Problem: We will be provided with three numbers a, b and c, and we need to solve the equation $ax^2 + bx + c = 0$.

Firstly, we need to determine whether the solutions of the equation are real or complex. So, we need to calculate the delta (Δ), which equals to $b^2 - 4ac$.

When delta equals to 0, we know that there is only one solution of the equation, which is a double root. We can easily obtain that $x = -\frac{b}{2a}$.

When delta is greater than 0, we know that there are 2 solutions, which are real numbers. We can then easily obtain the solutions by using the equation: $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$.

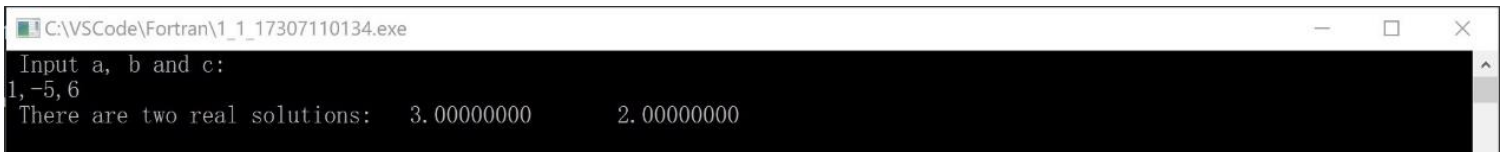
When delta is less than 0, we know that we won't have any real solutions. But we can still express the complex solutions in Fortran90. In this situation, the real part of the solutions is $-\frac{b}{2a}$, and the imaginary parts of the solutions are $\pm\frac{\sqrt{b^2-4ac}}{2a}$, which are actually $\pm\frac{\sqrt{-(b^2-4ac)}}{2a}i$. So we need to calculate the real part and the imaginary part separately and finally put them together by using the function cmplx( ).

Input: Three real numbers a, b, c

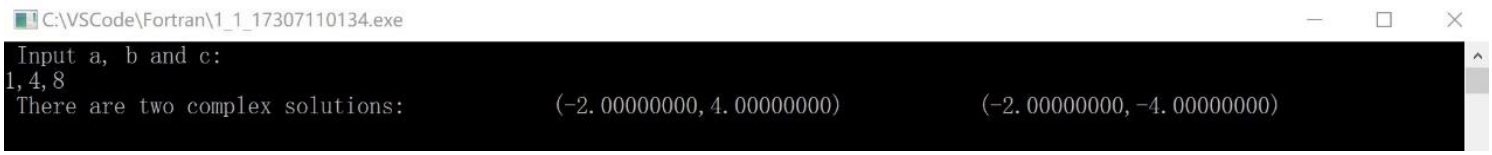
Output: The solutions of the equation $ax^2 + bx + c = 0$

1. *delta* ← $b^2 - 4ac$
2. **If** *delta* > 0 **Then**
3. *solu1* ← $\frac{-b+\sqrt{delta}}{2a}$
4. *solu2* ← $\frac{-b-\sqrt{delta}}{2a}$
5. Print(*solu1*, *solu2*)
6. **Elseif** *delta* < 0 **Then**
7. *real_part* ← $-\frac{b}{2a}$
8. *imaginary_part* ← $\sqrt{-delta}$
9. *solu3* ← Cmplx(*real_part*, *imaginary_part*)
10. *solu4* ← Cmplx(*real_part*, -*imaginary_part*)
11. Print(*solu3*, *solu4*)
12. **Else**
13. solu ← $-\frac{b}{2a}$
14. Print(*solu*)
15. **End**
16. **End**

$$x^2 + 2x + 1 = 0,\ x_1 = x_2 = -1$$



$$x^2 - 5x + 6 = 0,\qquad x_1 = 3, x_2 = 2$$



$$x^2 + 4x + 8 = 0,\qquad x_1 = -2 + 4i, x_2 = -2 - 4i$$

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1   PROGRAM solve_equation
2   implicit none
3   REAL a, b, c, delta, solu1, solu2, real_part, imaginary_part
4   COMPLEX solu3, solu4
5   ! Consider both real solutions and complex solutions.
6   ! For complex solutions, we need to calculate both real part and imaginary part.
7   PRINT *, 'Input a, b and c:'
8   READ *, a, b, c
9       delta = b**2 - 4*a*c
10      ! Calculate the delta to determine whether the solutions are real or complex.
11      IF (delta > 0) THEN
12      ! The solutions are real.
13          solu1 = (-b + sqrt(delta)) / (2*a)
14          solu2 = (-b - sqrt(delta)) / (2*a)
15          PRINT *, 'There are two real solutions:', solu1, solu2
16      ELSE IF (delta < 0) THEN
17      ! The solutions are complex.
18          real_part = (-b)/(2*a)
19          imaginary_part = sqrt(-delta)
20          solu3 = cmplx(real_part,imaginary_part)
21          solu4 = cmplx(real_part,-imaginary_part)
22          PRINT *, 'There are two complex solutions:', solu3, solu4
23      ELSE
24      ! The solution is a double root, so there is only one solution.
25          solu1 = -b / (2*a)
26          PRINT *, 'There is only one solution:', solu1
27      END IF
28  END
```