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 $-3 \le x \le 3$.

   (i) What is $f'(x)$?

   (ii) Where are the critical points of f?

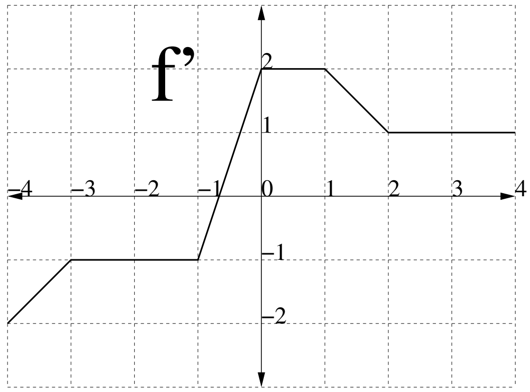
   (iii) List all local minimums of f (include endpoints).

   (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 $f'(x)$?

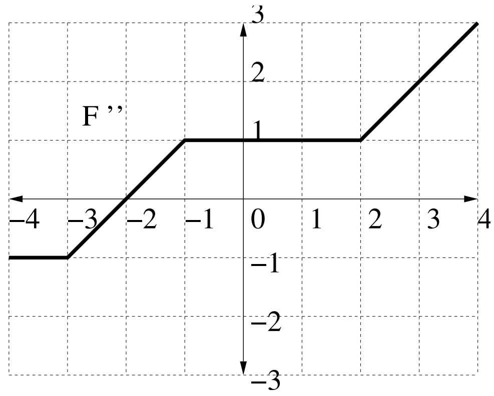
7. Find the area under the graph of $x^2 + 8$ between $x = -2$ and $x = 2$.

8. The rate of flow of oil though 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 $0 \le x \le 2$.

   (iv) Give a formula for $F(x)$ on $0 \le x \le 2$?

   (v) What is $F(2)$?