LESSON MAKER PRO

Roots Beyond Real

Solve quadratics and make sense of complex solutions.

HIGH SCHOOL · PC.T.4.3

PC.T.4.3 "Solve quadratic equations in one variable that have complex solutions."

NAME _____ DATE _____

WHEN SQUARES ARE NEGATIVE

Use i when a square equals a negative number: $i^2 = -1$, so sqrt(-a) = i sqrt(a) when a is positive. Complete the square or use the quadratic formula, and include both solutions. If an equation models a real-world quantity, complex solutions mean there is no real value that meets the target.

WORKED EXAMPLE

Solve $x^2 + 8x + 25 = 0$.

1. Subtract 25: $x^2 + 8x = -25$.
2. Complete the square: $(x + 4)^2 = -9$.
3. Take both square roots: $x + 4 = \pm 3i$.

Answer: x = -4 ± 3i

PRACTICE 6 problems

1 Solve $x^2 + 16 = 0$.

ANSWER _____

2 Solve $x^2 - 2x + 10 = 0$.

ANSWER _____

3 Solve $x^2 + 4x + 8 = 0$.

ANSWER _____

4 Solve $2x^2 + 4x + 10 = 0$.

ANSWER _____

5 Solve $x^2 - 6x + 18 = 0$.

ANSWER _____

6 Solve $3x^2 + 6x + 12 = 0$.

ANSWER _____

APPLY IT Show your work

1 In a platform game, an avatar's height in meters t seconds after a jump is $h(t) = -t^2 + 4t + 1$. A bonus ring is at 6 meters. Solve $h(t) = 6$ for t. Can the avatar reach the ring at a real time?

WORK SPACE

ANSWER _____

2 A school club models its sticker sale revenue, in dollars, as $R(x) = x(10 - x)$, where x is the price in dollars per pack. The club wants $29 in revenue. Solve $R(x) = 29$ for x. Can a real price meet the goal under this model?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Find the real value of k that makes $6 + 5i$ and $6 - 5i$ the solutions of $x^2 - 12x + k = 0$. Explain how you know.

WORK SPACE AND ANSWER

Roots Beyond Real

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Solve $x^2 + 16 = 0$.	**x = ±4i**
2	Solve $x^2 - 2x + 10 = 0$.	**x = 1 ± 3i**
3	Solve $x^2 + 4x + 8 = 0$.	**x = -2 ± 2i**
4	Solve $2x^2 + 4x + 10 = 0$.	**x = -1 ± 2i**
5	Solve $x^2 - 6x + 18 = 0$.	**x = 3 ± 3i**
6	Solve $3x^2 + 6x + 12 = 0$.	**x = -1 ± i sqrt(3)**

PART 2 · APPLY IT

1. **t = 2 ± i seconds. No, the avatar cannot reach the ring at a real time.** Setting the height to 6 gives $t^2 - 4t + 5 = 0$, or $(t - 2)^2 = -1$. The solutions are not real times.
2. **x = 5 ± 2i dollars. No real price meets the goal under this model.** Setting revenue to 29 gives $x^2 - 10x + 29 = 0$, or $(x - 5)^2 = -4$. Neither solution is a real price.

CHALLENGE

k = 61. Completing the square gives $(x - 6)^2 = 36 - k$. For x = 6 ± 5i, the left side is -25, so 36 - k = -25 and k = 61.

Accept the two roots written separately instead of with ±. In the word problems, accept any clear statement that complex solutions are not real times or prices.