

NAME:.....
 SIGNATURE:.....
 SUID:.....

Read each question carefully. Budget your time so you have the opportunity to attempt each question. There are 13 questions and the duration of the exam is 2 hours. Ambiguous or illegible answers and answers without work will not receive full credit.

Problem Number	Possible Points	Score
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	15	
9	10	
10	10	
11	10	
12	10	
13	10 5	
TOTAL	135 130	

1. Differentiate the function $s = \ln \left(\frac{t}{\sqrt[3]{\frac{e^{5t}}{5t(t+11)^2}}} \right)$ (you need not simplify your answer)

(10 points)

2. The marginal revenue function for a product is $-7(q - 45)$. Find the demand function for the product.
(10 points)

3. Evaluate the following limits where possible otherwise stating they do not exist.

$$(a) \lim_{x \rightarrow \infty} \frac{4x + x^2 - 21}{12 - 7x + x^2}$$

(2 points)

$$(b) \lim_{x \rightarrow 3} \frac{4x + x^2 - 21}{12 - 7x + x^2}$$

(3 points)

$$(c) \lim_{x \rightarrow h} \log_b \left(\frac{x+h}{x} \right)^{\frac{1}{h}}$$

(5 points)

4. Evaluate $f'(x)$ when (complete simplification is not necessary)

(a) $\int f(x) dx = x^3 + 55x^e + e^2$

(5 points)

(b) $f(x) = \sqrt{x^2 + 5}$

(3 points)

(c) $f(x) = \frac{x^3}{5 - x^2}$

(2 points)

5. Supply and demand equations for a certain product are $25q + p - 2050 = 0$ and $-40q + p + 3150 = 0$ respectively, where p represents the price per unit in dollars and q the number of units sold per time period.

(a) Find the equilibrium price algebraically.

(5 points)

(b) Find the equilibrium price after a tax of 50 dollars is imposed on the supplier.

(5 points)

6. Suppose $y = e^{(x-2)^2} (x-2)^2$.

(a) Given y is the composition of two functions $y = (f \circ g)(x)$ what could $f(x)$ and $g(x)$ possibly be? NOTE: **Neither f nor g is the function x .**

(3 points)

(b) Using this information find $\frac{dy}{dx}$ (you need not simplify your answer).

(7 points)

7. The curve C is given by the equation $y = x^2 - 4x + 3$.

(a) Find the equation of the line tangent to the curve C when $x = -5$

(5 points)

(b) Is this line perpendicular to the line $y = \frac{1}{14}x - 14$? **Give a reason why or why not.**

(5 points)

8. Evaluate the indefinite integrals

(a) $\int \left(3 - \frac{2}{\sqrt{x^3}} \right)^2 dx$

(10 points)

(b) $\int \left(\frac{x(2x+1) - (x^2+x)(1)}{x^2} \right) dx$

(5 points)

9. Sketch the graph of the function $y = 4x^3 - 3x^4$ stating clearly where it is increasing and decreasing, concave up and concave down and labeling **all** intercepts, relative maxima and minima and inflection points. SHOW ALL YOUR WORK

(10 points)

10. Verify $\frac{dr}{dq} = p\left(1 + \frac{1}{\eta}\right)$ when $p = \frac{300}{q} - 10$. SHOW ALL YOUR WORK.

(10 points)

11. A speaker manufacturer is currently able to sell 100 car speaker sets at a price of \$120 per set. Assuming elasticity of demand for car speakers sets is approximately -1.2 and the price were dropped to \$85, how many sets could the manufacturer sell now?

(10 points)

12. A theatre wishes to purchase a speaker system. The manufacturer has speaker systems with anywhere from 50 to 100 speakers. The cost of each speaker is listed as \$35, however, for each additional speaker above 50, there is a discount of 50 cents on the cost per speaker. What quantity of speakers will minimize cost for the theatre?

(10 points)

13. Given $\log_3 5 = k$ find an expression for $\log_3 \sqrt{\left(\frac{45}{27}\right)}$ in terms of k . (SHOW YOUR WORK).

(5 points)