Assignment 1 -- Alternatives

Purpose of this task is to write a C++ program which takes the coefficients of a general quadratic equation (like $ax^2 + bx + c = 0$, with $a, b, c \in R$) and computes the set of solutions ($x \in R$) for this equation.

Examples:
The equation $5x^2 - 3 = 0$ with coefficients a=5, b=0, c=−3 has the solution set { −0.77; 0.77 }, and the equation $-x^2 = 0$ with coefficients a=−1, b=0, c=0 has the solution set { 0 }.

Let's be smart and develop this program in several quite simple steps:

a) Write a program which asks for the factor "a", reads data from the keyboard (console input = "cin"), and prints the this value out again, for us to see if the data transfer was correct. After completing the test, expand your program to all three coefficients.

b) There is a well-known formula to compute the solution of quadratic equations from their three coefficients a, b, c. Provide this formula and implement it into C++ Syntax.
(Hint: include the module "cmath" to use the predefined function sqrt( ) for square roots)
Test the result(s) of your formula with $x^2-1=0$ and with $-2x^2+4x=0$.

c) There are special cases like these: $x^2+1=0$ or $-x^2+6x-9=0$. The first one is -- probably -- problematic for your program and the second one is slightly unaesthetic. Upgrade your program to have both sorts of special cases handled smoothly.
Draw a structogram from your code and check if all cases are represented reasonably.
(This drawing is part of your assignment!)

d) Now solve the following equations manually, and write down the solution set:
Input: a=−2, b=8, c=−6 ==> expected output: . . .
Input: a=0.5, b=−0.5, c=0.125 ==> expected output: . . .
Input: a=0, b=−5, c=3 ==> expected output: . . .
Input: a=0, b=0, c=7 ==> expected output: . . .
Input: a=0, b=0, c=0 ==> expected output: . . .
Input: a=0, b=2, c=0 ==> expected output: . . .
Then test your program with these data sets.
If your program does not behave like expected you have to implement further alternative processing paths. Before changing your code try to make a systematic analysis to find out which conditions (in the head of your "if" statements) are important, and in which order they should be evaluated.
Again, document your code with a structogram.

e) Are you sure your program is complete and correct now?
Be prepared to be asked to explain your claim.