x-5)-1|<\varepsilon$

$\Rightarrow |3x-6|<\varepsilon \Rightarrow 3|x-2|<\varepsilon$

$\Rightarrow |x-2|<\frac{\varepsilon}{3}$

choose $\delta=\varepsilon/3$