Draw The Graph Of F(x) = (x 1)2 2. Start By Creating A Table Of Ordered Pairs For The Function. Then

Draw The Graph Of F(x) = (x - 1)^2 + 2. Start By Creating A Table Of Ordered Pairs For The Function. Then

Understanding how to graph quadratic functions is fundamental in algebra and helps visualize how the function behaves. In this article, we'll explore the process of graphing the function $f(x) = (x - 1)^2 + 2$, starting from creating a table of ordered pairs to sketching the parabola accurately. This step-by-step guide is ideal for students and educators aiming to deepen their understanding of quadratic functions.

Understanding the Function $f(x) = (x - 1)^2 + 2$

Before diving into graphing, it's essential to interpret the structure of the function:

- Form of the function: This is a quadratic function written in vertex form: $y = a(x - h)^2 + k$.
- Vertex form: The vertex of the parabola is at (h, k). For our function:
- $h = 1$
- $k = 2$
- Direction of the parabola: Since the coefficient of the squared term is positive (1), the parabola opens upward.
- Vertex: The lowest point on the graph is at $(1, 2)$.

Understanding these components provides a good starting point for plotting the graph.

Creating a Table of Ordered Pairs for $f(x) = (x - 1)^2 + 2$

To graph the function accurately, begin by selecting a range of x-values around the vertex and calculating the corresponding y-values.

Choosing x-values

Select x-values symmetrically around the vertex $x=1$ to observe the parabola's symmetry:

- $x = -1$
- $x = 0$
- $x = 1$
- $x = 2$
- $x = 3$
- $x = 4$

You can expand this list if you want a broader view or more detailed graph.

Calculating y-values

Use the function $f(x) = (x - 1)^2 + 2$ to compute corresponding y-values:

x-value	Calculation	y-value $f(x)$
-1	$(-1 - 1)^2 + 2 = (-2)^2 + 2 = 4 + 2$	6
0	$(0 - 1)^2 + 2 = (-1)^2 + 2 = 1 + 2$	3
1	$(1 - 1)^2 + 2 = 0 + 2 = 2$	2 (vertex point)
2	$(2 - 1)^2 + 2 = 1^2 + 2 = 1 + 2$	3
3	$(3 - 1)^2 + 2 = 2^2 + 2 = 4 + 2$	6
4	$(4 - 1)^2 + 2 = 3^2 + 2 = 9 + 2$	11

This table summarizes the key points you'll plot on your coordinate plane.

Plotting the Function on a Coordinate Plane

With the table of ordered pairs, proceed to plotting:

- Mark each point (x, y) on the coordinate plane.
- For example, plot $(-1, 6)$, $(0, 3)$, $(1, 2)$, $(2, 3)$, $(3, 6)$, and $(4, 11)$.

Notice the symmetry about the vertical line $x=1$, which passes through the vertex.

Drawing the Parabola

- Connect the points smoothly to form a U-shaped curve.
- Ensure the parabola opens upward, consistent with the positive coefficient.
- The vertex at $(1, 2)$ is the lowest point.

Key Features of the Graph

Understanding the features of the parabola helps interpret its behavior:

Vertex

- Located at $(1, 2)$.
- It is the minimum point of the function.

Axis of Symmetry

- The parabola is symmetric about the vertical line $x=1$.

Intercepts

- Y-intercept: When $x=0$, $y=3$. So, the y-intercept is at $(0, 3)$.
- X-intercepts (Roots): Find when $f(x) = 0$.
- $(x - 1)^2 + 2 = 0$
- $(x - 1)^2 = -2$ (which has no real solutions)
- Conclusion: The graph does not cross the x-axis.

Additional Tips for Graphing Quadratic Functions

To enhance your graphing skills, consider these tips:

- **Plot more points:** Choosing additional x-values (like -2 or 5) can produce a more accurate graph.
- **Identify symmetry:** Use the axis of symmetry to mirror points on either side of the vertex.
- **Use technology:** Graphing calculators or software can verify your manual plots.
- **Understand transformations:** Recognize how shifts, stretches, and reflections affect the base parabola $y = x^2$.

Transformations and the Standard Parabola $y = x^2$

The given function $f(x) = (x - 1)^2 + 2$ is a transformation of the basic parabola:

- Horizontal shift: 1 unit to the right (due to $x - 1$)
- Vertical shift: 2 units upward (due to +2)
- No reflection or stretch: Since the coefficient of the squared term is 1, the parabola has the same "width" as $y = x^2$.

