**Name:** ______________________________ ________ / 25

There are 25 points possible on this quiz. No aids (book, calculator, etc.) are permitted. Show all work for full credit.

**1. [5 points]** Evaluate the limit. Show work and use proper limit notation for full credit.

$$\lim_{x\to -5} \frac{x+5}{x^2+7x+10} = \lim_{x\to -5} \frac{x+5}{(x+5)(x+2)}$$

$$= \lim_{x\to -5} \frac{1}{x+2}$$

$$= \boxed{-\frac{1}{3}}$$

**2. [5 points]** Evaluate the limit. Show work and use proper limit notation for full credit.

$$\lim_{x\to 0} \frac{2-\sqrt{4+h}}{h} = \lim_{x\to 0} \frac{(2-\sqrt{4+h})(2+\sqrt{4+h})}{h}$$

$$= \lim_{x\to 0} \frac{4-(4+h)}{h}$$

$$= \lim_{x\to 0} \frac{-h}{h} = \lim_{h\to 0} -1 = \boxed{-1}$$

**3. [4 points]**

**a**. Why is the following not a true statement?:

$$\frac{2x^2-3x}{x} = 2x-3$$

The expression on the right-hand side is defined at $x=0$, but the expression on the left-hand side is not.

**b**. Explain why the following equation *is* correct:

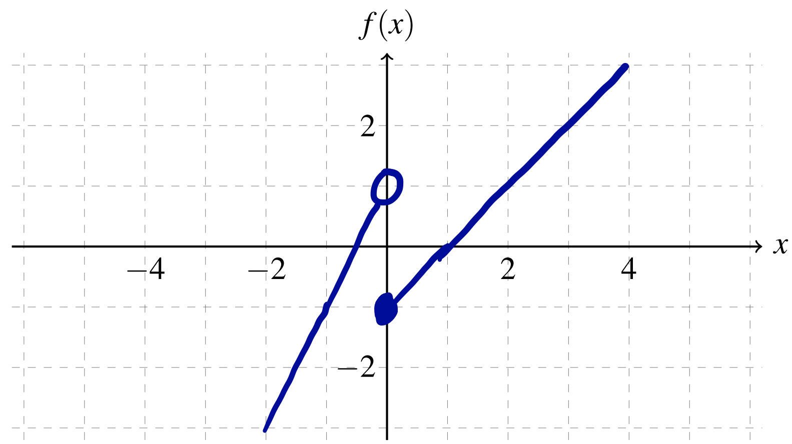
$$\lim_{x\to 0} \frac{2x^2-3x}{x} = \lim_{x\to 0} 2x-3$$

The expressions inside the limits are the same except at one point ($x=0$) and "limits don't care about one point."

**4. [6 points]** Consider the function

$$f(x) = \begin{cases} 2x+1 & x<0 \\ -1+x & x\geq 0 \end{cases}$$

**a**. On the axes below, sketch a graph of $f(x)$.




**b**. Evaluate the limit, or explain why it does not exist:

$\lim_{x\to 0} f(x)$

$\lim_{x\to 0^+} f(x) = -1$

$\lim_{x\to 0^-} f(x) = 1$

Since the left- and right-hand limits are different, the limit $\lim_{x\to 0} f(x)$ does not exist.

**c**. Is $f$ continuous at $x=0$? Explain using the definition of continuity.

The function is not continuous at $x=0$. We would need $\lim_{x\to 0} f(x) = f(0) = -1$. But the limit does not exist.

**5. [5 points]** Use the Intermediate Value Theorem to justify the claim that there exists a number $x$ on the interval $(0,1)$ satisfying $e^x - 6x = 0$.

Let $f(x) = e^x - 6x$. Notice $f(0) = 1 > 0$, but $f(1) \approx 2.7 - 6 < 0$. Since $f(x)$ is continuous on $[0,1]$ the IVT implies for some $x$ in $(0,1)$, $f(x) = 0$.