Imaginary Root Quest

Solve quadratic equations with nonreal roots.

HIGH SCHOOL · HSN-CN.C

CCSS.Math.Content.HSN-CN.C "Use complex numbers in polynomial identities and equations."

NAME ____________________ DATE ____________

WHEN ROOTS ARE COMPLEX

For ax^2 + bx + c = 0, use the quadratic formula. If the discriminant, b^2 - 4ac, is negative, rewrite its square root using i, where i^2 = -1. The two solutions will be complex conjugates.

WORKED EXAMPLE

Solve x^2 + 10x + 26 = 0.

1. Here a = 1, b = 10, and c = 26.
2. b^2 - 4ac = 10^2 - 4(1)(26) = -4.
3. x = (-10 ± sqrt(-4))/2 = (-10 ± 2i)/2.

Answer: x = -5 ± i

PRACTICE

6 problems

1. Solve x^2 + 9 = 0.

   ANSWER ____________________

2. Solve x^2 - 8x + 20 = 0.

   ANSWER ____________________

3. Solve 2x^2 + 6x + 18 = 0.

   ANSWER ____________________

4. Solve x^2 + 14x + 58 = 0.

   ANSWER ____________________

5. Solve 3x^2 - 18x + 35 = 0.

   ANSWER ____________________

6. Solve 6x^2 + 6x + 11 = 0.

   ANSWER ____________________

APPLY IT
Show your work

1 A student game designer uses $R(x) = x^2 - 12x + 40$ to model the number of bug reports predicted after x testing rounds. Solve $R(x) = 0$. What do the solutions mean in this context?

WORK SPACE

ANSWER ______________________

2 A photography club tests a phone camera focus model, $F(x) = 2x^2 + 8x + 17$, where x is a filter adjustment setting. Solve $F(x) = 0$. What do the solutions mean for real filter settings?

WORK SPACE

ANSWER ______________________

CHALLENGE
One step up

CHALLENGE

Solve $x^4 + 16 = 0$. List all four complex roots.

____

____

Imaginary Root Quest

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Solve x^2 + 9 = 0.	**x = ±3i**
2	Solve x^2 - 8x + 20 = 0.	**x = 4 ± 2i**
3	Solve 2x^2 + 6x + 18 = 0.	**x = (-3 ± 3sqrt(3)i)/2**
4	Solve x^2 + 14x + 58 = 0.	**x = -7 ± 3i**
5	Solve 3x^2 - 18x + 35 = 0.	**x = 3 ± (2sqrt(6)/3)i**
6	Solve 6x^2 + 6x + 11 = 0.	**x = -1/2 ± (sqrt(57)/6)i**

PART 2 · APPLY IT

1. **x = 6 ± 2i. There is no real number of testing rounds for which the model predicts 0 bug reports.** Use the quadratic formula to get x = (12 ± sqrt(12^2 - 4(1)(40)))/2 = 6 ± 2i. Since testing rounds must be real, the model never reaches 0 bug reports.
2. **x = -2 ± (3sqrt(2)/2)i. No real filter setting makes F(x) equal to 0.** The quadratic formula gives x = (-8 ± sqrt(8^2 - 4(2)(17)))/4 = -2 ± (3sqrt(2)/2)i. Because both roots are nonreal, there is no real adjustment setting with a focus rating of 0.

CHALLENGE

x = sqrt(2) + sqrt(2)i, sqrt(2) - sqrt(2)i, -sqrt(2) + sqrt(2)i, or -sqrt(2) - sqrt(2)i

Accept equivalent complex-number forms and roots listed in any order. For the challenge, students must include all four distinct roots.