3.2

39) $f(x) = \begin{cases} 3-x & , x<1 \\ ax^2+bx & , x \geq 1 \end{cases}$

(a) $3-1 = a(1)^2 + b(1)$

$2 = a+b \leftarrow$

(b) $\lim_{h \to 0^-} \frac{[3-(1+h)] - [a+b]}{h}$

$\lim_{h \to 0^-} \frac{\cancel{2} - h - \cancel{2}}{h} = -1$

$\lim_{h \to 0^+} \frac{[a(1+h)^2 + b(1+h)] - [a+b]}{h}$

$\lim_{h \to 0^+} \frac{[a(1+2h+h^2) + b(1+h)] - a - b}{h}$

$\lim_{h \to 0^+} \frac{\cancel{a} + 2ah + ah^2 + \cancel{b} + bh - \cancel{a} - \cancel{b}}{h}$

$\lim_{h \to 0^+} \frac{\cancel{h}(2a+ah+b)}{\cancel{h}}$

$\lim_{h \to 0^+} \frac{2a+ah+b}{1} = 2a+b$

$-1 = 2a+b$

$-1 = 2a + (2-a)$

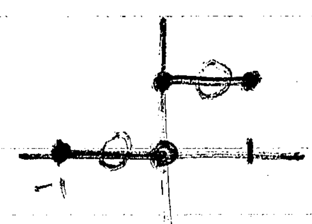
$-1 = a+2$

$-3 = a$

$2 = -3+b$

$5 = b$

37)



$\lim_{h \to 0^+} \frac{[2(1+h)-1] - [1]}{h}$

$\lim_{h \to 0^+} \frac{\cancel{2} + 2h \cancel{-1} \cancel{-1}}{h} = 2$

3) $\lim_{h \to 0^-} \frac{\sqrt{1+h} - 1}{h} \cdot \frac{\sqrt{1+h}+1}{\sqrt{1+h}+1}$

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

$\lim_{h \to 0^-} \frac{1}{\sqrt{1+h}+1} = \frac{1}{2}$

3.2

35) $f(x) = \begin{cases} (x+1)^2 & , x \leq 0 \\ 2x+1 & , 0 < x < 3 \\ (4-x)^2 & , x \geq 3 \end{cases}$

$\lim_{h \to 0^-} \frac{((0+h)+1)^2 - 1}{h}$ $\lim_{h \to 0^+} \frac{[2(0+h)+1] - 1}{h}$

$\lim_{h \to 0^-} \frac{h^2 + 2h + \cancel{1} - \cancel{1}}{h}$ $\lim_{h \to 0^+} \frac{2h + \cancel{1} - \cancel{1}}{h} = 2$

$\lim_{h \to 0^-} \frac{\cancel{h}(h+2)}{\cancel{h}} = 2$

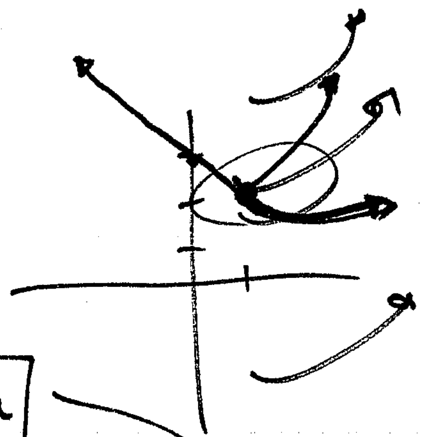
$\lim_{h \to 0^-} \frac{[2(3+h)+1] - 1}{h}$

$\lim_{h \to 0^-} \frac{6 + 2h + \cancel{1} - \cancel{1}}{h} = \lim_{h \to 0^-} \frac{6}{h} + 2 = \infty$

3.2

37) $f(x) = \begin{cases} 0 , & -1 \le x < 0 \\ 1 , & 0 \le x \le 1 \end{cases}$

39) $f(x) = \begin{cases} 3 - x , & x < 1 \\ ax^2 + bx , & x \ge 1 \end{cases}$



(a) $3 - 1 = a(1)^2 + b(1)$

$2 = a + b \leftarrow$ $\boxed{b = 2 - a}$

(b) $\lim_{h \to 0^-} \dfrac{[3-(1+h)] - \overset{a+b=2}{[3-1]}}{h} = \lim_{h \to 0^-} \dfrac{\cancel{3} - \cancel{1} - h - \cancel{2}}{h} = \lim_{h \to 0^-} -\dfrac{h}{h}$

$= \underline{-1}$

$\lim_{h \to 0^+} \dfrac{[a(1+h)^2 + b(1+h)] - [a+b]}{h} = \lim_{h \to 0^+} \dfrac{[a(1+2h+h^2) + b(1+h)] - [a+b]}{h}$

$\lim_{h \to 0^+} \dfrac{[\cancel{a} + 2ah + ah^2 \cancel{+b} + bh] - [\cancel{a} \cancel{+b}]}{h}$

$\lim_{h \to 0^+} \dfrac{\cancel{h}(2a + ah + b)}{\cancel{h}} = \underline{2a + b} = -1$

$2a + (2 - a) = -1$

$a + 2 = -1$

$a = -3 \; , \; b = 5$

31) $f(x) = \dfrac{x^3 - 8}{x^2 - 4x - 5}$

$x^2 - 4x - 5 = 0$

$(x+1)(x-5) = 0$

$x = -1, 5$

3.2

4) $\lim_{h \to 0^-} \frac{(1+h)-1}{h} = \lim_{h \to 0^-} \frac{h}{h} = \lim_{h \to 0^-} 1 = \boxed{1}$

$\lim_{h \to 0^+} \frac{\frac{1}{1+h} - 1}{h} = \lim_{h \to 0^+} \frac{\frac{1}{1+h} - \frac{1+h}{1+h}}{\frac{h}{1}} = \lim_{h \to 0^+} \frac{-\cancel{h}}{1+h} \cdot \frac{1}{\cancel{h}} = \lim_{h \to 0^+} \frac{-1}{1+h} = \boxed{-1}$

45) $f(x) = \begin{cases} 2x+1, & x \leq 0 \\ x^2+1, & x > 0 \end{cases}$

$\lim_{h \to 0^+} \frac{(0+h)^2+1-1}{h}$ nDer$(x^2+1, x, 0) = 0$

3.2

3) $f(x) = \begin{cases} \sqrt{x} & , \ x \le 1 \\ 2x-1 & , \ x > 1 \end{cases}$

$$\lim_{h\to 0^-} \frac{\sqrt{1+h}-1}{h} \cdot \frac{\sqrt{1+h}+1}{\sqrt{1+h}+1} = \lim_{h\to 0^-} \frac{\cancel{1}+h-\cancel{1}}{h[\sqrt{1+h}+1]} = \lim_{h\to 0^-} \frac{\cancel{h}}{\cancel{h}[\sqrt{1+h}+1]}$$

$$\lim_{h\to 0^-} \frac{1}{\sqrt{1+h}+1} = \boxed{\frac{1}{2}}$$

$$\lim_{h\to 0^+} \frac{[2(1+h)-1]-1}{h} = \lim_{h\to 0^+} \frac{[\cancel{2}+2h-\cancel{1}]-\cancel{1}}{h} = \lim_{h\to 0^+} \frac{2\cancel{h}}{\cancel{h}} = \boxed{2}$$