LESSON MAKER PRO

Roots Beyond Real

Solve quadratic equations with complex-number solutions.

HIGH SCHOOL · HSN-CN.C.7

CCSS.Math.Content.HSN-CN.C.7 "Solve quadratic equations with real coefficients that have complex solutions."

NAME _____ DATE _____

WHEN ROOTS USE I

For $ax^2 + bx + c = 0$, use $x = (-b \pm \sqrt{b^2 - 4ac})/(2a)$. If $b^2 - 4ac$ is negative, use $\sqrt{-k} = i\sqrt{k}$ to write the two complex solutions.

WORKED EXAMPLE

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

1. Here, $a = 1$, $b = 8$, and $c = 20$.
2. $x = (-8 \pm \sqrt{8^2 - 4(1)(20)})/(2(1))$
3. $x = (-8 \pm \sqrt{-16})/2 = (-8 \pm 4i)/2$
4. $x = -4 \pm 2i$

Answer: $x = -4 \pm 2i$

PRACTICE 6 problems

1 Solve $x^2 + 81 = 0$.

ANSWER _____

2 Solve $x^2 - 14x + 58 = 0$.

ANSWER _____

3 Solve $2x^2 + 6x + 17 = 0$.

ANSWER _____

4 Solve $4x^2 - 16x + 29 = 0$.

ANSWER _____

5 Solve $x^2 + 12x + 40 = 0$.

ANSWER _____

6 Solve $3x^2 - 3x + 7 = 0$.

ANSWER _____

APPLY IT Show your work

1 A student coding club models the projected profit from a new app, in hundreds of dollars, after t weeks by $P(t) = t^2 - 12t + 52$. Find the values of t that would make $P(t) = 0$. Then state whether the model predicts a real break-even week.

WORK SPACE

ANSWER _____

2 A robotics club uses $r^2 + 14r + 65 = 0$ as the characteristic equation for one motor-control setting. Solve for r.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Solve $3x^2 - 12x + 25 = 0$. Then explain, using the discriminant, why the solutions cannot be real.

WORK SPACE AND ANSWER

Roots Beyond Real

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Solve $x^2 + 81 = 0$.	**x = ±9i**
2	Solve $x^2 - 14x + 58 = 0$.	**x = 7 ± 3i**
3	Solve $2x^2 + 6x + 17 = 0$.	**x = -3/2 ± (5/2)i**
4	Solve $4x^2 - 16x + 29 = 0$.	**x = 2 ± (sqrt(13)/2)i**
5	Solve $x^2 + 12x + 40 = 0$.	**x = -6 ± 2i**
6	Solve $3x^2 - 3x + 7 = 0$.	**x = 1/2 ± (5sqrt(3)/6)i**

PART 2 · APPLY IT

1. **t = 6 ± 4i; the model does not predict a real break-even week.** Set $t^2 - 12t + 52$ equal to 0. The discriminant is -64, so the solutions are complex rather than real.
2. **r = -7 ± 4i** Use the quadratic formula. The discriminant is $14^2 - 4(1)(65) = -64$.

CHALLENGE

x = 2 ± (sqrt(39)/3)i. The discriminant is -156, which is negative, so there are no real solutions.

Accept solutions in either order. Accept equivalent complex forms, including forms with i written before the radical term.