Name:...............................

1. (20 pts)

(a) Find the derivative of the function $f(x) = \sqrt{5x+4}$ by using the limit definition for derivative.

$$f'(x) = \lim_{t \to x} \frac{\sqrt{5t+4} - \sqrt{5x+4}}{t-x} \cdot \frac{\sqrt{5t+4} + \sqrt{5x+4}}{\sqrt{5t+4} + \sqrt{5x+4}}$$

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

$$= \frac{5}{2\sqrt{5x+4}} \quad ///$$

(b) Find the formula for the line tangent to $f(x)$ at $x = 1$

$$m_1 = f'(1) = \frac{5}{2\sqrt{5+4}} = \frac{5}{6} \qquad f(1) = \sqrt{5+4} = 3$$

$$y - f(1) = m_1 (x-1)$$

$$y - 3 = \frac{5}{6}(x-1)$$

2. (10 pts) Approximate the value of $\sqrt[5]{32.01}$ by using Linear Approximation.

$$f(x) = \sqrt[5]{x} \qquad f'(x) = \frac{1}{5} x^{-4/5} \qquad \text{nice point: } a = 32$$

$$f(32) = 2 \qquad f'(32) = \frac{1}{5}(32)^{-4/5} = \frac{1}{80}$$

$$\sqrt[5]{\underbrace{32.01}_{b}} \approx f(a) + (32.01 - a) f'(a)$$

$$= 2 + (0.01)\frac{1}{80} = 2.000125 \quad ///$$

Name:..............................

3. (40pts) Find the following derivatives[State the derivative rules that you used]

(a) $f(x) = \cot(x^3 + e^x) + 5x$

$$f'(x) = \underbrace{\underbrace{-\csc^2(x^3+e^x)\cdot(3x^2+e^x)}_{CR} + 5}_{SR}$$

(b) $y = (\sin(\cos x))(\ln(x^2))$

$$\frac{dy}{dx} = \underbrace{\underbrace{\cos(\cos x)\cdot(-\sin x)}_{CR}\ln(x^2) + \underbrace{\left(\frac{1}{x^2}\cdot 2x\right)}_{CR}\sin(\cos x)}_{PR}$$

(c) $g(x) = \dfrac{5x^2 + 10x}{\sin^2 x}$

$g'(x) = (10x+10)(s$

$$\underbrace{g'(x) = \frac{\overbrace{(10x+10)}^{SR}(\sin^2 x) - \overbrace{(2\sin x\cos x)}^{CR}(5x^2+10x)}{\sin^4 x}}_{QR}$$