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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. $f(x) = \sqrt{5x} + x^e + \frac{5}{3x^2}$ $= \sqrt{5} \cdot x^{1/2} + x^e + \frac{5}{3} x^{-2}$

$$f'(x) = \frac{\sqrt{5}}{2} x^{-1/2} + e x^{e-1} - \frac{10}{3} x^{-3}$$

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

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

c. $h(x) = x^{-2/3} e^x$

$$h'(x) = \left(-\frac{2}{3} x^{-5/3}\right)(e^x) + \left(x^{-2/3}\right)(e^x)$$

2. [5 points] For what x-values does $f(x) = ax^3 - bx + c$ have a horizontal tangent? (Assume a, b, c are fixed positive constants)

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

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

3. [8 points] Suppose that $f(2)=10$, $f'(2)=3$, $g(2)=-1$, and $g'(2)=4$. Find the following values:

a. $(f+g)'(2)=$ $f'(2)+g'(2)=3+4=7$

b. $(6f-g)'(2)=$ $6f'(2)-g'(2)=6\cdot 3-4=18-4=14$

c. $(fg)'(2)=$ $f(2)\cdot g'(2)+f'(2)\cdot g(2)=10\cdot 4+3\cdot(-1)=40-3=37$

d. $(\frac{f}{g})'(2)=$ $\dfrac{g(2)\cdot f'(2)-f(2)\cdot g'(2)}{[g(2)]^2}=\dfrac{(-1)(3)-(10)(4)}{(-1)^2}=-43$

4. [5 points] Find an equation of the tangent line to the curve $y=7x-\frac{2}{x}$ when $x=1$.

$y=7x-2x^{-1}$

$y(1)=7-2=5$

$y'(x)=7+2x^{-2}$

$y'(1)=7+2=9$

$y-5=9(x-1)$

$y=9x-9+5$

$\boxed{y=9x-4}$