1. (a) Given \( f(x) = \frac{4x - 3}{2x - 4} \), find \( f^{-1}(x) \), check your answer, and determine the domain and range of \( f(x) \).
(b) Does every function \( g(x) \) have an inverse function \( g^{-1}(x) \)? If you answer yes, explain why? If not give an example of a function \( g(x) \) that has no inverse also indicating why?

2. Solve for \( x \) and simplify when possible.
   
   (a) \( 9^{4x^2-1} + 1 = 4 \)
   (b) \( 5^{2x-1} = 2^{1-x} \)
   (c) \( \log_2(x+4) + \log_2(x-2) = 4 \)

3) Graph the following functions indicating all intercepts and asymptotes.
   
   (a) \( f(x) = e^{-x} - 1 \)
   (b) \( g(x) = \ln |x| \), that is,
   
   \[
   g(x) = \begin{cases} 
   \ln x & \text{if } x > 0 \\
   \ln(-x) & \text{if } x < 0.
   \end{cases}
   \]

4. Determine the type of conic section (hyperbola, parabola, or ellipse) given by
   
   \[ 4x^2 - y^2 - 24x - 4y + 16 = 0 \]

   and write down the coordinates of the center, vertices and foci.

5. Suppose you invest $12000 in a venture that yields 10% compounded quarterly. How much time will it take for your investment to triple?

6. Let
   
   \[
   A = \begin{pmatrix}
   1 & -6 & 3 \\
   2 & -7 & 3 \\
   4 & -12 & 5 
   \end{pmatrix}
   \]

   (a) Compute the product \( A \cdot A \) (show your work!)
   (b) Compute the determinant of \( A \)

7. Use Cramer's rule to find \( x \) and \( y \), given that
   
   \[
   2x - y = -1 \\
   x + \frac{1}{2}y = \frac{3}{2}
   \]
8. Solve the system of equations:

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

9. (a) Graph the region that satisfies the constraints

\[
  x \geq 0, \quad y \geq 0, \quad 2x + 3y \geq 6, \quad 3x + 2y \geq 6, \quad x + y \leq 10
\]

(b) Subject to the constraints in part (a), find the maximum and minimum values of the objective function

\[
  z = x + y - 1
\]

and the coordinates \( x \) and \( y \) at which these values occur.

10. Find the solution to the nonlinear system:

\[
\begin{align*}
  x^2 + y^2 &= 4 \\
  x^2 + 2y &= 4
\end{align*}
\]

11. (a) Find the sum of the first 40 terms of the series given by the general formula \( \{3n - 4\} \).

(b) Find a formula to compute the sum of the first \( n \) even numbers, and apply it to sum \( 2 + 4 + \cdots + 20 \).

(c) Suppose that \( \{a_n\} \) is an arithmetic sequence such that \( a_8 = 75 \) and \( a_{20} = 39 \), find the common difference \( d \) and express the \( n^{th} \) term \( a_n \) by a formula that only depends on \( n \).

12. (a) Find the sum of the infinite series \( \sum_{n=1}^{\infty} \frac{3^{n+1}}{5^n} \).

(b) Find and simplify the fourth term in the binomial expansion of \( (x - 2y)^6 \).

13. (a) Find \( t \) so that \( t + 3, 2t + 1, \) and \( 5t + 2 \) are consecutive terms of an arithmetic sequence.

(b) Write down the \( n^{th} \) term of the sequence \( \{a_n\} \) suggested by the pattern:

\[
1, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \cdots
\]

in other words, find a simplified general formula for \( a_n \).

14. In how many ways can a committee consisting of 2 faculty members and 3 students be formed from a pool of 6 faculty and 10 students eligible to serve on the committee?