MAT 129-002

#1a $\lim_{x \to 3^-} f(x) = \lim_{x \to 3^-} 1/x = 1/3$

#1b $\lim_{x \to 3^+} f(x) = \lim_{x \to 3^+} \sqrt{x-3} = 0$

#1c $\lim_{x \to 3} f(x)$ does not exist

#1d Not continuous at $x=3$.
Jump discontinuity.

#2 $\lim_{x \to 4} \frac{x^2-4x}{x^2-3x-4}$

$= \lim_{x \to 4} \frac{x\cancel{(x-4)}}{(x+1)\cancel{(x-4)}} = 4/5$

#3 $\lim_{x \to 0} \frac{\sin 7x}{4x}$

$= \lim_{x \to 0} \cancel{\frac{\sin 7x}{7x}}^{\,1} \frac{7x}{4x} = 7/4$

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

$= \lim_{h \to 0} \frac{[4(x+h)^2 - 2(x+h) + 3] - [4x^2 - 2x + 3]}{h}$

$= \lim_{h \to 0} \frac{\cancel{4x^2} + 8xh + 4h^2 - \cancel{2x} - 2h + \cancel{3} - \cancel{4x^2} + \cancel{2x} - \cancel{3}}{h}$

$= \lim_{h \to 0} (8x + 4h - 2) = 8x - 2$

#5 $f(x) = 2\sqrt{x^3} + \sqrt[3]{x^2}$
$f(x) = 2x^{3/2} + x^{2/3}$
$f'(x) = 3x^{1/2} + \frac{2}{3}x^{-1/3}$

#6 $f(x) = (x^2 + x^{-1})(x^5 - 2x^2)$

$f'(x) = (x^2 + x^{-1})(5x^4 - 4x) + (x^5 - 2x^2)(2x - x^{-2})$

#7 $f(x) = \frac{x^3 + x}{x^4 - 2}$

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

#8

$$y = x^3 - 3x^2 + 1$$
$$y' = 3x^2 - 6x$$

want $0 = y' = 3x^2 - 6x = 3x(x-2)$

$x = 0$ $x = 2$

$y = 1$ $y = -3$

#9

$$y = x^3 - 5x + 1$$
$$y' = 3x^2 - 5$$

at $x=1$ $y' = -2$

tangent line $y + 3 = -2(x-1)$

#10

$$s = t^3 - 6t^2 + 9t$$
$$v = 3t^2 - 12t + 9$$

when is $0 = v = 3t^2 - 12t + 9$

$$0 = 3(t^2 - 4t + 3)$$
$$0 = 3(t-1)(t-3)$$

$t = 1$ and $t = 3$