In-class 2.1 Practice Problems

1) Find equation of tangent line at $x=-2$ for $f(x)=3-4x+3x^2$ using general limit definition of derivative

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

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

$$f'(x)=\lim_{h\to 0}\frac{3-4x-4h+3(x^2+2xh+h^2)-3+4x-3x^2}{h}$$

$$f'(x)=\lim_{h\to 0}\frac{\cancel{3}\cancel{-4x}-4h+\cancel{3x^2}+6xh+3h^2\cancel{-3}\cancel{+4x}\cancel{-3x^2}}{h}$$

$$f'(x)=\lim_{h\to 0}\frac{-4h+6xh+3h^2}{h}=\lim_{h\to 0}\frac{\cancel{h}(-4+6x+3h)}{\cancel{h}}=-4+6x+0$$

$$f'(x)=-4+6x \qquad \boxed{\frac{d}{dx}f(x)=-4+6x}$$

$$f(-2)=3-4(-2)+3(-2)^2=23$$

$$\boxed{f'(-2)=-4+6(-2)=-16}$$

point: $(-2, 23)$

slope: $m=-16$

$$\boxed{y-23=-16(x+2)}$$

2) Use alternative definition of derivative to find equation of tangent line for $g(x)=\sqrt{2-5x}$ at $x=-3$

$$f'(c)=\lim_{x\to c}\frac{f(x)-f(c)}{x-c} \qquad g'(c)=\lim_{x\to c}\frac{g(x)-g(c)}{x-c}$$

$g(-3)=\sqrt{2-5(-3)}$
$=\sqrt{17}$

$$g'(-3)=\lim_{x\to -3}\frac{g(x)-g(-3)}{x-(-3)}=\lim_{x\to -3}\frac{\sqrt{2-5x}-\sqrt{17}}{x+3}$$

$$\lim_{x\to -3}\frac{\sqrt{2-5x}-\sqrt{17}}{x+3}\cdot\frac{\sqrt{2-5x}+\sqrt{17}}{\sqrt{2-5x}+\sqrt{17}}=\lim_{x\to -3}\frac{2-5x-17}{(x+3)(\sqrt{2-5x}+\sqrt{17})}$$

$$g'(-3)=\lim_{x\to -3}\frac{-5x-15}{(x+3)(\sqrt{2-5x}+\sqrt{17})}$$

$$=\lim_{x\to -3}\frac{-5\cancel{(x+3)}}{\cancel{(x+3)}(\sqrt{2-5x}+\sqrt{17})}=\frac{-5}{\sqrt{2+15}+\sqrt{17}}=\frac{-5}{2\sqrt{17}}$$

$$\boxed{g'(-3)=\frac{-5}{2\sqrt{17}}}$$

point: $g(-3)=\sqrt{2-5(-3)}=\sqrt{17}$

slope: $m=\frac{-5}{2\sqrt{17}}$

point: $(-3,\sqrt{17})$

slope: $m=\frac{-5}{2\sqrt{17}}$

$$\boxed{y-\sqrt{17}=\frac{-5}{2\sqrt{17}}(x+3)}$$