Find All The Zeros Of The Quadratic Function.y=x-13x+22If There Is More Than One Zero, Separate Them

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Understanding how to find the zeros of a quadratic function is a fundamental skill in algebra. In this article, we will delve into the process of identifying all zeros of the quadratic function $y = x - 13x + 22$. If the function has more than one zero, we will also explore how to accurately separate and interpret each of them. Whether you're a student studying for an exam or a math enthusiast looking to sharpen your skills, this comprehensive guide will walk you through each step with clear explanations and practical examples.

What Is a Zero of a Quadratic Function?

Definition of a Zero

A zero of a quadratic function is the value of x that makes the function's output equal to zero. In other words, if $y = f(x)$, then the zero is the value $x = a$ for which $f(a) = 0$. Graphically, zeros correspond to the points where the parabola intersects the x-axis.

Importance of Finding Zeros

- Roots of the Equation: Zeros are also known as roots or solutions of the quadratic equation.
- Graphing: They help in sketching the parabola accurately.
- Real-Life Applications: Zeros can represent solutions in real-world problems like projectile motion, economics, and engineering.

Analyzing the Given Function

Let's analyze the function $y = x - 13x + 22$.

Simplify the Expression

First, combine like terms:
- $x - 13x = -12x$

So, the simplified quadratic function is:
- $y = -12x + 22$

Identify the Type of Function

This simplified function is a linear function because it has the form $y = mx + b$, where m is the slope and b is the y-intercept.

Important note: A linear function has only one zero unless the line is parallel to the x-axis and passes through the origin.

However, since the original problem suggests finding zeros of a quadratic function, there might be a typo in the function provided. Typically, a quadratic function is expressed as y = ax^2 + bx + c.

Assuming the intended quadratic function is:

y = x^2 - 13x + 22

This form makes sense because it is quadratic and suitable for finding zeros.

If the function is y = x^2 - 13x + 22, then proceed accordingly.

Finding the Zeros of the Quadratic Function y = x^2 - 13x + 22

Method 1: Factoring

Factoring is often the simplest method to find zeros if the quadratic can be factored easily.

Step-by-step process:

1. Write the quadratic in standard form: y = ax^2 + bx + c
- Here, a = 1, b = -13, c = 22

2. Find two numbers that multiply to ac = 1 22 = 22 and add to b = -13.

3. List factor pairs of 22:
- 1 and 22
- 2 and 11

4. Determine which pair sums to -13:
- 1 + 22 = 23
- 2 + 11 = 13

Since we need -13, both numbers should be negative:
- -2 and -11

5. Verify:
- (-2) (-11) = 22
- (-2) + (-11) = -13

6. Rewrite the quadratic:
y = x^2 - 13x + 22 = x^2 - 2x - 11x + 22

7. Factor by grouping:
y = (x^2 - 2x) + (-11x + 22)
= x(x - 2) -11(x - 2)

8. Factor out the common binomial:
y = (x - 2)(x - 11)

Zeros:
Set each factor equal to zero:
- x - 2 = 0 => x = 2

- $x - 11 = 0 \Rightarrow x = 11$

Therefore, the zeros are $x = 2$ and $x = 11$.

Method 2: Quadratic Formula

If factoring is difficult or not straightforward, use the quadratic formula:

$x = [-b \pm √ (b^2 - 4ac)] / 2a$

Calculate discriminant:
$D = b^2 - 4ac = (-13)^2 - 4\ 1\ 22 = 169 - 88 = 81$

Since $D > 0$, there are two real zeros.

Calculate the zeros:
$x = [13 \pm √\ 81] / 2$
$x = [13 \pm 9] / 2$

- For the positive root:
$x = (13 + 9) / 2 = 22 / 2 = 11$

- For the negative root:
$x = (13 - 9) / 2 = 4 / 2 = 2$

Zeros are $x = 2$ and $x = 11$.

Separating Multiple Zeros in a Quadratic Function

When a quadratic function has more than one zero, it is essential to clearly differentiate between the solutions. Here are some tips:

- List each zero on its own line or bullet point:
- $x = 2$
- $x = 11$

- Use "and" or commas to separate solutions in sentences:
"The zeros of the function are $x = 2$ and $x = 11$."

- Verify each zero by substitution:
Substitute each zero back into the original function to confirm that $y = 0$.

Graphing the Quadratic Function and Its Zeros

Understanding the zeros visually helps solidify the concept.

Steps to Graph y = x^2 - 13x + 22

1. Plot the zeros at points (2, 0) and (11, 0).

2. Find the vertex of the parabola:

- Use the vertex formula:
$x = -b / 2a = 13 / 2 = 6.5$

3. Calculate y at x = 6.5:
$y = (6.5)^2 - 13(6.5) + 22$
$y = 42.25 - 84.5 + 22$
$y = -20.25$

4. Plot the vertex at (6.5, -20.25).

5. Draw the parabola passing through these points, symmetric about the vertical line $x = 6.5$.

Real-Life Applications of Finding Zeros

Zeros of quadratic functions are not just mathematical concepts—they have practical applications:

- Physics: Determining when a projectile hits the ground.
- Economics: Finding break-even points.
- Engineering: Analyzing system stability.

