

Quiz #4: Differentiation – The Basic Rules, the Quotient Rule, and Product Rule

Remember to get full credit, you need to show all work, clearly and neatly. Remember, this isn't just about you getting the answer, but you showing someone else how you got the answer.



You may not use a calculator on this assessment.

I. Find the first and second derivative of each of the following functions.

(a) $f(x) = \frac{2}{x^3} + 9 - 5x^4 + \frac{x^7}{2} + \frac{4x^{10}}{5}$

$$= 2x^{-3} + 9 - 5x^4 + \frac{1}{2}x^7 + \frac{4}{5}x^{10}$$

$$f'(x) = 2(-3)x^{-4} + 0 - 5 \cdot 4x^3 + \frac{1}{2}(7)x^6 + \frac{4}{5}(10)x^9$$

$$= -6x^{-4} - 20x^3 + \frac{7}{2}x^6 + 8x^9$$

$$= \boxed{-\frac{6}{x^4} - 20x^3 + \frac{7}{2}x^6 + 8x^9}$$

$$f''(x) = -6(-4)x^{-5} - 20(3)x^2 + \frac{7}{2}(6)x^5 + 8(9)x^8$$

$$= 24x^{-5} - 60x^2 + 21x^5 + 72x^8$$

$$= \boxed{\frac{24}{x^5} - 60x^2 + 21x^5 + 72x^8}$$

(b) $g(x) = \frac{2}{3\sqrt{x}} - 4\sqrt[3]{x^3}$

$$= \frac{2}{3} \cdot \frac{1}{x^{1/2}} - 4x^{3/4}$$

$$= \frac{2}{3}x^{-1/2} - 4x^{3/4}$$

$$g'(x) = \frac{2}{3}\left(-\frac{1}{2}\right)x^{-3/2} - 4\left(\frac{3}{4}\right)x^{-1/4}$$

$$= -\frac{1}{3} \cdot \frac{1}{\sqrt{x^3}} - \frac{3}{\sqrt[4]{x}}$$

$$= \boxed{-\frac{1}{3\sqrt{x^3}} - \frac{3}{\sqrt[4]{x}}}$$

$$g''(x) = \frac{d}{dx}\left[-\frac{1}{3}x^{-3/2} - 3x^{-1/4}\right]$$

$$= -\frac{1}{3}\left(-\frac{3}{2}\right)x^{-5/2} - 3\left(-\frac{1}{4}\right)x^{-5/4}$$

$$= \frac{1}{2} \cdot \frac{1}{\sqrt{x^5}} + \frac{3}{4} \cdot \frac{1}{\sqrt[4]{x^5}} = \boxed{\frac{1}{2\sqrt{x^5}} + \frac{3}{4\sqrt[4]{x^5}}}$$

$$\begin{aligned}
 \text{(c) } h(t) &= -\frac{3e^t}{2} + \frac{5e^{2t}}{e^t} - \frac{6e^t}{2e^t} \\
 &= -\frac{3}{2}e^t + 5e^{2t-t} - \frac{6}{2}e^{t-t} \\
 &= -\frac{3}{2}e^t + 5e^t - 3e^0 \\
 &= \frac{7}{2}e^t - 3
 \end{aligned}$$

$$h'(t) = \frac{7}{2}e^t - 0$$

$$= \frac{7}{2}e^t$$

$$h''(t) = \frac{7}{2}e^t$$

Skill #: D11

Score:

2. Find the first derivative of the following functions. DO NOT expand and simplify your answer!

$$\text{(a) } y(x) = \left(\frac{x^5}{6} + 3x^2 - x - 7\right)(x^3 - 7e^x + 5)$$

$$= \underbrace{\left(\frac{1}{6}x^5 + 3x^2 - x - 7\right)}_{1st} \underbrace{(x^3 - 7e^x + 5)}_{2nd}$$

$$y'(x) = \frac{d}{dx} \left[\frac{1}{6}x^5 + 3x^2 - x - 7 \right] \cdot (x^3 - 7e^x + 5) + \frac{d}{dx} [x^3 - 7e^x + 5] \left(\frac{1}{6}x^5 + 3x^2 - x - 7 \right)$$

$$= \left(\frac{5}{6}x^4 + 6x - 1 \right) (x^3 - 7e^x + 5) + (3x^2 - 7e^x) \left(\frac{1}{6}x^5 + 3x^2 - x - 7 \right)$$

$$(b) f(x) = \frac{5e^x + x^7 + 2x}{4x^5 - 6x^2 + e^x}$$

$$f'(x) = \frac{(4x^5 - 6x^2 + e^x) \frac{d}{dx}[5e^x + x^7 + 2x] - (5e^x + x^7 + 2x) \frac{d}{dx}[4x^5 - 6x^2 + e^x]}{(4x^5 - 6x^2 + e^x)^2}$$

$$= \frac{(4x^5 - 6x^2 + e^x)(5e^x + 7x^6 + 2) - (5e^x + x^7 + 2x)(20x^4 - 12x + e^x)}{(4x^5 - 6x^2 + e^x)^2}$$

Skill #: G1
Score:

Skill #: D12
Score:

INTEGRITY STATEMENT:

On my personal integrity, I have not given, nor received, nor witnessed any unauthorized assistance on this exam."

(signature)

If you can't sign this in good conscience, please don't. Come speak to me.

