Solve - 23/4/2025, 2:21:59 pm

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Problem

$$x^2 - 7x + 64 = 0$$

Solution

$$\frac{7}{2} - \frac{3\sqrt{23}i}{2}, \frac{7}{2} + \frac{3\sqrt{23}i}{2}$$

Explanation

Let's tackle this quadratic equation, *x^2 - 7x + 64 = 0*, and find its solutions. Notice that factoring doesn't seem straightforward here, so we'll rely on the **quadratic formula**.
1. **Identify *a*, *b*, and *c*.** The *standard form* of a quadratic equation is *ax^2 + bx + c = 0*. In our case, *a = 1*, *b = -7*, and *c = 64*.
2. **Recall the quadratic formula.** The **quadratic formula** states that the solutions to *ax^2 + bx + c = 0* are given by:
x = (-b ± √(b^2 - 4ac)) / 2a. This formula is your best friend when solving quadratic equations that aren't easily factorable.
3. **Substitute the values of *a*, *b*, and *c* into the formula.** Carefully plug in the values we identified:
*x = (-(-7) ± √($(-7)^2$ - 4 * 1 * 64)) / (2 * 1)*
4. **Simplify the expression.** Start with the discriminant (the part under the square root):
x = (7 ± √(49 - 256)) / 2
x = (7 ± √(-207)) / 2
5. **Deal with the negative square root.** Since we have a negative number under the square root, we'll have *complex* solutions involving the *imaginary unit* 'i', where *i = √(-1)*. We can rewrite √(-207) as √(207) * √(-1) = √(207) * i = √(9*23) * i = 3√(23)i
x = (7 ± 3√(23)i) / 2
6. **Write out the two distinct solutions.** The '±' symbol means we have two solutions:
x_1 = (7 + 3√(23)i) / 2 and *x_2 = (7 - 3√(23)i) / 2*
Therefore, the solutions to the equation *x^2 - 7x + 64 = 0* are * (7/2) + (3√(23)i/2) * and * (7/2) - (3√(23)i/2) *.
Note: The fact that we have complex solutions means the graph of this quadratic equation will not intersect the x-axis. The solutions are *complex conjugates* of each other, which is a common occurrence when the discriminant is negative.
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