Instructions. Do 20 of the following 22 questions. Each question is worth 5pts. Please show all appropriate work in order to obtain maximal credit. Good Luck.

1. Simplify the complex fraction \( \frac{\frac{2}{x+5} + \frac{1}{x-5}}{3 - \frac{2}{x-5}} \).

2. Write the complex number \( \frac{2 + 3i}{5 + 2i} \) in standard form.

3. Solve the radical equation \( \sqrt{2x - 5} - \sqrt{x + 1} = -1 \). Check all proposed solutions.
4. Solve the equation \(2x^{2/3} + 2x^{1/3} - 24 = 0\).

5. Solve the inequality \(|3 - 5x| > 13\). Write the answer in interval notation.

6. Solve the inequality \(\frac{x + 1}{x - 2} \geq 2\) and write the answer in interval notation.

7. Determine the center and radius of the circle whose equation is \(x^2 + y^2 - 10x + 6y + 18 = 0\).
8. Let $f(x) = -3x^2 + 2$, find the difference quotient $\frac{f(x + h) - f(x)}{h}$.

9. Find all zeros (real and complex) of $P(x) = x^4 + 2x^3 + 4x^2 - 2x - 5$. Hint: 1 and $-1$ are zeros.

10. Find the slope-intercept form of the line through the points $(-1, 3)$ and $(1, -4)$. 
11. A farmer has $1000 to spend to fence a rectangular corral. Because extra reinforcement is needed on one side, the corral costs $6 per foot along that side. It costs $2 per foot to fence the remaining sides. What dimensions of the corral will maximize the area of the corral?

12. Consider the following systems of equations. For each system, find the values of \( k \) for which there are (if possible), (i) one solution, (ii) no solution, (iii) infinitely many solutions?

(a) \[
\begin{align*}
3x + 4y - z &= 10 \\
5y + 2z &= 0 \\
kz &= 0
\end{align*}
\]

(b) \[
\begin{align*}
3x - 6y - z &= 5 \\
y + z &= 19 \\
kz &= 100
\end{align*}
\]

13. Let \( A = \begin{bmatrix} 2 & 0 & 4 \\ -3 & 5 & -2 \end{bmatrix}, \ B = \begin{bmatrix} 2 & 4 \\ 1 & -3 \end{bmatrix}, \text{ and } C = \begin{bmatrix} 3 & -1 & 1 \\ -2 & 2 & 0 \end{bmatrix}. \) Find the following, if possible, if an operation is not possible, state why it is not possible.

(a) \( BC \)  \quad (b) \( CB \)  \quad (c) \( 3A - C \)  \quad (d) \( B + 2A \)
14. Arnie the Aardvark and Wally the Warthog are good friends. Arnie’s age in months is 2 less than 3 times Wally’s age in months. Wally is 24 months younger than Arnie. How old are Arnie and Wally?

15. Evaluate the sum \( \sum_{i=2}^{5} (i^2 + 1) \).

16. Find the inverse of \( A = \begin{bmatrix} 1 & 3 & -1 \\ 2 & 7 & -1 \\ -4 & -13 & 2 \end{bmatrix} \) if it exists.
17. Find the term of $(2x - 3y)^9$ that contains $x^4$ (do not find the full expansion).

18. Find the inverse function of $f(x) = (x + 1)^3 - 2$. Verify that the function you have found is the inverse function to $f$.

19. Sketch the graph of $f(x) = \log_3 x$, then sketch $g(x) = -2 + \log_3(x - 4)$ and $h(x) = \log_3 x^4$. 
20. Write $\log_b \left( \frac{\sqrt[4]{x^3 z^5}}{y^4} \right)$ in terms of $\log_b x$, $\log_b y$ and $\log_b z$.

21. Solve the equation $\frac{2^x - 2^{-x}}{2^x + 3(2^{-x})} = \frac{1}{3}$.

22. Suppose $15,000 is invested at an annual interest rate of 5% compounded daily. Use the formula $A = P \left( 1 + \frac{r}{n} \right)^{nt}$ to help you solve the following.

(a) How much will it be worth after 5 years?
(b) How long will it take until the investment is triple its original value?