Check that you have all three pages. SHOW ALL YOUR WORK. Write complex answers in $a + bi$ form.

1. (8 points) Write the complex numbers in the standard form $a + bi$, where $a, b$ are real numbers:
   (a) $\sqrt{-16} + i^{11}$
   (b) $\frac{1 + i}{2 - i}$

2. (7 points) State the Quadratic Formula (for the solutions of the general quadratic $ax^2 + bx + c = 0$) and use it to solve the equation $x^2 + 29 - 10x = 0$. Specify your values of $a, b, c$ and simplify your answer.

3. (10 points) Find all $x$ that satisfy the equation $\frac{x}{x+2} + \frac{12}{x^2 - 4} = \frac{3}{x - 2}$.

4. (10 points) Find all the real numbers $x$ which satisfy the equation $\sqrt{x + 8} - 6 = x$.

5. (6 points) (a) The slope $m_1$ of the line $3x + 2y = 7$ is $m_1 = \underline{\hspace{2cm}}$.
   
   (b) The slope $m_2$ of a line perpendicular to the line in (a) is $m_2 = \underline{\hspace{2cm}}$. 
6. (6 points) (a) The slope \( m \) of the line passing through \((1, -2)\) and \((-2, 7)\) is \( m = \) __________.

(b) An equation for the line passing through the points in (a) is \( y = \) ____________.

7. (7 points) Sketch the graph of the piecewise-defined function

\[
f(x) = \begin{cases} 
2, & x \geq 0, \\
3x + 6, & x < 0.
\end{cases}
\]

8. (8 points) For the graph of the quadratic

\[ y = 9x^2 - 6x - 1 \]

(a) Find the vertex. Is it a relative maximum or minimum?

(b) Find the \( x \)-intercepts if any (give exact values not a calculator approximation).

9. (6 points) (a) Test to see whether the function \( f(x) = x^3 + \frac{1}{x^3} \) is even, odd or neither.

(b) Test whether the graph of \( x^2 + y^2 = xy + 1 \) is symmetric about the origin.

10. (6 points) Solve the linear equation for \( x \). Give an exact answer, not a calculator approximation.

\[
\sqrt{2}(x + 9) = 3(x + \sqrt{2}) - \sqrt{2}
\]
11. (9 points) The graph of \( y = f(x) \) is shown on the first set of axes. Sketch the graphs requested on the other two. Underneath describe the transformations in words.

\[
y = f(x) \quad y = f(x + 1) \quad y = -2f(x)
\]

12. (8 points) (a) Use your calculator to graph the function

\[
f(x) = x^3 - x^2 - 12x + 15
\]

from \( x = -5 \) to \( x = 5 \) (use zoom fit for the \( y \) values and label your axes with the resulting \( y \) range).

(b) Give the coordinates (to 3 decimal places) of the points:
   - relative maximum = 
   - relative minimum =

(c) Specify the interval(s) on which the function is increasing.

13. (9 points) A gardener has 2000 yards of fencing to enclose four adjacent plots as shown. Let \( x \) denote the width of the enclosure and \( y \) its total length.

(a) Write the length \( y \) in terms of \( x \):

(b) Write the total area enclosed in terms of \( x \):

(c) What choice of \( x \) maximizes this area? Justify your answer.