LESSON MAKER PRO

Pairs Beyond Real

Solve quadratics with complex solutions.

HIGH SCHOOL · MT.PLUS.ALG.POLY.4

MT.PLUS.ALG.POLY.4 "Solve quadratic equations that have complex solutions and understand why the solutions form a conjugate pair."

NAME _____ DATE _____

WHY SOLUTIONS PAIR UP

For $ax^2+bx+c=0$, find the discriminant $D=b^2-4ac$. When a, b, and c are real and D is negative, use $i^2=-1$ in the quadratic formula. The plus and minus signs give solutions with the same real part and opposite imaginary parts, called a conjugate pair.

WORKED EXAMPLE

Solve $x^2+14x+65=0$.

1. $D=14^2-4(1)(65)=-64$.
2. $\text{sqrt}(D)=8i$.
3. $x=(-14\pm8i)/2$.
4. $x=-7\pm4i$.

Answer: x=-7+4i and x=-7-4i

PRACTICE 6 problems

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

ANSWER _____

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

ANSWER _____

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

ANSWER _____

4 Solve $2x^2+4x+5=0$.

ANSWER _____

5 Find the discriminant, then solve $x^2+3x+4=0$.

ANSWER _____

6 Solve $3x^2-6x+4=0$. Why do the solutions form a conjugate pair?

ANSWER _____

APPLY IT Show your work

1 In a video game, a ball's height is $h(t)=-t^2+4t+1$ meters after t seconds. Solve $h(t)=6$. Does the ball reach the 6-meter target?

WORK SPACE

ANSWER _____

2 A concert planner models revenue with $R(x)=-x^2+8x$, where x is hundreds of tickets sold and R(x) is hundreds of dollars. Solve $R(x)=17$. Can this model reach the $1,700 goal?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A quadratic equation with real coefficients has one solution, $2+3i$. Its equation is $2x^2+bx+c=0$. Find b, c, and the other solution. Explain why that solution is required.

WORK SPACE AND ANSWER

Pairs Beyond Real

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Solve $x^2+4x+8=0$.	**x=-2+2i and x=-2-2i**
2	Solve $x^2-2x+10=0$.	**x=1+3i and x=1-3i**
3	Solve $x^2+6x+18=0$.	**x=-3+3i and x=-3-3i**
4	Solve $2x^2+4x+5=0$.	**x=-1+i sqrt(6)/2 and x=-1-i sqrt(6)/2**
5	Find the discriminant, then solve $x^2+3x+4=0$.	**D=-7; x=(-3+i sqrt(7))/2 and x=(-3-i sqrt(7))/2**
6	Solve $3x^2-6x+4=0$. Why do the solutions form a conjugate pair?	**x=1+i sqrt(3)/3 and x=1-i sqrt(3)/3. The coefficients are real, so the two solutions have the same real part and opposite imaginary parts.**

PART 2 · APPLY IT

1. **t=2+i and t=2-i; no, the ball does not reach 6 meters.** Setting the height equal to 6 gives $t^2-4t+5=0$, whose solutions are 2±i. Neither is a real time, and the ball's maximum height is 5 meters.
2. **x=4+i and x=4-i; no, the model cannot reach $1,700.** Setting R(x)=17 gives $x^2-8x+17=0$, whose solutions are 4±i. Neither is a real ticket quantity, and the model's maximum revenue is $1,600.

CHALLENGE

b=-8, c=26, and the other solution is 2-3i. Because the coefficients are real, the nonreal solutions must be conjugates: $(x-(2+3i))(x-(2-3i))=x^2-4x+13$, so the equation is $2x^2-8x+26=0$.

Accept either order for a pair of solutions or the equivalent ± form. For explanations, accept that a negative discriminant produces opposite imaginary parts when the coefficients are real.