Name: ______________________________ Math 231 Quiz 2

1. (8 pts) Evaluate the limit, if it exists.

(a) $\displaystyle\lim_{h\to 0}\frac{\sqrt{1+h}-1}{h}$

$$= \lim_{h\to 0}\frac{(\sqrt{1+h}-1)}{h}\cdot\frac{(\sqrt{1+h}+1)}{\sqrt{1+h}+1}$$

$$= \lim_{h\to 0}\frac{(1+h)-1}{(\sqrt{1+h}+1)h}$$

$$= \lim_{h\to 0}\frac{\cancel{h}}{(\sqrt{1+h}+1)\cancel{h}}$$

$$= \lim_{h\to 0}\frac{1}{\sqrt{1+h}+1}$$

$$= \frac{1}{\sqrt{1+0}+1}$$

$$= \boxed{\frac{1}{2}}$$

(b) $\displaystyle\lim_{x\to 2}\frac{\frac{1}{x}-\frac{1}{2}}{x-2}$

$$= \lim_{x\to 2}\frac{\frac{2-x}{2x}}{x-2}$$

$$= \lim_{x\to 2}\frac{-\cancel{(x-2)}}{2x\cancel{(x-2)}}$$

$$= \lim_{x\to 2}\frac{-1}{2x}$$

$$= \boxed{-\frac{1}{4}}$$

2. (12 pts) Evaluate the limit, if it exists.

(a) $\lim_{n\to\infty} \frac{n^2 + \cancel{n} + \cancel{2}}{n^2 + \cancel{n}} = \lim_{n\to\infty} \frac{n^2}{n^2} = \lim_{n\to\infty} 1 = \boxed{1}$

drop lower-order terms

(b) $\lim_{x\to-\infty} \frac{6x^2 - \cancel{6x} + \cancel{1}}{12x - \cancel{6}} = \lim_{x\to-\infty} \frac{6x^2}{12x} = \lim_{x\to-\infty} \frac{x}{2} = \boxed{-\infty}$

drop lower-order terms

(c) $\lim_{x\to-\infty} \frac{6x^2 - \cancel{6x} + \cancel{1}}{2x^3 - \cancel{3x^2} + \cancel{x}} = \lim_{x\to-\infty} \frac{6x^2}{2x^3} = \lim_{x\to-\infty} \frac{3}{x} = \frac{3}{-\infty} = \boxed{0}$

drop lower-order terms

(d) (Bonus) $\lim_{x\to\infty} \left(\sqrt{x+1} - \sqrt{x}\right)$ (*hint: rationalize the expression*)

$$= \lim_{x\to\infty} \left(\sqrt{x+1} - \sqrt{x}\right) \frac{\sqrt{x+1} + \sqrt{x}}{\sqrt{x+1} + \sqrt{x}}$$

$$= \lim_{x\to\infty} \frac{(x+1) - x}{\sqrt{x+1} + \sqrt{x}}$$

$$= \lim_{x\to\infty} \frac{1}{\sqrt{x+1} + \sqrt{x}}$$

$$= \frac{1}{\infty + \infty}$$

$$= \boxed{0}$$