Instructions

- Write your name and uID in the space provided on the first page of the test. If you do not write your name and uID, your test may not be graded!

- You are allowed one (1) approved scientific calculator and one (1) 4 × 6 inch notecard (front and back) of notes. Otherwise this is a closed book test. No other books, papers, phones, laptops, or messaging devices are permitted.

- Give clear, complete solutions, showing the steps of your calculations. Answers without accompanying work will receive no credit.

- Work the problems on the pages provided. The blank pages at the end of the test may be used for scratch work. Clearly indicate your final answer by writing it in the blank provided.

- There are twelve (12) problems, worth a varying number of points. Work ALL of the problems.

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1. (10 points) The demand equation for some brand of watch is given by \( q = -14p + 976 \), and the supply equation is \( q = 15p - 10 \). Find the equilibrium quantity and price.

Equilibrium quantity: 

Equilibrium price: 

2. (10 points) Solve the following linear inequality and graph its solution on the real number line:

\[
\frac{x - 11}{-7} + 2 < \frac{2 - x}{3} + 3
\]

Solution: 

\[
\begin{align*}
\frac{x - 11}{-7} + 2 &< \frac{2 - x}{3} + 3 \\
\text{Graph}
\end{align*}
\]
3. Given the matrices \( A = \begin{bmatrix} 1 & -2 \\ -3 & 4 \\ 5 & 5 \end{bmatrix} \), \( B = \begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix} \), \( C = \begin{bmatrix} 0 & 1 \\ -1 & 1 \\ 3 & -2 \end{bmatrix} \), perform the following operations or clearly explain why these operations cannot be performed.

(a) (2 points) \( B^T \)

\[ B^T = \]  

(b) (2 points) \( 3C \)

\[ 3C = \]  

(c) (2 points) \( A + C \)

\[ A + C = \]  

(d) (2 points) \( AC \)

\[ AC = \]  

(e) (3 points) \( B^{-1} \)

\[ B^{-1} = \]  

(f) (4 points) Solve the system of equations below. (Hint: You can use \( B^{-1} \) from part (e), if you like.)

\[
\begin{align*}
2x + 5y &= 1 \\
x + 3y &= -6
\end{align*}
\]

Solution: \[ \]
4. (8 points) Write the equation of the line that passes through the point (1, 2) and is parallel to the line $8x + 2y = 17$. Put your answer in slope-intercept form.

Line: _______________________

5. The total costs for a company to produce and sell $x$ units of a product are given by $C(x) = 200 + 5x + x^2$ (in dollars). The sale price for one item is $35.

(a) (3 points) Find the revenue function, $R(x)$.

$R(x) = _______________________

(b) (3 points) Find the profit function, $P(x)$.

$P(x) = _______________________

(c) (4 points) How many items should be sold to maximize profit?

Number of items: _______________________


6. Let \( f(x) = x^3 + 1 \) and \( g(x) = \sqrt{x - 1} \). Compute the following:

   (a) (2 points) The domain of \( g(x) \).

   \[
   \text{Domain of } g(x): \quad \underline{\text{______________}}
   \]

   (b) (2 points) \( (f \circ g)(x) \)

   \[
   (f \circ g)(x) = \underline{\text{______________}}
   \]

   (c) (2 points) \( g(f(5)) \) (Give an exact answer, not a calculator approximation.)

   \[
   g(f(5)) = \underline{\text{______________}}
   \]

   (d) (2 points) \( f^{-1}(x) \)

   \[
   f^{-1}(x) = \underline{\text{______________}}
   \]
7. Solve the following equations:

(a) (8 points) \( \log_5(5x) + 5 \log_5 x = 7 \).

Solution(s): ___________________________

(b) (8 points) \( e^{3x} - 17 = 10 \).

Solution(s): ___________________________
8. (10 points) Graph the function \( y = f(x) = \frac{1}{3}(x + 2)^2 - 3. \)

Vertex: ______________________

Is the graph concave up or concave down? ______________________
9. Find the maximum value of \( z = 4x - 3y \) subject to the constraints

\[
\begin{align*}
x & \geq 0 \\
y & \geq 0 \\
x + y & \leq 4 \\
3x + 2y & \geq 6
\end{align*}
\]

(a) (8 points) Graph the feasible region and label all of its vertices.

(b) (4 points) The maximum value is \( \underline{\text{__________}} \) located at the point \( \underline{\text{__________}} \).
10. A construction company purchases a large piece of equipment for $100,000. Suppose the company takes out a loan for this equipment, making payments monthly with an annual interest rate of 3.6% compounded monthly for 5 years.

(a) (6 points) What are the monthly payments?

Payment: ______________________

(b) (4 points) Find the unpaid balance (loan payoff amount) after 3 years of payments.

Payoff amount: ______________________

11. Mike’s company wants to remodel the office five years from now. The work will cost $80,000 at that time. Instead of borrowing the money, Mike suggests that they start now and invest money at the end of every month in a savings account earning 6% annual interest, compounded monthly for the next 5 years.

(a) (6 points) How much will they have to invest each month to reach their goal?

Monthly investment: ______________________

(b) (4 points) How much interest will they earn over the 5 years?

Interest: ______________________
12. Suppose you invest $2000 in an account with an annual interest rate of 4.5%. How much will the account be worth in 3 years if

(a) (3 points) the investment earns simple interest?

Account value: ______________________

(b) (3 points) the interest on the investment is compounded monthly?

Account value: ______________________

(c) (3 points) the interest on the investment is compounded continuously?

Account value: ______________________
SCRATCH WORK
SCRATCH WORK