Understanding these transformations helps in graphing similar functions efficiently.

Summary

Graphing $f(x) = (x - 1)^2 + 2$ involves a systematic approach:

- Recognize the vertex form and identify key features.
- Create a table of ordered pairs around the vertex.
- Plot the points carefully, noting symmetry.
- Draw a smooth, upward-opening parabola passing through the points.
- Analyze the features such as vertex, axis of symmetry, and intercepts.

By practicing these steps and understanding the underlying transformations, you'll be able to graph quadratic functions accurately and interpret their graphs effectively.

Conclusion

Mastering the process of graphing quadratic functions like $f(x) = (x - 1)^2 + 2$ enhances your algebraic skills and visual understanding of parabola behavior. Remember to start with identifying key features, create a detailed table of points, and then connect these points smoothly on the coordinate plane. With practice, graphing becomes an intuitive skill that supports further studies in mathematics, including calculus, functions, and analysis.

If you'd like more detailed examples, tips on graphing transformations, or practice exercises, feel free to ask!

Frequently Asked Questions

How do I create a table of ordered pairs for the function F(x) = (x - 1)^2?

To create a table, choose a range of x-values (e.g., x = 0, 1, 2, 3, 4), then substitute each into F(x) = (x - 1)^2 to find corresponding y-values. For example, when x=0, F(0)=(0-1)^2=1; when x=1, F(1)=(1-1)^2=0, and so on.

What are the key features of the graph of F(x) = (x - 1)^2?

The graph is a parabola opening upwards with its vertex at (1, 0). The vertex is the minimum point, and the parabola is symmetric about the vertical line x=1.

How can I sketch the graph after creating the table of points?

Plot the ordered pairs from your table on a coordinate plane, then draw a smooth curve passing through these points, ensuring the parabola opens upward with the vertex at (1,0).

What is the significance of the vertex in the graph of F(x) = (x - 1)^2?

The vertex represents the minimum point of the parabola at (1, 0), indicating the lowest value of the function, which occurs when x=1.

How does shifting the basic parabola y = x^2 affect its graph in F(x) = (x - 1)^2?

The subtraction of 1 inside the function shifts the basic parabola y = x^2 horizontally to the right by 1 unit, relocating the vertex from (0,0) to (1,0).

Additional Resources

Draw The Graph Of F(x) = (x + 1)^2 – 2 — this is a fundamental task in algebra and coordinate geometry that helps students and enthusiasts visualize quadratic functions. Graphing such functions not only enhances understanding of their behavior but also provides insights into their properties such as vertices, axes of symmetry, and intercepts. In this comprehensive guide, we will explore the step-by-step process of drawing the graph of F(x) = (x + 1)^2 – 2, starting with creating a table of ordered pairs, analyzing key features, and finally sketching the graph with clarity and precision.

Understanding the Function F(x) = (x + 1)^2 – 2

Before diving into graphing, it’s essential to understand the structure and characteristics of the function:

- Type of function: Quadratic function, represented in vertex form.
- Standard form: $y = a(x-h)^2 + k$, where (h, k) is the vertex.
- Vertex: The point $(-1, -2)$ — derived from the form $(x + 1)^2 - 2$.

This form makes it straightforward to identify transformations from the parent function $y = x^2$. Specifically, the graph of $y = x^2$ shifts 1 unit left (due to $+1$ inside the squared term) and 2 units down (due to -2).

Creating a Table of Ordered Pairs for F(x)

To accurately sketch the graph, start by selecting a range of x-values around the vertex and computing the corresponding y-values. Here’s a systematic approach:

Step 1: Choose x-values

Select x-values around the vertex -1 to capture the parabola’s shape:

- x = -4, -3, -2, -1, 0, 1, 2, 3, 4

Step 2: Compute corresponding y-values

Calculate $F(x) = (x + 1)^2 - 2$:

x	$x + 1$	$(x + 1)^2$	$F(x) = (x + 1)^2 - 2$
-4	-3	9	9 - 2 = 7
-3	-2	4	4 - 2 = 2
-2	-1	1	1 - 2 = -1
-1	0	0	0 - 2 = -2 (vertex point)
0	1	1	1 - 2 = -1
1	2	4	4 - 2 = 2
2	3	9	9 - 2 = 7
3	4	16	16 - 2 = 14
4	5	25	25 - 2 = 23

Step 3: Plot the points

Using the table, plot these ordered pairs:

- (-4, 7)
- (-3, 2)
- (-2, -1)
- (-1, -2) (vertex)
- (0, -1)
- (1, 2)
- (2, 7)
- (3, 14)
- (4, 23)

This set of points provides a clear view of the parabola's shape, with the vertex at $(-1, -2)$ being the lowest point.