Summary and Key Takeaways

- The zeros of a quadratic function are the solutions to the equation $y = 0$.
- To find zeros, you can factor the quadratic, complete the square, or use the quadratic formula.
- When more than one zero exists, list each solution separately.
- Confirm solutions by substitution into the original function.
- Graphing helps visualize the zeros and the shape of the parabola.

Conclusion

Finding all zeros of a quadratic function like $y = x^2 - 13x + 22$ is an essential skill in algebra that provides insight into the behavior of quadratic equations. Whether through factoring or the quadratic formula, identifying these solutions enables you to analyze and interpret the function comprehensively. Remember to always verify your zeros and understand their significance in both mathematical and real-world contexts.

If you need further clarification or help with similar problems, consider exploring online quadratic calculators, algebra tutorials, or consulting with math teachers for personalized guidance.

Frequently Asked Questions

How do you find the zeros of the quadratic function $y = x^2 - 13x + 22$?

To find the zeros, set $y = 0$ and solve the quadratic equation $x^2 - 13x + 22 = 0$ using factoring, quadratic formula, or completing the square.

What are the zeros of the quadratic function y = x^2 - 13x + 22?

The zeros are the values of x that satisfy x^2 - 13x + 22 = 0. Factoring gives (x - 11)(x - 2) = 0, so the zeros are x = 11 and x = 2.

How can I factor the quadratic y = x^2 - 13x + 22 to find its zeros?

Look for two numbers that multiply to 22 and add to -13. These are -11 and -2. So, the factored form is (x - 11)(x - 2) = 0, leading to zeros at x = 11 and x = 2.

What method should I use to find zeros if the quadratic cannot be easily factored?

Use the quadratic formula: x = [-b ± □ (b^2 - 4ac)] / 2a. For y = x^2 - 13x + 22, a=1, b=-13, c=22.

Are there any real zeros for the quadratic y = x^2 - 13x + 22?

Yes, since the discriminant (b^2 - 4ac) = (-13)^2 - 4122 = 169 - 88 = 81 is positive, the quadratic has two real zeros at x = 2 and x = 11.

Can the zeros of the quadratic function be complex?

In this case, no. Since the discriminant is positive, the zeros are real. If the discriminant were negative, the zeros would be complex conjugates.

How do the zeros relate to the graph of the quadratic function y = x^2 - 13x + 22?

The zeros are the x-intercepts of the parabola, where the graph crosses the x-axis at x = 2 and x = 11.

What is the significance of finding all zeros of a quadratic function?

Finding zeros helps identify where the function equals zero, which is useful for graphing, solving equations, and understanding the function's behavior.

Additional Resources

Find All The Zeros Of The Quadratic Function.y = x - 13x + 22

Introduction

Quadratic functions hold a central place in algebra and higher mathematics, serving as foundational tools for understanding a wide array of phenomena—from physics to economics. One fundamental aspect of quadratic functions is determining their zeros, or roots, which are the values of the variable that make the function equal to zero. In this detailed investigation, we explore the process of finding all zeros of the quadratic function:

\[y = x - 13x + 22 \]

This seemingly simple function offers a rich case study in algebraic manipulation, the application of the quadratic formula, and the interpretation of roots. Our goal is to systematically analyze the function, clarify the process of finding its zeros, and address potential pitfalls or misconceptions that might arise.

Understanding the Quadratic Function

The Given Function

Let's begin by examining the provided function:

$$ y = x - 13x + 22 $$

At first glance, the expression appears to involve linear terms, but the key is to simplify it into a standard quadratic form.

Simplification Process

Combine like terms:

$$ y = x - 13x + 22 $$
$$ y = (1x - 13x) + 22 $$
$$ y = -12x + 22 $$

This simplifies the function to:

$$ y = -12x + 22 $$

Is the Function Quadratic?

Given the simplified form, $y = -12x + 22$, the function is linear, not quadratic, because it has the form $y = mx + c$, where m and c are constants.

Important Observation: The initial expression, despite the title indicating a quadratic function, simplifies into a linear function. Therefore, the process of finding zeros corresponds to solving a linear equation, not a quadratic one.

Clarifying the Nature of the Function

Is it truly quadratic?

To confirm whether the original function was quadratic, let's revisit the initial expression:

$$ y = x - 13x + 22 $$

Suppose the original was intended as:

$$ y = x^2 - 13x + 22 $$

which is a classic quadratic form.

