AP Quest. 1

① b. $f'(x) = \dfrac{\cos x(1+\cos x) - (x+\sin x)(-\sin x)}{(\cos x)^2}$

$= \dfrac{\cos x + \cos^2 x + x\sin x + \sin^2 x}{(\cos x)^2}$

$= \dfrac{\cos x + x\sin x + \overbrace{\cos^2 x + \sin^2 x}^{1}}{(\cos x)^2}$

$= \dfrac{\cos x + x\sin x + 1}{\cos^2 x}$

c. pt. $f(0) = \dfrac{0+\sin 0}{\cos 0} = \dfrac{0+0}{1} = 0$ pt $(0,0)$

Slope $f'(0) = \dfrac{\cos 0 + 0\sin 0 + 1}{(\cos 0)^2} = \dfrac{1+0+1}{1^2} = 2$

$y - 0 = 2(x-0) = y = 2x$

AP Quest 2

a. $f(x) = \begin{cases} 2x+1 & x \leq 2 \\ \frac{1}{2}x^2 + k & x > 2 \end{cases}$

$f(2) = 2(2)+1 = 5$ $\lim f(x) = 5$ so

$$\lim_{x\to 2^+} \frac{1}{2}x^2 + k = 5$$

$$\frac{1}{2}(2)^2 + k = 5$$

$$2 + k = 5$$

$$k = 3$$

b. $\lim_{x\to 2^-} x = 2 = \lim_{x\to 2^+} 2 = 2$

$\therefore$ $f(x)$ is differentiable @ $x = 2$

c. $f(x)$ is not diff. @ $x = 2$ when $k = 4$ because

$$\lim_{x\to 2^-} 2x+1 = 5 \qquad \lim_{x\to 2^+} \frac{1}{2}x^2 + 4 = 6$$

so $\lim_{x\to 2} f(x)$ DNE and $f(x)$ is not cont. @ $x = 2$.

AP Quest. 3

$$f(x) = \frac{4x-8}{x^2+5x-14} = \frac{4(x-2)}{(x-2)(x+7)} = \frac{4}{x+7}$$ * hole @ $x=2$

a. pt. $(1, \frac{1}{2})$ $\quad \frac{4}{1+7} = \frac{4}{8} = \frac{1}{2}$

slope $f'(x) = \frac{(x+7)(0)-4(1)}{(x+7)^2} = \frac{-4}{(x+7)^2}$ @ $x=1$

$\frac{-4}{(1+7)^2} = \frac{-4}{64} = \frac{-1}{16}$ slope normal slope $= 16$

$$\boxed{y - \tfrac{1}{2} = 16(x-1)}$$

b. $f(x)$ is not continuous @ 2 and -7 therefore $f'(x)$ does not exist @ those 2 points.

c. $\lim\limits_{x \to 2} \frac{-4}{(x+7)^2} = \frac{-4}{81}$

$\lim\limits_{x \to -7} \frac{-4}{(x+7)^2} = -\infty$

$\lim\limits_{x \to -7^-} \frac{-4}{(x+7)^2} = -\infty$ $\qquad$ $\lim\limits_{x \to -7^+} \frac{-4}{(x+7)^2} = -\infty$

x	y
-7.1	-big

$\frac{-4}{(-7.1+7)^2} = \frac{-4}{(-.1)^2}$

x	y
-6.9	-big

$\frac{-4}{(-6.9+7)^2} = \frac{-4}{(.1)^2}$