MA 121-004 TEST 1 FORM A 1/30/09 J. GRIGGS

16 POINTS EACH:

) a.) $$\lim_{x \to -5} \frac{x^2+2x-15}{x+5} = \lim_{x \to -5} \frac{(x+5)(x-3)}{(x+5)}$$

$$= \lim_{\substack{x \to -5 \\ (x \neq -5)}} \frac{\cancel{(x+5)}^{1}(x-3)}{\cancel{(x+5)}_{1}} = \lim_{x \to -5} (x-3) = -8$$

b.) $$\lim_{x \to \infty} \frac{2x-1}{x^2-3x+7} = \lim_{x \to \infty} \frac{\frac{2x}{x^2} - \frac{1}{x^2}}{\frac{x^2}{x^2} - \frac{3x}{x^2} + \frac{7}{x^2}}$$

$$= \lim_{x \to \infty} \frac{\cancel{\frac{2}{x}}^{\to 0} - \cancel{\frac{1}{x^2}}^{\to 0}}{1 - \cancel{\frac{3}{x}}_{\to 0} + \cancel{\frac{7}{x^2}}_{\to 0}} = \frac{0}{1} = 0$$

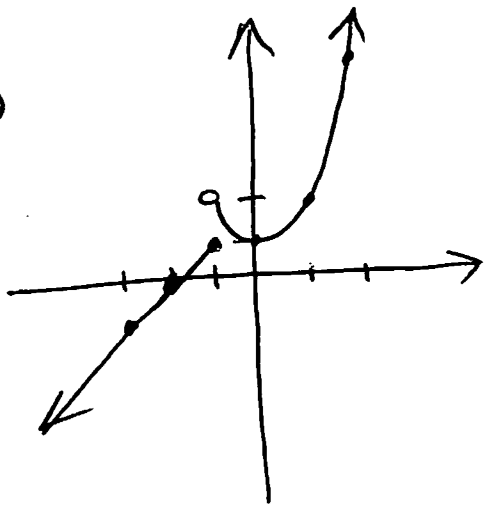
: .) a.)

$y = x+2 \quad (x \le -1)$

x	y
-1	1
-2	0
-3	-1

$y = x^2+1 \quad (x > -1)$

x	y
-1	2 delete
0	1
1	2
2	5



b.) 1.) $f(-1)$ exists? yes, $f(-1)=1$

2.) $\lim_{x \to -1} f(x)$ exists? no

$\lim_{x \to -1^+} f(x) = 2 \quad \lim_{x \to -1^-} f(x) = 1$

$\therefore$ DISCONTINUOUS

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3.) $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$

$= \lim_{h \to 0} \frac{[5(x+h)^2 - 3(x+h) + 1] - [5x^2 - 3x + 1]}{h}$

$= \lim_{h \to 0} \frac{5(x^2+2xh+h^2) - 3x - 3h + 1 - 5x^2 + 3x - 1}{h}$

$= \lim_{h \to 0} \frac{\cancel{5x^2} + 10xh + 5h^2 \cancel{- 3x} - 3h \cancel{+1} \cancel{-5x^2} \cancel{+3x} \cancel{-1}}{h}$

$= \lim_{h \to 0} \frac{h(10x + 5h - 3)}{h} = \lim_{h \to 0} (10x + \underset{0}{5h} - 3)$

$f'(x) = 10x - 3$

(short cut: $5(2x^1) - 3(1) + 0 = 10x - 3$)

4.) eq. of tangent line at $(4, 14)$: $f(x) = x^2 - \sqrt{x} = x^2 - x^{\frac{1}{2}}$

$f'(x) = m_{TAN} = 2x - \frac{1}{2}x^{-\frac{1}{2}} = 2x - \frac{1}{2\sqrt{x}}$

$f'(4) = 2(4) - \frac{1}{2\sqrt{4}} = 8 - \frac{1}{4} = \frac{31}{4}$

$y - y_1 = m(x - x_1)$ $\quad y - 14 = \frac{31}{4}(x - 4)$

or: $\begin{cases} 31x - 4y - 68 = 0 \\ y = \frac{31}{4}x - 17 \end{cases}$

5.) $f(x) = x^2 - 6x + 1$

vertex $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$ $\quad b = -6, \; a = 1 \quad \frac{6}{2(1)} = 3$

$f(3) = 3^2 - 6 \cdot 3 + 1$

$f(3) = 9 - 18 + 1 = -8$

$V(3, -8)$

y-int: (set $x = 0$)

$y = 0^2 - 6 \cdot 0 + 1 = 1$

$(0, 1)$

x-int (set $y = 0$)

$0 = x^2 - 6x + 1$

$x = \frac{6 \pm \sqrt{6^2 - 4(1)(1)}}{2(1)} = \frac{6 \pm \sqrt{32}}{2}$

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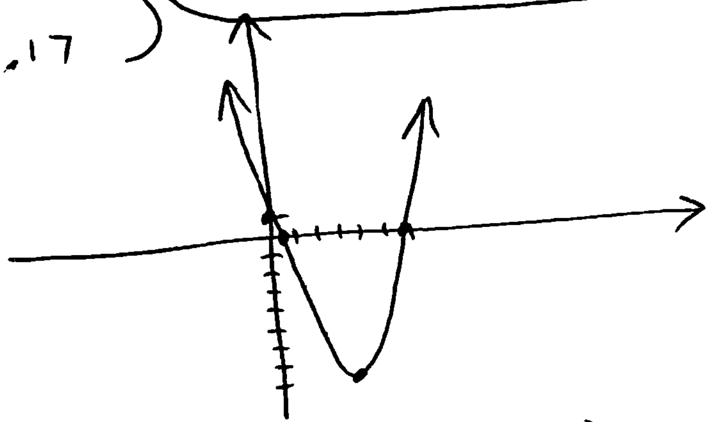
$$x_1 = \frac{6+\sqrt{32}}{2} \approx 5.83$$

$$x_2 = \frac{6-\sqrt{32}}{2} \approx .17$$

$(5.83, 0)$ & $(.17, 0)$



6.) a.) $$\frac{\frac{2}{x+h} - \frac{2}{x}}{h} = \frac{\frac{2(x)}{(x+h)(x)} - \frac{2(x+h)}{x(x+h)}}{h}$$

$$= \frac{2x - 2(x+h)}{x(x+h)} \cdot \frac{1}{h} = \frac{\cancel{2x} - \cancel{2x} - 2h}{x(x+h)\cdot h}$$

$$= \frac{-2\cancel{h}}{x(x+h)\cdot\cancel{h}} = \frac{-2}{x(x+h)}$$

b.) $f(x) = 10x^4 - 5x^{-1/3} + 4x^{1/2} - 8x^{-2} + 5$

$f'(x) = 10(4x^3) - 5(-\frac{1}{3}\cdot x^{-4/3}) + 4(\frac{1}{2}x^{-1/2})$

$-8(-2x^{-3}) + 0$

$f'(x) = 40x^3 + \frac{5}{3}x^{-4/3} + 2x^{-1/2} + 16x^{-3}$