However, as given, with the terms $x - 13x$, it simplifies directly to a linear function.

Conclusion: The provided function is linear, and its zero can be found straightforwardly.

Finding the Zero of a Linear Function

Since the simplified function is:

$$ y = -12x + 22 $$

The zero (or root) is the value of x such that $y = 0$:

$$ 0 = -12x + 22 $$

Solving for x:

$$ -12x = -22 $$
$$ x = \frac{-22}{-12} $$
$$ x = \frac{22}{12} $$
$$ x = \frac{11}{6} $$

Answer: The zero of the function is at:

$$ x = \frac{11}{6} $$

Contextual Analysis: Why the Confusion?

Misinterpretation of the Function

The initial confusion arises because the title mentions "quadratic," while the expression provided simplifies into a linear function. This is a common source of misunderstanding in algebraic problems, especially when the notation or transcription isn't precise.

Possible Correction: The Original Function as a Quadratic

If the original function was intended as:

$$ y = x^2 - 13x + 22 $$

then the problem becomes a classic quadratic to analyze, requiring different methods such as factoring or applying the quadratic formula.

Investigating the Quadratic Scenario

Suppose the intended function was:

$$ y = x^2 - 13x + 22 $$

Let's explore how to find its zeros.

Method 1: Factoring

Find two numbers that multiply to 22 and add to -13:

- Factors of 22: (1, 22), (2, 11)
- Sum of factors to -13: For negative sum, both factors negative:

$$
-1 \times -22 = 22,\quad -1 + (-22) = -23 \quad (\not\ -13) \\
-2 \times -11 = 22,\quad -2 + (-11) = -13
$$

The pair -2 and -11 works.

Rewrite the quadratic as:

$$ y = x^2 - 2x - 11x + 22 $$

Group terms:

$$
(y) = (x^2 - 2x) + (-11x + 22)
$$

Factor each group:

$$
= x(x - 2) -11(x - 2)
$$

Factor out common term:

$$
= (x - 2)(x - 11)
$$

Set equal to zero:

$$
(x - 2)(x - 11) = 0
$$

Solutions:

$$
x = 2,\quad x = 11
$$

Roots: $x = 2$ and $x = 11$

Method 2: Quadratic Formula

Apply the quadratic formula:

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

Coefficients:

$$
a=1,\quad b=-13,\quad c=22
$$

Calculate discriminant:

$$
D = b^2 - 4ac = (-13)^2 - 4 \times 1 \times 22 = 169 - 88 = 81
$$

Since $D > 0$, two real roots exist:

$$
x = \frac{13 \pm \sqrt{81}}{2} = \frac{13 \pm 9}{2}
$$

Solutions:

$$
x = \frac{13 + 9}{2} = \frac{22}{2} = 11
$$

$$
x = \frac{13 - 9}{2} = \frac{4}{2} = 2
$$

Roots: 2 and 11, consistent with factoring.

Summary of Findings

Scenario	Function	Zeros	Method	Notes
Original	$y = x - 13x + 22$	$\frac{11}{6}$	Linear solving	Simplifies to linear $y = -12x + 22$
Corrected / Intended	$y = x^2 - 13x + 22$	$2, 11$	Factoring / Quadratic formula	Standard quadratic roots

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Broader Mathematical Implications

The Importance of Precise Expression

This case underscores the importance of precise mathematical notation. A small typo or misinterpretation can shift the entire nature of the problem—from linear to quadratic—and thus change the solution method.

Methodological Takeaways

- Linear equations are straightforward: isolate x by algebraic manipulation.
- Quadratic equations require factoring or the quadratic formula, with attention to the discriminant.
- Discriminant analysis informs us about the number and nature of roots:
- $D > 0$: Two real roots.
- $D = 0$: One real root (double root).
- $D < 0$: Complex roots.

Practical Applications and Educational Significance

Understanding how to find zeros of functions is vital across scientific fields. For example:

- In physics, roots can signify equilibrium points.
- In economics, they can represent breakeven points.
- In engineering, roots of characteristic equations determine system stability.

Teaching students to distinguish between linear and quadratic functions is fundamental, and this investigation exemplifies that clarity.

Conclusion

The process of finding all zeros of the function $y = x - 13x + 22$ reveals that the initial expression simplifies into a linear function, with a single zero at $x= \frac{11}{6}$. However, if the intended function was quadratic, namely $y = x^2 - 13x + 22$, the roots are $x=2$ and $x=11$. This exploration highlights the importance of careful interpretation, algebraic mastery, and the utility of multiple solution methods.

In summary:

- For the linear function: Zero at $x= \frac{11}{6}$.
- For the quadratic function (if intended): Zeros at $x=2$ and $x=11$.

Clarity in problem statement and thorough analysis are essential in mathematics to avoid misconceptions and to arrive at accurate conclusions.

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