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Introduction to Solving Complex Equations

Mathematics often presents us with equations that involve complex numbers, which are numbers comprising both real and imaginary parts. One common type involves quadratic equations, where solutions may be real or complex conjugates. In this article, we will explore how to solve the given equation:

12 14x + 58 = 0A. {2+19i, 2 19i}B. {7+3i, 7 - 3i}c. {3+7i, 3 - 7i}D. {2+9i, 2 - 91}

This appears to be a multiple-choice question asking for the solutions to a linear or quadratic equation involving complex numbers. Our goal is to understand the structure of the problem, apply algebraic techniques, and determine the correct solution set among the options provided.

Understanding the Equation and Its Components

Before diving into solving, it's crucial to interpret the given expression correctly. The statement is somewhat ambiguous, but based on standard mathematical notation, we can analyze the components.

2.1. Deciphering the Expression

The expression appears as:

12 14x + 58 = 0A. {2+19i, 2 19i}B. {7+3i, 7 - 3i}c. {3+7i, 3 - 7i}D. {2+9i, 2 - 91}

It likely represents:

- An equation involving an expression with coefficients, perhaps "12 14x + 58 = 0"
- Multiple-choice options labeled A, B, C, D, each with a set of complex solutions

Given the structure, the core problem is probably to solve the linear or quadratic equation and match the solutions to one of the provided options.

2.2. Hypotheses About the Equation

- The initial expression 12 14x + 58 = 0 could be a misprint or formatting issue, and might mean:

12 14x + 58 = 0 or

(12)(14x) + 58 = 0

- Alternatively, it might be a quadratic equation or related to solving for the roots of a polynomial.

- The options suggest solutions involving complex conjugates, indicating the solutions are complex numbers.

Step-by-Step Solution Approach

To resolve this, we will:

1. Clarify the form of the equation.
2. Solve the equation algebraically.
3. Identify the solutions.
4. Match the solutions with the options provided.

Clarifying the Equation

Given the options and typical problem structure, the most plausible interpretation is:

Equation:

$$
12 \times 14x + 58 = 0
$$

which simplifies to:

$$
168x + 58 = 0
$$

or perhaps, more generally, the quadratic:

$$
ax^2 + bx + c = 0
$$

\]

but since the options involve conjugate complex solutions, it suggests the quadratic has complex roots.

Alternatively, if the original problem intended to present a quadratic, perhaps the expression was:

\[
(14x)^2 + 58 = 0
\]

which would involve solving:

\[
(14x)^2 = -58
\]

or

\[
14^2 x^2 = -58
\]

leading to:

\[
196 x^2 = -58
\]

and

\[
x^2 = -\frac{58}{196} = -\frac{29}{98}
\]

which produces complex solutions.

Solving the Quadratic Equation

Assuming the quadratic form:

\[
ax^2 + bx + c = 0
\]

and that the solutions involve complex conjugates, the quadratic formula applies:

$$
x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
$$

3.1. Applying the Quadratic Formula

Suppose the quadratic is:

$$
14x^2 + 58 = 0
$$

which simplifies to:

$$
14x^2 = -58
$$

then,

$$
x^2 = -\frac{58}{14} = -\frac{29}{7}
$$

So,

$$
x = \pm \sqrt{-\frac{29}{7}} = \pm i \sqrt{\frac{29}{7}}
$$

which are purely imaginary solutions.

3.2. Expressing the Solutions

The solutions are:

$$
x = \pm i \sqrt{\frac{29}{7}}
$$

or,

$$
x = \pm i \frac{\sqrt{29}}{\sqrt{7}}
$$

which are conjugate pairs involving imaginary numbers.

Matching Solutions with Multiple-Choice Options

Now, compare the derived solutions:

$$
x = \pm i \frac{\sqrt{29}}{\sqrt{7}}
$$

with the options:

- A. {2 + 19i, 2 - 19i}
- B. {7 + 3i, 7 - 3i}
- C. {3 + 7i, 3 - 7i}
- D. {2 + 9i, 2 - 91}

Note that option D seems inconsistent because the second element is "2 - 91", which is not of the form "a ± bi", and is likely a typo.

Matching the form, the solutions involve purely imaginary parts, so options with real parts (like 2, 7, 3) are unlikely unless the original quadratic involves real parts as well.

Given our solutions are purely imaginary, none of the options perfectly match. However, the closest match in terms of imaginary parts is option B, which involves 3i and 3i, and option C with 7i and 7i.

But our computed solutions involve $\sqrt{\frac{29}{7}}$, roughly 2.04, thus approximate imaginary parts are about ±2.04i.

None of the options exactly match this, but the options with imaginary parts close to 2 or 3 are options B and C.

3.3. Final Selection

Since our derived solutions are approximately:

$$
x \approx \pm 2.04i
$$

and options are:

- B. {7 + 3i, 7 - 3i}
- C. {3 + 7i, 3 - 7i}

Option B has imaginary parts ±3i, which is close to our approximate solution, but with a real part of 7, which doesn't match.

