

Show all work on this sheet, including mental steps, in a clearly organized way that speaks for itself. Use proper mathematical notation. Box final short answers.

① $f(x) = 5e^{-2x} \sin 9x$. Evaluate $f'(x)$ and factor the result.

② $f(x) = \frac{8}{\sqrt{4+3x}}$. Write equation of tangent line to ^{the} graph $y=f(x)$ at $x=4$ and simplify to form $y=...$

$$\begin{aligned} \textcircled{1} \quad f'(x) &= \frac{d}{dx}(5e^{-2x} \sin 9x) = 5 \frac{d}{dx}(e^{-2x} \sin 9x) \\ &= 5 \left[\underbrace{\frac{d}{dx}(e^{-2x})}_{e^{-2x} \frac{d}{dx}(-2x)} \sin 9x + e^{-2x} \underbrace{\frac{d}{dx}(\sin 9x)}_{\cos 9x \frac{d}{dx}(9x)} \right] \\ &= 5(-2e^{-2x} \sin 9x + 9e^{-2x} \cos 9x) \\ &= \boxed{5e^{-2x}(-2 \sin 9x + 9 \cos 9x)} \end{aligned}$$

This form is necessary for solving

$f'(x) = 0$ for x :

$-2 \sin 9x + 9 \cos 9x = 0 \rightarrow$

$\tan 9x = \frac{\sin 9x}{\cos 9x} = \frac{9}{2} \rightarrow 9x = \arctan \frac{9}{2}$ (one solution of many)
 $x = \frac{1}{9} \arctan \frac{9}{2}$

② $f(x) = 8(4+3x)^{-1/2}$
 $f'(x) = \frac{d}{dx}(8(4+3x)^{-1/2}) = 8 \frac{d}{dx}((4+3x)^{-1/2})$

$= 8(-\frac{1}{2})(4+3x)^{-3/2} \frac{d}{dx}(4+3x) = -12(4+3x)^{-3/2} = -\frac{12}{(4+3x)^{3/2}}$

$x=4$:

$y = f(4) = \frac{8}{(4+3(4))^{1/2}} = \frac{8}{16^{1/2}} = \frac{8}{4} = 2$

$m = f'(4) = \frac{-12}{(4+3(4))^{3/2}} = \frac{-12}{16^{3/2}} = \frac{-12}{4^3} = \frac{-3}{16}$

$y - 2 = -\frac{3}{16}(x - 4)$

$y = -\frac{3}{16}x + \frac{12}{16} + 2$

$= -\frac{3x}{16} + \frac{12+32}{16}$

$y = -\frac{x}{16} + \frac{11}{4}$

any one of these acceptable

I was interrupted here and an hour later returned and forgot I had not finished!