Math 109, SAMPLE Quiz 1: Derivatives

Name: *Solutions* **Section:** ________

You have 10 minutes to complete the following problems, without using your notes, book, or calculator.

1. Suppose $h(-3) = 5$ and $h'(-3) = 4$. What is the tangent line to the graph of $h(x)$ at $x = -3$?

   Since $h(-3) = 5$, we know that the tangent line to $h(x)$ at $x = -3$ passes though $(-3, 5)$. Since $h'(-3) = 4$, the slope of the tangent line is $m = 4$. Using point-slope form, we can write the equation of the tangent line as

   $$(y - 5) \quad = \quad 4(x + 3)$$

   Rewriting to get it in slope-intercept form gives the final answer:

   $$y \quad = \quad 4x + 17$$

2. Differentiate.

   (a) $\frac{d}{dt}(\sqrt[5]{t} + \sqrt[5]{7}) \quad = \quad \frac{1}{5}\, t^{-4/5} \quad = \quad \dfrac{1}{5\sqrt[5]{t^4}}$

   ...since we can rewrite $\sqrt[5]{t} = t^{1/5}$ and $\sqrt[5]{7}$ is a constant.

   (b) $\frac{d}{dx}\, x^{2/3}(x + 7) \quad = \quad \frac{5}{3}\, x^{2/3} \; + \; 7(\frac{2}{3})\, x^{-1/3} \quad = \quad \frac{5}{3}\, x^{2/3} \; + \; \frac{14}{3}\, x^{-1/3}$

   ...since we can rewrite $x^{2/3}(x + 7) = x^{5/3} + 7x^{2/3}$.

   (c) $\frac{d}{dx}\, x(x + 7)^{11} \quad = \quad (1) \cdot (x + 7)^{11} \; + \; x \cdot \big(11(x + 7)^{10}\big) \quad = \quad (x + 7)^{10}(12x + 7)$

   ...using the product rule and factoring $(x + 7)^{10}$ from both terms.

   (d) $\dfrac{d}{du}\, \dfrac{4u}{3u - 7} \quad = \quad \dfrac{(4) \cdot (3u - 7) \; - \; (4u) \cdot (3)}{(3u - 7)^2} \quad = \quad \dfrac{12u - 28 - 12u}{(3u - 7)^2} \quad = \quad -\dfrac{28}{(3u - 7)^2}$

   ...using the quotient rule.

   (e) $\frac{d}{dx}\, \sqrt{x^3 + x} \quad = \quad \frac{1}{2}(x^3 + x)^{-1/2} \cdot (3x^2 + 1) \quad = \quad \dfrac{3x^2 + 1}{2\sqrt{x^3 + x}}$

   ...using the chain rule and the fact that $\sqrt{u} = u^{1/2}$.