Option C has imaginary parts ±7i, which are farther from 2.04i.

Given the ambiguity and potential typos, the best fit based on the imaginary parts would be Option B, assuming the problem aims to select solutions with similar imaginary parts.

Conclusion and Final Remarks

The problem of solving the equation:

$$
14x^2 + 58 = 0
$$

leads to solutions:

$$
x = \pm i \sqrt{\frac{29}{7}}
$$

which approximate to $\pm 2.04i$. Among the options provided, the closest match in terms of the magnitude of the imaginary component is Option B: {7 + 3i, 7 - 3i}, bearing in mind the potential typographical errors.

4.1. Key Takeaways

- Complex solutions often come in conjugate pairs.
- The quadratic formula is essential for solving equations with negative discriminants.
- Understanding the structure of complex roots helps in matching multiple-choice answers.
- Always verify the original equation's form; assumptions may be necessary when the prompt is ambiguous.

Additional Resources for Learning Complex Equations

- Understanding Complex Numbers: Explore the basics of imaginary and complex numbers.
- Quadratic Equations and the Discriminant: Learn how the discriminant determines the nature of roots.
- Applying the Quadratic Formula: Practice with various quadratic equations involving real and complex solutions.
- Complex Conjugates: Understand why solutions to polynomials with real coefficients come in conjugate pairs.

Summary

In this comprehensive guide, we've analyzed the possible interpretations of the given equation, applied algebraic techniques to solve for complex roots, and matched our solutions with the options provided. While some ambiguity exists in the original problem statement, the key concepts covered here—solving quadratic equations, understanding complex conjugates, and interpreting multiple-choice options—are fundamental in mastering algebra involving complex numbers.

If you encounter similar problems, remember to:

- Clarify the equation's form.
- Use the quadratic formula when necessary.
- Recognize the nature of roots based on the discriminant.
- Match solutions accordingly, considering conjugates and imaginary parts.

By mastering these techniques, you'll enhance your proficiency in solving complex equations and confidently tackle similar problems

Frequently Asked Questions

What type of equation is 12 + 14x + 58 = 0, and how do we solve it?

It's a linear equation in x. To solve, combine like terms: 14x + (12 + 58) = 0, which simplifies to 14x + 70 = 0. Subtract 70 from both sides: 14x = -70, then divide both sides by 14: x = -5.

Are the solutions to the equation real or complex numbers?

Since the equation simplifies to a linear form with a real solution, the solution is a real number, not complex. The options involving complex conjugates are not applicable here.

Given the options with complex numbers, which option correctly represents the solution set?

None of the provided options (A, B, C, D) directly match the real solution x = -5, which indicates the options are likely part of a multiple-choice question about complex roots or related concepts.

What are the roots of a quadratic equation with complex solutions, and how are they expressed?

Complex roots of quadratic equations appear in conjugate pairs, typically expressed as a + bi and a - bi, where a and b are real numbers, and i is the imaginary unit.

Which option correctly lists conjugate pairs of complex numbers?

Option B: {7 + 3i, 7 - 3i} and Option C: {3 + 7i, 3 - 7i} are conjugate pairs. However, since the original equation is linear, these options may be from a different context.

How do you identify the conjugate pair in a set of complex solutions?

A conjugate pair consists of two complex numbers that are identical except for the sign of the imaginary part, such as a + bi and a - bi.

Can the solutions involve imaginary numbers for the given linear equation?

No, linear equations with real coefficients typically have real solutions unless the equation involves square roots of negative numbers, which is not the case here.

Why are the options with imaginary components (i) relevant in solving equations?

Options with imaginary components are relevant when solving quadratic equations or higher-degree polynomials that have complex roots, but not for simple linear equations like the one given.

Based on the original equation, what is the final solution for x?

The solution is x = -5, which is a real number. None of the options provided directly match this solution, indicating the question might be about identifying conjugate pairs in a different context.

Additional Resources

Solve: 12 14x + 58 = 0 — an essential problem in algebraic and complex number analysis — invites us to explore the roots of a linear equation that may involve complex solutions. Whether you're a student tackling polynomial equations or a professional mathematician delving into complex roots, understanding how to solve such equations is fundamental. This guide offers a comprehensive, step-by-step breakdown to help you navigate the solution process, interpret the roots, and connect the results to the given multiple-choice options.

Understanding the Equation: 12 14x + 58 = 0

At first glance, the equation appears straightforward: a linear algebraic equation involving a coefficient, a variable, and a constant term. However, the options provided suggest that the solutions are complex numbers, which indicates that the roots might involve imaginary components.

Before diving into solving the equation, let's clarify the notation and interpret the problem:

- The original question seems to contain a typo or formatting issue: "12 14x + 58 = 0A. {2+19i, 2 19i} ..." appears to be a list of options, with options labeled A, B, C, D, each containing a set of complex conjugates.
- The core task is to solve for x in the equation and then identify which of the provided options

correctly represents the solutions.

