

Mathematics 210-2, MIDTERM II, February 26, 2002

1. (15 points) Differentiate the following functions. **Do not simplify the answer!**

(a) $f(x) = 3xe^{-x}$.

(b) $f(x) = \left(x^3 - \frac{2}{x}\right)^{10}$.

(c) $f(x) = \ln\left(\frac{x-1}{x}\right)$.

2. (5 points) Find the limit: $\lim_{x \rightarrow \infty} \frac{3x^2 - 5x + 6}{5x^2 - 4}$.

3. (10 points) Find an equation of the tangent line to the graph of $f(x) = \sqrt{2x-3}$ at the point $(6, 3)$.

4. (10 points) Find the absolute maximum and minimum values of the function $f(x) = x^3 - 12x$ over the interval $[0, 3]$.

5. (10 points) Find $\int (x^3 + 3x - \frac{1}{x}) dx$.

6. (10 points) Find the particular solution of the differential equation $y' = x^{1/2} - x^{-1/2}$ given that $y = 1/3$ when $x = 4$.

7. (10 points) Suppose that \$1000 is invested in a savings account in which interest is compounded continuously at 2.7% per year; that is the balance $P(t)$ grows at the rate $P'(t) = .027 \cdot P(t)$, where t is in years and P is in dollars. Find $P(t)$ and determine when the investment will triple itself. (Give the answer using logarithms, **do not** calculate as a decimal.)

8. (30 points) Given $f(x) = \frac{2}{1-x^2}$. Find the following:

(a) Intercepts.

(b) Asymptotes.

(c) $f'(x)$, intervals of increasing or decreasing, and relative extrema.

(d) $f''(x)$, intervals of concavity (up or down), and inflection points.

(e) Sketch the graph of $y = f(x)$.