Vertical Progression:

8th Grade	**8.EE.A Use properties of operations to generate equivalent expressions.** o **8.EE.C.7** Solve linear equations in one variable. o **8.EE.C.7b** Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
Algebra 1	**ELG.MA.HS.A.REI. Solve equations and inequalities in one variable.** o **A-REI.4** Solve quadratic equations in one variable. o **A-REI.4a** Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. o **A-REI.4b** Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.
Algebra 2	**ELG.MA.HS.N.6 Use complex numbers in polynomial identities and equations.** o **N-CN.7** Solve quadratic equations with real coefficients that have complex solutions.
	ELG.MA.HS.N.6 Use complex numbers in polynomial identities and equations. o **N-CN.8 (+)**Extend polynomial identities to the complex numbers. *For example, rewrite* $x^2 + 4$ *as* $(x + 2i)(x - 2i)$ o **N-CN.9 (+)**Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

Students will demonstrate command of the ELG by:

- Solving quadratic equations with real coefficients that have complex solutions by factoring, completing the square, and using the quadratic formula.

Vocabulary:

- complex solutions
- quadratic equations

Sample Instructional/Assessment Tasks:

1) **Standard(s): N-CN.7**
Source: PARCC Practice PBA Test #10

Item Prompt:

What are the solutions to the equation $2x^2 - x + 1 = 0$?

Correct Answer:

$\frac{1}{4} - \left(\frac{\sqrt{7}}{4}\right)i$ and $\frac{1}{4} + \left(\frac{\sqrt{7}}{4}\right)i$

2) **Standard(s): N-CN.7**
Source: https://www.illustrativemathematics.org/content-standards/HSN/CN/C/7/tasks/1690

Item Prompt:

Renee reasons as follows to solve the equation $x^2 + x + 1 = 0$.

First I will rewrite this as a square plus some number.

$$x^2 + x + 1 = \left(x + \frac{1}{2}\right)^2 + \frac{3}{4}$$

Now I can subtract $\frac{3}{4}$ from both sides of the equation.

$$\left(x + \frac{1}{2}\right)^2 = -\frac{3}{4}$$

But I can't take the square root of a negative number so I can't solve this equation.

a. Show how Renee might have continued to find the complex solutions of $x^2 + x + 1 = 0$.

b. Apply Renee's reasoning to find the solutions to $x^2 + 4x + 6 = 0$.

Correct Answer:

a. $x + \frac{1}{2} = \pm\frac{\sqrt{3}}{2}$; $x = -\frac{1}{2} \pm \frac{\sqrt{3}}{2}i$

b. $x = -2 \pm i\sqrt{2}$