

Name: _____ Solutions _____

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There are 25 points possible on this quiz. No aids (book, calculator, etc.) are permitted. Show all work for full credit.

1. [9 points] For each function below, find its derivative. You do not need to simplify your answer.

a. $f(x) = \sqrt{3x} + x^e + \frac{4}{3x^2} = \sqrt{3} \cdot x^{1/2} + x^e + \frac{4}{3} x^{-2}$

$$f'(x) = \frac{\sqrt{3}}{2} x^{-1/2} + e x^{e-1} - \frac{8}{3} x^{-3}$$

b. $h(x) = x^{-1/3} e^x$

$$h'(x) = \left(-\frac{1}{3} x^{-4/3}\right) e^x + \left(x^{-1/3}\right) e^x$$

c. $g(x) = \frac{x+1}{x^3+2}$

$$g'(x) = \frac{(x^3+2)(1) - (x+1)(3x^2)}{(x^3+2)^2}$$

2. [4 points] For what x -values does $f(x) = ax^3 - bx + c$ have a horizontal tangent? (Assume a , b , and c are positive real numbers.)

$$f'(x) = 3ax^2 - b = 0$$

$$x = \pm \sqrt{\frac{b}{3a}}$$

3. [8 points] Suppose that $f(2) = 5$, $f'(2) = 3$, $g(2) = -1$, and $g'(2) = 6$. Find the following values:

a. $(f + g)'(2) = f'(2) + g'(2) = 3 + 6 = 9$

b. $(10f - g)'(2) = 10f'(2) - g'(2) = 10 \cdot 3 - 6 = 30 - 6 = 24$

c. $(fg)'(2) = f(2) \cdot g'(2) + f'(2) \cdot g(2) = 5 \cdot 6 + 3(-1) = 30 - 3 = 27$

d. $\left(\frac{f}{g}\right)'(2) = \frac{g(2) \cdot f'(2) - f(2) \cdot g'(2)}{(g(2))^2} = \frac{(-1)(3) - (5)(6)}{(-1)^2} = \frac{-3 - 30}{1} = -33$

4. [4 points] Find an equation of the tangent line to the curve $y = 10x - \frac{2}{x}$ when $x = 1$.

$$y(1) = 10 - 2 = 8$$

$$y = 10x - 2x^{-1}$$

$$y'(x) = 10 + 2x^{-2}$$

$$y'(1) = 10 + 2 = 12 = m$$

$$y - 8 = 12(x - 1)$$

$$y = 12x - 12 + 8$$

$$\boxed{y = 12x - 4}$$