Step 1: Clarify and Rewrite the Equation

Given the expression, it's reasonable to interpret "12 14x" as "12 × 14x" or perhaps "12 times 14x," which simplifies to:

- $12 \times 14x = (12 \times 14) x = 168x$

Thus, the equation becomes:

$168x + 58 = 0$

Alternatively, if the original was intended as "12x + 14x + 58 = 0," then:

$12x + 14x + 58 = 0 \rightarrow (12 + 14) x + 58 = 0 \rightarrow 26x + 58 = 0$

But given the options involve complex numbers with imaginary parts, the most consistent interpretation is that the initial equation is:

$168x + 58 = 0$

Step 2: Solve the Equation

Isolate x:

$168x + 58 = 0$
$\Rightarrow 168x = -58$
$\Rightarrow x = -58 / 168$

Simplify the fraction:

$x = -58 / 168$

Divide numerator and denominator by 2:

$x = -29 / 84$

This is a real number solution.

Step 3: Interpreting the Complex Roots in the Options

However, the options provided are sets of complex conjugates:

- A. $\{2 + 19i, 2 - 19i\}$

- B. {7 + 3i, 7 - 3i}
- C. {3 + 7i, 3 - 7i}
- D. {2 + 9i, 2 - 9i}

This suggests that perhaps the original problem was intended to involve solving a quadratic or higher-degree polynomial with complex roots, rather than a simple linear equation.

Possible scenario: The initial problem may be a misprint or incomplete, and the real intention is to find roots of a quadratic equation of the form:

$ax^2 + bx + c = 0$

whose solutions are complex conjugates matching one of the options above.

Step 4: Connecting the Dots — What Could the Real Equation Be?

Suppose the original problem was to solve:

$x^2 + px + q = 0$

and the options are the roots (complex conjugates).

Given the options, let's analyze the roots:

Roots in Option B: {7 + 3i, 7 - 3i}

- Sum of roots: $(7 + 3i) + (7 - 3i) = 14$
- Product of roots: $(7 + 3i)(7 - 3i) = 7^2 - (3i)^2 = 49 - (-9) = 49 + 9 = 58$

From Vieta's formulas:

- Sum of roots = $-b/a$
- Product of roots = c/a

Assuming quadratic with leading coefficient 1:

- Sum = $-b = 14 \rightarrow b = -14$
- Product = $c = 58$

Thus, quadratic:

$x^2 - (14)x + 58 = 0$

Now, solving:

Discriminant $\Delta = b^2 - 4ac = 14^2 - 4 \times 1 \times 58 = 196 - 232 = -36$

Since the discriminant is negative, the roots are complex conjugates:

$x = [14 \pm \sqrt{-36}] / 2 = [14 \pm 6i] / 2 = 7 \pm 3i$

This matches options in B.

Conclusion:

The roots $7 \pm 3i$ are solutions to the quadratic equation:

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

Final Step: Connecting Back to the Original Question

Given that, the most probable interpretation is that the problem was about solving a quadratic with complex roots, and the options provided are the roots themselves.

Therefore, the correct answer is:

Option B: $\{7 + 3i, 7 - 3i\}$

Additional Insights: How to Recognize and Solve Complex Roots

Recognizing Complex Roots from Quadratic Equations

When solving quadratic equations, the discriminant (Δ) indicates the nature of the roots:

- $\Delta > 0$: Two distinct real roots
- $\Delta = 0$: One real repeated root
- $\Delta < 0$: Two complex conjugate roots

Calculating Complex Roots

For quadratic $ax^2 + bx + c = 0$:

$x = [-b \pm \sqrt{\Delta}] / 2a$

- If $\Delta < 0$, $\sqrt{\Delta}$ involves imaginary numbers: $\sqrt{-k} = i\sqrt{k}$
- Roots are conjugate pairs: $\alpha \pm \beta i$

Summary and Key Takeaways

- Interpreting the problem: When given options involving complex conjugates, consider quadratic equations and Vieta's formulas.
- Solving quadratics: Use the quadratic formula and analyze the discriminant to determine the nature

of roots.
- Complex roots: Always come in conjugate pairs for polynomials with real coefficients.
- Matching options: Cross-verify roots with the quadratic's sum and product to identify correct roots.

Final Remarks

While the initial linear equation appears simple, the options suggest a more complex scenario involving quadratic equations and complex roots. Recognizing the structure of the roots, applying Vieta's formulas, and solving the quadratic equation systematically are key skills in advanced algebra and complex analysis. Whether you're preparing for exams or tackling real-world problems, mastering these techniques enhances your mathematical toolkit.

In conclusion, based on the analysis, the best match for the complex roots described in the options is Option B: {7 + 3i, 7 - 3i}, which correspond to roots of the quadratic equation x^2 - 14x + 58 = 0.

Solve 12 14x 58 0a 2 19i 2 19i B 7 3i 7 3i C 3 7i 3 7i D 2 9i 2 91

Solve 12 14x 58 0a 2 19i 2 19i B 7 3i 7 3i C 3 7i 3 7i D 2 9i 2 91

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