PART I: Answer all 8 questions. Questions 1 - 4 are worth 7 points each and question 5 - 8 are worth 8 points each. Justify each answer and show all your work.

1. Let \( f(x) = 2x^2 + 1 \). Find and simplify:

   (a) \( \frac{f(x+h) - f(x)}{h} \)

   (b) \( f(\sqrt{x}) - 1 \)
2. (a) Find an equation of the straight line that passes through the points 
(1, −5) and (−2, 16).

(b) Given points $A(1, −3)$, $B(3, −3)$, $C(3, 5)$ and $D(1, 5)$. Show
that the length of the line segment $BC$ is four times the length
of the line segment $DC$. 
3. (a) Find the center and radius of the circle having equation
\[ x^2 + y^2 + 8x - 4y - 44 = 0. \]

(b) Sketch the circle in part (a) and indicate its center and at least four points on it.
4. For the function given by $f(x) = \frac{x-2}{x+1}$:
   (a) Find the $x$ and $y$ intercepts of the graph of $f(x)$.
   (b) Find the vertical and horizontal asymptotes of $f(x)$.
   (c) Use the information above to sketch the graph of $f(x)$. 
5. Sketch the graph of \( y = f(x) = -x^2 + 4x - 3 \).
   Identify its vertex and \( x \) and \( y \) intercepts on the graph, and label each point. State the domain and range of \( f(x) \).
6. Find all zeros (roots), real or complex, of the polynomial 
\[ P(x) = x^3 + 3x^2 + 4x - 2. \] Give the complete factorization of \( P(x) \).
7. Find the domain of \( g(x) = \sqrt{x^2 + x} \). Write the solution using interval notation and graph it on the real number line.
8. Use the graph of $y = x^2$ and transformations to sketch the graph of $y = 3(x - 2)^2 - 3$. Label all intercepts.
PART II: Answer 4 out of 5 questions. Each question is worth 10 points. Justify each answer and show all your work.

9. (a) Solve the equation and check: \( \frac{1}{5x} = \frac{x-8}{x^2+4x} \)

(b) Factor the following expression completely:
\( 3x^3 - 36x^2 + 96x \)
10. (a) Write $\frac{3-i}{4+2i}$ in the form $a + bi$, where $a$ and $b$ are real numbers.

(b) Solve for $x$: $| -2x - 1 | > 3$
11. (a) Solve the following equation and check: \( \sqrt{x - 1} = x - 3 \)

(b) Solve for \( x \): \( 2^{(3x+1)} = \frac{1}{4} \)
12. (a) Solve for $x$ and check: $\log_4(x^2 + 3x) - \log_4(x + 5) = 1$

(b) Given $f(x) = \frac{1}{x+1}$ and $g(x) = \frac{1}{x}$. Find $(f \circ g)(x)$ and state its domain.
13. (a) Solve the system of equations:
\[ 2x + 7y = 3 \]
\[ 3x + 4y = -2 \]

(b) Sketch the graph of \( f(x) = \sqrt{x-2} \). Use the graph of \( f \) to sketch the graph of \( f^{-1} \), the inverse of \( f \). State the domain and range of \( f^{-1} \). Find \( f^{-1} \).