Math 19: Quiz 4 PRACTICE SOLUTIONS Name:

For full credit you must (NEATLY) show your work. Partial credit may be given for incorrect solutions if sufficient work is shown.

1. (6 pts) Use the four-step process to find $f'(x)$ for $f(x) = x - 3x^2$.

$$\begin{aligned} f(x+h) &= (x+h) - 3(x+h)^2 \\ &= x + h - 3(x^2 + 2xh + h^2) \\ &= x + h - 3x^2 - 6xh - 3h^2. \end{aligned}$$

$$\begin{aligned} f(x+h) - f(x) &= \cancel{x} + h - \cancel{3x^2} - 6xh - 3h^2 - (\cancel{x} - \cancel{3x^2}). \\ &= h - 6xh - 3h^2. \end{aligned}$$

$$\begin{aligned} \frac{f(x+h) - f(x)}{h} &= \frac{h - 6xh - 3h^2}{h} \\ &= 1 - 6x - 3h. \end{aligned}$$

$$\begin{aligned} f'(x) &= \lim_{h \to 0} \frac{f(x+h) - f(x)}{h} \\ &= \lim_{h \to 0} 1 - 6x - 3h \\ &= \boxed{1 - 6x} \end{aligned}$$

2. (2 pts) Find the equation of the tangent line to $f(x) = x - 3x^2$ at $x = 3$.

The slope of the tangent line at $x = 3$ is $f'(3) = 1 - 6(3) = -17$. A point on the line is $x_0 = 3$, $y_0 = f(3) = 3 - 3(3)^2 = -24$. Using point slope form

$$y - (-24) = -17(x - 3) \implies \boxed{y = -17x + 27}.$$

(You can just write the equation on the left. No need to simplify.)

3. (2 pt) Use any method to evaluate

$$\begin{aligned} \frac{d}{dx}\left(2x^3 - \frac{1}{\sqrt[3]{x}} + 10\right) &= \frac{d}{dx}\left(2x^3 - x^{-1/3} + 10\right) \\ &= 2 \cdot 3x^2 - \left(-\frac{1}{3}\right) x^{-4/3} + 0 \\ &= \boxed{6x^2 + \frac{1}{3}x^{-4/3}} \end{aligned}$$