231 Gateway 2 Practice Test - Differentiation

No uses of Calculators; No Partial Credit. 30 minutes to finish test. More space will be provided on the actual test.

1. (10 pts) Let $f(x) = \dfrac{1}{\sqrt[3]{x}} - \sec(x)$. Use the definition of the derivative to express the derivative of $f(x)$ at $x = 4$ in the form of a limit. Do not evaluate or simplify. (The symbol 'f' should not appear in your answer.)

2. (10 pts) Find the derivative: $s(t) = \dfrac{2}{t^3} - \dfrac{1}{t} + 7 + 8t^2 - 4t$.

3. (10 pts) Find the derivative: $f(u) = \dfrac{1}{\sqrt[3]{u}} - 3\sqrt{u} + \pi$

4. (10 pts) Find the derivative: $r(\theta) = \theta^3(\cos(\theta))$.

5. (10 pts) Find the derivative: $x(t) = \dfrac{2 + t - t^2}{t^3 - 3t + 1}$.

6. (10 pts) Find the derivative: $y(x) = \dfrac{1}{\sqrt{x^2 + 3x - 1}}$.

7. (10 pts) Find the derivative: $v(u) = \cot^4(u)$.

8. (10 pts) Suppose that the point $(4, 5)$ is on the graph of $y = f(x)$ and that the derivative of $f(x)$ at $x = 4$ is 11. Give an equation of the tangent line to $y = f(x)$ at the point $(4, 5)$.

9. (10 pts) Find $q''(t)$: $q = 3\sin\left(\dfrac{1 - t}{\pi}\right)$.

10. (10 pts) Find $\dfrac{dy}{dx}$ for $x^9y^4 - x^5y^8 = x^7 + y^6 + \sqrt{\pi}$.