1. (a) (8 points) Express n in terms of the remaining symbols, i.e. solve for n:

\[ S = \frac{R[(1+r)^n - 1]}{r} \]

Answer 1(a): \( n = \) __________

(b) (8 points). Solve the equation:

\[ \frac{3}{x-4} + \frac{x-3}{x} = 2. \]

Answer 1(b): \( x = \) __________

(c) (8 points). Solve the inequality:

\[ \frac{1+2t}{3} < -4(5-t). \]

Write your answer using interval notation.
2 (a). (6 points). Find the slope, x-intercept and y-intercept of the line given by the equation:

\[3x + 4y - 7 = 0.\]

Answer 2(a): slope = _____, x-intercept = _______, y-intercept = _______

(b) (8 points). Find an equation of the line \( L \) through the point \((3, 8)\) and perpendicular to \(2y = 7x+1\).

Answer 2(b): \( y = \) ______________________

(c) (8 points). Let \( f(x) = \frac{1}{\sqrt{5-3x}} \). Find the domain of \( f \).

Write your answer using interval notation.

Answer 2(c): ______________________
3 (a). (8 points). Let \( h(x) = \sqrt[3]{x^2} - 5 \).

Find non-identity functions \( f \) and \( g \) such that \( h(x) = f(g(x)) \).

Answer 3(a): \( f(x) = \) _______________, \( g(x) = \) _______________

(b) (8 points). Let \( g(x) = \frac{1}{x+2} \).

Find \( \frac{g(x+h) - g(x)}{h} \) and simplify your answer

Answer 3(b): ___________________________
4(a). (10 points). Use properties of logarithms to write the following expression in terms of $\ln(x)$, $\ln(x+2)$, and $\ln(x - 3)$.

\[
\ln \left( \sqrt[4]{\frac{x^3(x-3)}{(x+2)}} \right).
\]

Answer 4(a): ________________________

(b). (10 points). Solve $\log_5(21 - 4x) = 2\log_5(x)$.

Answer 4(b): $x =$ ________________________
5. (a) (10 points). A bank account pays 2.64% annual interest, compounded quarterly.
How much must be deposited now so that the account contains exactly $10,400 at the end of 8 years?

Answer 5(a): __________________________

(b) (10 points). A person can choose one of the following optional rates for an account:
 Option A: 10.2% compounded quarterly
 Option B: 10% compounded continuously.
Which of these two options is the better choice? Justify your answer.

Answer 5(b):

6(a). (12 points). A debt of $1600 due in seven years and $1300 due in eleven years is to be repaid by a single payment three years from now. If the interest rate is 6% compounded monthly, how much is the payment?
Answer 6(a): _______________________

(b). (14 points) A loan of $250,000 is amortized over 30 years at the rate of 8% compounded monthly.

Find (i) The monthly payment 
(ii) The principal remaining after 12 years.

Answer 6(b): (i) Monthly payment = ____________

(ii) Principal remaining after 12 years = ____________
7. The total cost $C$, and total revenue $R$ functions for an item are given by:

\[ C(x) = 8x + 54 \quad \text{(cost)} \]

\[ R(x) = x(32 - 2x) \quad \text{(revenue)} \]

where $x$ is the quantity of units manufactured and sold, measured in thousands of units, and $R$ and $C$ are measured in thousands of dollars

(a) (4 points) Write the profit $P$ as a function of $x$.

Answer 7(a): $P(x) = \underline{\text{____________________}}$

(b) (8 points) Find the break-even point(s).

Answer 7(b): \underline{\text{____________________}}

(c) (6 points) Find the production level that will produce the maximum profit, by completing the square. (Include the appropriate units in your answer)

Answer 7(c): \underline{\text{____________________}}
8 (a). (6 points) Write the following system of equations as a matrix equation $AX = B$:

\[
\begin{align*}
&x + 7y - 3z + t = 5 \\
&y + z = 1 \\
&x + 2y + 4z - 9t = 3
\end{align*}
\]

Answer 8(a): $A =$ \underline{\hspace{2cm}} $X =$ \underline{\hspace{2cm}} $B =$ \underline{\hspace{2cm}}

(b). (8 points) Use the $[A \mid I]$ method to find the inverse of $\begin{bmatrix} 1 & 2 \\ 6 & 14 \end{bmatrix}$.

Solutions obtained by any other method will not be given credit.

(c). (8 points) Find $x$ and $y$ such that $\begin{bmatrix} x & -1 \\ 3 & 0 \end{bmatrix} \begin{bmatrix} 2 & 1 \\ 4 & 1 \end{bmatrix} = 3 \begin{bmatrix} y \\ 2 \end{bmatrix}$.

Answer 8(b): \underline{\hspace{2cm}}

Answer 8(c): $x =$ \underline{\hspace{2cm}} $y =$ \underline{\hspace{2cm}}
9 (12 points). Solve the system of linear equations given below by using matrix reduction.

No credit will be given by solutions obtained by any other method.

\[ x + 2y + z = 3 \]
\[ 2x + 3y - z = 4 \]
\[ x + 4y + 7z = 7 \]

Answer 9: x = __________, y = ___________, z = ____________
10 (a). (10 points). A chemical manufacturer wishes to fill an order of 700 gallons of a 22% acid solution. (Twenty-two percent by volume is acid.) If 31% acid solutions and 18% acid solutions are available in stock, how many gallons of each solution must be mixed to fill the order? Let \( x = \) the number of gallons of the 31% acid solution used. and \( y = \) the number of gallons of the 18% acid solution used. Set up, but do not solve a system of linear equations in \( x \) and \( y \), whose solutions will give the number of gallons of the 31% and 18% acid solutions used.

(b). (10 points). A small company provides an incentive plan for its two top executives, the President and Vice President of the company. Each executive receives as a bonus a percentage of the portion of the annual profit that remains after the bonus of the other executive has been deducted (see the table below for the percentages of each executive).

If the company has an annual profit of $2,300,000, find the bonus for each executive. Let \( x = \) the bonus in dollars received by the President of the company. And \( y = \) the bonus in dollars received by the Vice President of the company. Set up, but do not solve a system of linear equations in \( x \) and \( y \), whose solutions will give the bonus for each executive.

<table>
<thead>
<tr>
<th>Officer</th>
<th>Bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>President</td>
<td>4%</td>
</tr>
<tr>
<td>Vice President</td>
<td>3%</td>
</tr>
</tbody>
</table>