Answer seven questions, selecting three from group I and two from each of the other two groups. Each complete answer will receive one credit. No credit will be allowed unless all operations (except mental ones) necessary to find results are given.

**Group I**

1. Solve \( \frac{ax + b}{cx + d} = 1 \). Determine the value of \( x \) when \( a = c \), when \( b = d \), when \( a = c \) and \( b = d \).

2. a. Simplify \( \frac{3 + 2 \sqrt{-1}}{3 - 2 \sqrt{-1}} (3 - 4 \sqrt{-1}) \).

b. Find the value of \( x^2 - 6x + 14 \) if \( x = 3 + \sqrt{-5} \).

3. a. Find the square root of \( 8 + \sqrt{60} \).

b. Without extracting the roots determine which is the greater \( \sqrt{7} \) or \( \sqrt{18} \).

4. Free the following equation from radicals and find the value of \( x \) when \( q = 0 \): \( x = -\frac{1}{2}q + \sqrt{-\frac{3}{4}q^2 + \sqrt{q^4 + r^4}} \).

**Group II**

5. The hypotenuse of a right triangle is 20; the sum of the other two sides is 28. Find the lengths of the sides.

6. In a geometric progression the sum of the first and second terms is 12; the sum of the third and fourth terms is 108. Find (a) the ratio, (b) the sum of the first seven terms.

7. The sum of all the even integers from 2 to a certain number inclusive is 702; find the last of these integers.

**Group III**

8. Plot the graphs of the following system of equations:

\[
\begin{align*}
\frac{x^2 + y^2}{3x - 2y} &= 4 \\
3x + 2y &= 6
\end{align*}
\]

From the graphs find the approximate values of \( x \) and \( y \) that satisfy both equations.

9. Find the roots of the equation \( ax^2 + bx + c = 0 \) and discuss their values when \( c \) and \( a \) are both positive.

10. Solve as a quadratic \( (x - \frac{1}{x})^2 + \frac{5}{6}(x - \frac{1}{x}) = 1 \).