(4) (14 points) Find the instantaneous rate of change of $f(x)$ at $x = 2$. (Credit will not be awarded for use of derivative rules not yet convered in this course.)

$$f(x) = \sqrt{x-1}. \quad @\ x=2$$

$$\lim_{x\to 2} \frac{f(x)-f(2)}{x-2} \to \lim_{x\to 2} \frac{\sqrt{x-1}-\sqrt{2-1}}{x-2} \to \lim_{x\to 2} \frac{\sqrt{x-1}-1}{x-2}$$

$$\lim_{x\to 2} \frac{\sqrt{x-1}-1}{x-2} \frac{(\sqrt{x-1}+1)}{(\sqrt{x-1}+1)} \quad \lim_{x\to 2} \frac{x-1-1}{x-2(\sqrt{x-1}+1)} \quad \lim_{x\to 2} \frac{\cancel{x-2}}{\cancel{x-2}(\sqrt{x-1}+1)}$$

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

(5) (10 points) Use the results of problem ($\cancel{3}$ 4) to find the equation of the line tangent to the graph of $f(x) = \sqrt{x-1}$ at the point $(2, 1)$.

#4 gave us the slope of the tangent line @ point (2,1) ✓

soo...

$$y-1 = 1/2(x-2)$$
$$y-1 = 1/2x - 1$$
$$y = 1/2x$$

(6) (16 points 8 each) A particle moves along the x-axis so that its position at time t is given by

$$x(t) = 2t^2 - 1.$$

(a) Find the average velocity of the particle over the time interval from $t = 0$ to $t = 2$.

Average velocity from $t=0$ to $t=2$ $= \dfrac{x(2) - x(0)}{2-0}$

$$\frac{(2(2)^2-1)-(2(0)^2-1)}{2-0} = \frac{(8-1)-(0-1)}{2} = \frac{7+(+1)}{2} = \frac{8}{2} = 4$$

(b) Find the instantaneous velocity of the particle at $t = 1$. (Note: No units are necessary.)

Instantanious velocity @ $t=1$ $= \lim\limits_{t\to 1} \dfrac{x(t) - x(1)}{t-1}$

$$\lim_{t\to 1} \frac{2t^2-1-1}{t-1} \to \lim_{t\to 1} \frac{2t^2-2}{t-1} \to \lim_{t\to 1} \frac{2(t^2-1)}{t-1}$$

$$\lim_{t\to 1} \frac{2(t+1)\cancel{(t-1)}}{\cancel{t-1}} \quad \lim_{t\to 1} 2(t+1) = 2(1+1) = 2(2) = 4$$