

SAMPLE Final MAT 122 Fall 2004
Final is 11:00am-1:30pm, Mon. 12/13/04
Exam locations given on right

| room | section |
|------------|---------|
| Javits 101 | R1, |
| Javits 103 | R2, R3 |
| Javits 109 | ELC2 |

1. Compute the derivative of each of the following functions.

(i) x^5

(ii) $1/x^2$

(iii) 4^x

(iv) $x^8 + 4x^{3/2} + 1$

(v) $x \ln x^2$

(vi) $\ln(x^4 + 1)$

(vii) $(x + 1)/(x - 1)$

(viii) $(x^2(1 + x)^6)^2$

(ix) e^{x^2+x}

(x) $x(x^2 + 1)(x - 1)^3$

2. Compute the second derivative of each of the following functions.

(i) x^4

(ii) xe^x

(iii) $\ln(x + x^2)$

3. Find an antiderivative for each of the following functions.

(i) x^4

(ii) $x + \frac{1}{x}$

(iii) $x^3(2 + x^4)$

(iv) $x \ln(x^2 + 1)$

(v) e^{2x}

4. Say whether each of the following formulas is true or false.

(i) $\int \ln x dx = x \ln x - x$

(ii) $\int (1 + x)e^x dx = xe^x$

(iii) $\int \frac{1}{(1+x)^2} dx = \frac{x}{1-x}$

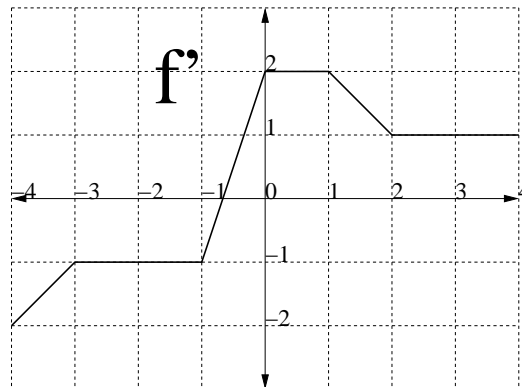
(iv) $\int \frac{1}{x} \ln x dx = \frac{1}{2}(\ln x)^2$

5. Answer the following questions about the function $f(x) = 3x^4 + 4x^3 - 12x^2 + 1$ on the interval $-3 \leq x \leq 3$.

- (i) What is $f'(x)$?
- (ii) Where are the critical points of f ?
- (iii) List all local minimums of f (include endpoints).
- (iv) Where is the global minimum of f on this interval?
- (v) What is the minimum value of f on this interval?

6. The DERIVATIVE of f is graphed below. Answer the questions about f .

- (i) At what interior points does f have a local maximum?
- (ii) If $f(0) = 0$, what is $f(2)$?
- (iii) Which is larger: $f''(-2)$ or $f''(2)$?
- (iv) Where does f take its global maximum?
- (v) Evaluate $\int_0^3 f'(x)dx$.
- (vi) Evaluate $\int_0^3 f''(x)dx$.
- (vii) What is the maximum value of $f'(x)$?



7. Find the area under the graph of $x^2 + 8$ between $x = -2$ and $x = 2$.

8. The rate of flow of oil through a pipeline is measured every quarter of an hour. As the outside temperature cools, the rate of flow slows down and the data is given by following table:

| | | | | | | | |
|--------------------------|------|-----|-----|-----|-----|-----|-----|
| time (in minutes) | 0 | 15 | 30 | 45 | 60 | 75 | 90 |
| rates (gallons per hour) | 1000 | 900 | 800 | 750 | 700 | 700 | 650 |

Assuming the rate is never increasing, given upper and lower bounds for total amount of oil which flowed through the pipe during the hour and a half of observations.

9. Suppose the **second** derivative F'' of F is given by the following graph. Assume that $F'(0) = 0$ and $F(0) = 1$. Answer the following questions:

- (i) What is $F'(2)$?
- (ii) What is $F'(4)$?
- (iii) Give a formula for $F'(x)$ on $0 \leq x \leq 2$.
- (iv) Give a formula for $F(x)$ on $0 \leq x \leq 2$?
- (v) What is $F(2)$?

