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MATH 200 – Quiz 6 ❄

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1. Suppose $f(x) = e^x\sqrt{x}$. $= e^x \cdot x^{1/2}$

   (a) $f'(x) = \frac{d}{dx}[e^x] \cdot x^{1/2} + e^x \cdot \frac{d}{dx}[x^{1/2}] = e^x \cdot x^{1/2} + e^x \frac{1}{2}x^{-1/2} = \boxed{e^x\sqrt{x} + \frac{e^x}{2\sqrt{x}}} = \boxed{e^x\left(\sqrt{x} + \frac{1}{2\sqrt{x}}\right)}$

   (b) Find the equation of the tangent line to the graph of $f(x)$ at the point $(1, f(1))$. $= (1, e^1\sqrt{1}) = (1, e)$

   The slope of the line is $f'(1) = e^1\left(\sqrt{1} + \dfrac{1}{2\sqrt{1}}\right) = \dfrac{3e}{2}$.

   Using the point-slope formula for the equation of a straight line, we get

$$\begin{aligned} y - y_0 &= m(x - x_0) \\ y - e &= \frac{3e}{2}(x-1) \\ y &= \frac{3e}{2}x - \frac{3e}{2} + e \\ y &= \frac{3e}{2}x - \frac{e}{2} \end{aligned}$$

   Answer: $\boxed{y = \dfrac{3e}{2}x - \dfrac{e}{2}}$

2. $\dfrac{d}{dx}\left[\dfrac{x^2+3x-4}{x+\sqrt{5}}\right] = \dfrac{(2x+3)(x+\sqrt{5}) - (x^2+3x-4)\cdot 1}{(x+\sqrt{5})^2} = \dfrac{2x^2 + 2\sqrt{5}\,x + 3x + 3\sqrt{5} - x^2 - 3x + 4}{x^2 + 2\sqrt{5}\,x + 5} =$

$$\boxed{= \frac{x^2 + 2\sqrt{5}\,x + 4 + 3\sqrt{5}}{x^2 + 2\sqrt{5}\,x + 5}}$$

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1. Suppose $f(x) = \dfrac{1}{\sqrt{x}}$. $= x^{-1/2}$

   (a) $f'(x) = \ = -\dfrac{1}{2}x^{-1/2-1} = -\dfrac{1}{2}x^{-3/2} = -\dfrac{1}{2x^{3/2}} = \boxed{-\dfrac{1}{2\sqrt{x}^3}}$

   (b) Find the equation of the tangent line to the graph of $f(x)$ at the point $(4, f(4))$. $= \left(4, \dfrac{1}{\sqrt{4}}\right) = \left(4, \dfrac{1}{2}\right)$

   The slope of the line is $f'(4) = -\dfrac{1}{2\sqrt{4}^3} = -\dfrac{1}{2\cdot 2^3} = -\dfrac{1}{16}$.

   Using the point-slope formula for the equation of a straight line, we get

$$\begin{aligned} y - y_0 &= m(x - x_0) \\ y - \frac{1}{2} &= -\frac{1}{16}(x-4) \\ y &= -\frac{1}{16}x + \frac{1}{4} + \frac{1}{2} \\ y &= -\frac{1}{16}x + \frac{3}{4} \end{aligned}$$

   Answer: $\boxed{y = -\dfrac{1}{16}x + \dfrac{3}{4}}$

2. $\dfrac{d}{dx}\left[\dfrac{x^2+x}{x+5}\right] = \dfrac{(2x+1)(x+5) - (x^2+x)\cdot 1}{(x+5)^2} = \dfrac{2x^2 + 11x + 5 - x^2 - x}{x^2+10x+25} = \boxed{\dfrac{x^2+10x+5}{x^2+10x+25}}$