

Gateway Exam

Please print this sheet and solve the problems in the space provided. Please use pencil. Then, in pen, please write this statement on the back and sign it: "I did this work myself, without any help from people, machines, or books."

- Factor this polynomial completely and determine the roots: $2x^2 - 2x - 24$.
- Simplify the expression. Do not use negative exponents or fractions in numerator or denominator:
$$\frac{x^{-1} + y^{-3}}{y^2}$$
- Find $f'(x)$ directly from the definition of the derivative (no short-cuts), given that $f(x) = \frac{-1}{2x}$.
- Evaluate the limit and explain your process in just a few words. Use the term "well-known limit."
$$\lim_{x \rightarrow 0} \frac{\sin(5x)}{2x}$$

In questions 5 through 8, find the derivatives using differentiation rules. Write your answer to 8. as a polynomial.

5. $\frac{d}{dx}(3x^2 + 7)$

6. $\frac{d}{dx}\left(x^4 + 2x^2 + \frac{1}{x^2}\right)$

7. $f'(t)$, where $f(t) = \frac{t + 4t^7}{t}$ ($t \neq 0$)

8. $\frac{d}{dx}\left((x-5)(4x^2-4)\right)$