Analyzing Key Features of the Graph

Understanding the features of the parabola aids in accurate sketching and interpretation:

1. Vertex

- Located at $(-1, -2)$, which is the minimum point for this parabola.
- Indicates the axis of symmetry passes through $x = -1$.

2. Axis of Symmetry

- The vertical line $x = -1$.
- It divides the parabola into mirror-image halves.

3. Intercepts

- Y-intercept: When $x = 0$, $F(0) = -1$. So, the y-intercept is $(0, -1)$.
- X-intercepts: Find x-values where $F(x) = 0$:

$(x + 1)^2 - 2 = 0$

$(x + 1)^2 = 2$

$x + 1 = \pm \sqrt{2}$

$x = -1 \pm \sqrt{2}$

Approximate:

- $x \approx -1 + 1.414 = 0.414$
- $x \approx -1 - 1.414 = -2.414$

So, x-intercepts are roughly at $(0.414, 0)$ and $(-2.414, 0)$.

4. Direction of Opening

- Since the coefficient of the squared term is positive ($+1$), the parabola opens upward.

5. Range and Domain

- Domain: All real numbers $(-\infty, \infty)$.
- Range: $y \geq -2$, with the minimum at $y = -2$.

Sketching the Graph

Using the plotted points and the features identified, you can now sketch the graph:

Step 1: Draw the axes

- Label the x-axis and y-axis.
- Mark the vertex at $(-1, -2)$.

Step 2: Plot the key points

- Plot the vertex $(-1, -2)$.
- Plot intercepts:
- Y-intercept at $(0, -1)$.
- X-intercepts approximately at $(0.414, 0)$ and $(-2.414, 0)$.
- Plot additional points from the table for accuracy.

Step 3: Draw the parabola

- Connect the points with a smooth, symmetric curve.
- Ensure the parabola opens upward.
- Confirm symmetry about $x = -1$.

Step 4: Add details

- Label key points.
- Indicate the axis of symmetry.
- Shade or highlight the vertex and intercepts.

Features and Insights from the Graph

Once the graph is complete, analyze it for deeper understanding:

- The vertex at $(-1, -2)$ indicates the minimum value of the function.
- The parabola is symmetric about the line $x = -1$.
- The y-intercept confirms the point $(0, -1)$.
- The x-intercepts at approximately $(0.414, 0)$ and $(-2.414, 0)$ show where the graph crosses the x-axis.
- As x moves away from -1, $F(x)$ increases rapidly, indicating the parabola's arms extend infinitely upward.

Pros and Cons of Graphing Using a Table of Points

Pros:

- Provides an accurate visual representation when enough points are plotted.
- Helps in understanding the shape and key features of the parabola.
- Useful for functions with transformations, as in this case.

Cons:

- Time-consuming for complex functions or when high precision is needed.
- Limited by the number of points; too few points may misrepresent the shape.
- Requires careful calculation and plotting to avoid errors.

Features and Variations in Graphing Quadratic Functions

Beyond this specific example, understanding how to graph quadratic functions can be generalized:

- Vertex form simplifies plotting by directly revealing the vertex and transformations.
- Standard form requires completing the square or using the quadratic formula to find intercepts.
- Factored form (if applicable) makes it straightforward to find roots.

Depending on the form, different strategies—like completing the square or using calculus—may be employed for more advanced analysis.

Conclusion

Drawing the graph of \(F(x) = (x + 1)^2 – 2 \) exemplifies the foundational skills in algebraic graphing, emphasizing the importance of creating a table of values, analyzing key features, and translating data into a visual format. By carefully selecting x-values, computing corresponding y-values, and understanding the symmetry and intercepts, one can accurately sketch the parabola and interpret its properties. This process not only solidifies comprehension of quadratic functions and their transformations but also enhances problem-solving and analytical skills vital in mathematics. Whether for educational purposes or practical applications, mastering the art of graphing quadratic functions is a cornerstone of algebraic literacy.

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