Write neatly and carefully. Justify your answer. You won't receive credits if I cannot read your answer, and/or you didn't show your work.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Find the derivative of the function.
Points: 5

1) $f(x) = \ln\left(\frac{x^3 - 4}{x}\right)$

A) $\frac{3x^2 - 1}{x(x^3 - 4)}$ B) $\frac{2x^3 + 4}{x(x^3 - 4)}$ C) $\frac{x}{x^3 - 4}$ D) $\frac{3x^2}{x^3 - 4}$

Differentiate.
Points: 5

2) $f(x) = 9^{x^3}$

A) $9\ln 3(x^2)\left(9^{x^3}\right)$ B) $3(x^2)\left(9^{x^3}\right)$ C) $\ln 9\left(9^{x^3}\right)$ D) $3\ln 9(x^2)\left(9^{x^3}\right)$

Find the derivative of the function.
Points: 8

3) $y = x^6\ln x - \frac{1}{3}x^3$

A) $7x^5 - x^2$ B) $6x^5 - x^2$ C) $x^5 - x^2 + 6x^5\ln x$ D) $x^6\ln x - x^2 + 6x^5$

Solve the problem.
Points: 8

4) If $3500 is invested in an account that pays interest compounded continuously, how long will it take to grow to $10,500 at 9%?

A) 15.1 years B) 12.2 years C) 8.0 years D) 9.9 years

Points: 8

5) The demand function for a certain product is given by

$D(p) = 200e^{-0.1p}$,

where p is price per unit. Recall that total revenue is given by R(p) = pD(p). At what price per unit p will the revenue be maximum?

A) $20 B) $5 C) $9 D) $10

Points: 8

6) A consumer group in one city compares the costs of goods and services in that city over various years, and uses 1970 as a base. The same goods and services that cost $100 in 1970 cost $37 in 1941. Assume the exponential-decay model in which t is the number of years before 1970. Estimate what the same goods and services cost in 1900. (You will need to find the value of k)

A) $9 B) $11 C) $8 D) $1080

Find all relative maxima or minima (Use SDT).

Points: 8

7) $y = \ln x - x$

A) (-1, -1), relative maximum
B) (1, 0), relative minimum
C) (1, -1), relative maximum
D) (-1, 0), relative minimum

Evaluate. Assume u > 0 when ln u appears.
Points: 8

8) $\int 6x^2 \sqrt[4]{8 + 4x^3}\, dx$

A) $6(8 + 4x^3)^{5/4}$

B) $\frac{2}{5}(8 + 4x^3)^{5/4} + C$

C) $-4(8 + 4x^3)^{-3/4} + C$

D) $\frac{2}{5}(8 + 4x^3)^{5/4}$

Solve the problem.
Points: 8

9) A manufacturer determined that its marginal cost per unit produced is given by the function

$C'(x) = 0.0006x^2 - 0.4x + 87.$

Find the total cost of producing the 401st unit through the 500th unit. (Use integral)

A) \$9000

B) \$15,100

C) \$2900

D) \$2876.96

Evaluate. Assume u > 0 when ln u appears.
Points: 5

10) $\int \frac{1}{x\,(\ln x)^{13}}\,dx$

A) $-\frac{1}{12x\,(\ln x)^{12}} + C$ B) $-\frac{1}{14(\ln x)^{14}}$ C) $-\frac{1}{12(\ln x)^{12}}$ D) $-\frac{1}{12(\ln x)^{12}} + C$

Approximate the area under the graph of f(x) over the specified interval by dividing the interval into the indicated number of subintervals and using the left endpoint of each subinterval.
Points: 8

11) $f(x) = 0.5x^4 + 0.1x^3 + x^2 - 1$; interval [1, 4]; 3 subintervals

A) 212.4 B) 69.6 C) 63.6 D) 213.0

Evaluate.
Points: 5

12) $\int_1^6 \frac{2x + 2}{x^2 + 2x + 6}\,dx$

A) ln 54 B) $\ln \frac{7}{27}$ C) 14 ln 6 D) ln 6

Solve the problem.
Points: 8

13) A company determines that its marginal revenue per day is given by $R'(t) = 100e^t$, $R(0) = 0$, where $R(t)$ = the revenue, in dollars, on the t^{th} day. The company's marginal cost per day is given by $C'(t) = 140 - 0.3t$, $C(0) = 0$, where $C(t)$ = the cost, in dollars, on the t^{th} day. Find the total profit from $t = 0$ to $t = 5$ (the first 5 days). Round to the nearest dollar.

Note: $P(T) = R(T) - C(T) = \int_0^T [R'(t) - C'(t)]\, dt$.

A) $14,145 B) $14,049 C) $14,038 D) $14,045

Find the area bounded by the given curves.
Points: 8

14) $y = x^2 - 5x + 4$, $y = -(x - 1)^2$

A) $\frac{7}{8}$ B) $\frac{9}{8}$ C) $\frac{8}{7}$ D) $\frac{8}{9}$