On The Same Coordinate Plane, Mark All Points (x,y) Such That (A) Y=x-2, (B) Y=-x-2, (C) Y=|x|-2

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This exercise involves exploring the graphs of three different equations on the same coordinate plane. Each equation represents a distinct geometric figure—a line or a V-shaped graph—whose points satisfy the given relations between x and y. By plotting these points accurately, we can better understand their slopes, intercepts, and overall shapes. Visualizing these graphs side by side reveals interesting relationships, intersections, and symmetry properties, making this a fundamental exercise in understanding linear and absolute value functions.

Understanding the Equations and Their Graphs

Equation (A): y = x - 2

This is a linear equation with a slope of 1 and a y-intercept at (0, -2). The line rises one unit vertically for each unit moved horizontally to the right. The key features include:

- Y-intercept: (0, -2)
- Slope: 1 (indicating a 45-degree angle with the x-axis)
- X-intercept: Set y = 0, then 0 = x - 2 → x = 2, so (2, 0)

Plotting the two points (0, -2) and (2, 0) and drawing a straight line through them gives the graph of y = x - 2.

Equation (B): y = -x - 2

This is another linear equation but with a negative slope of -1 and the same y-intercept at (0, -2). Its features include:

- Y-intercept: (0, -2)
- Slope: -1 (indicating the line falls one unit vertically for each unit moved horizontally to the right)
- X-intercept: Set y = 0, then 0 = -x - 2 → x = -2, so (-2, 0)

Plotting points (0, -2) and (-2, 0) and drawing the line through them will give the graph of y = -x - 2.

Equation (C): y = |x| - 2

This is an absolute value function, creating a "V" shape that opens upwards, shifted downward by 2 units. Its features include:

- Vertex: The point where the absolute value expression is zero: |x| = 0 → x = 0, y = -2, so the vertex is at (0, -2).
- Shape: Two linear segments meeting at the vertex.
- For x ≥ 0: y = x - 2
- For x ≤ 0: y = -x - 2

Plotting the points for different x-values will help visualize the V shape.

Plotting the Points Step-by-Step

Plotting Equation (A): y = x - 2

Choose some x-values to find corresponding y-values:

1. At x = 0: y = 0 - 2 = -2 → (0, -2)
2. At x = 2: y = 2 - 2 = 0 → (2, 0)
3. At x = -2: y = -2 - 2 = -4 → (-2, -4)
4. At x = 4: y = 4 - 2 = 2 → (4, 2)

Plot these points and draw a straight line passing through them, extending in both directions.

Plotting Equation (B): $y = -x - 2$

Choose some x-values:

1. At $x = 0$: $y = -0 - 2 = -2 \rightarrow (0, -2)$
2. At $x = -2$: $y = -(-2) - 2 = 2 - 2 = 0 \rightarrow (-2, 0)$
3. At $x = 2$: $y = -2 - 2 = -4 \rightarrow (2, -4)$
4. At $x = -4$: $y = -(-4) - 2 = 4 - 2 = 2 \rightarrow (-4, 2)$

Plot these points and connect with a straight line.

Plotting Equation (C): $y = |x| - 2$

Choose x-values:

1. At $x = 0$: $y = 0 - 2 = -2 \rightarrow (0, -2)$
2. At $x = 2$: $y = 2 - 2 = 0 \rightarrow (2, 0)$
3. At $x = -2$: $y = 2 - 2 = 0 \rightarrow (-2, 0)$
4. At $x = 4$: $y = 4 - 2 = 2 \rightarrow (4, 2)$
5. At $x = -4$: $y = 4 - 2 = 2 \rightarrow (-4, 2)$

The graph consists of two lines:

- For $x \geq 0$: $y = x - 2$
- For $x \leq 0$: $y = -x - 2$

These meet at the vertex $(0, -2)$.

Visualizing the Graphs on the Same Plane

Drawing the Lines and V-Shape

Begin by plotting the key points identified above:

- For y = x - 2:
- (0, -2)
- (2, 0)
- (-2, -4)
- (4, 2)
- For y = -x - 2:
- (0, -2)
- (-2, 0)
- (2, -4)
- (-4, 2)
- For y = |x| - 2:
- (0, -2)
- (2, 0)
- (-2, 0)
- (4, 2)
- (-4, 2)

Plot these points on the coordinate plane. Notice that the lines y = x - 2 and y = -x - 2 both pass through the point (0, -2), which is the vertex of the absolute value graph.

Analyzing the Relationships Between the Graphs

- The lines y = x - 2 and y = -x - 2 are symmetric with respect to the y-axis.
- Both pass through the point (0, -2), which also lies on y = |x| - 2.
- The absolute value graph forms a "V" with its vertex at (0, -2), opening upward.
- The lines y = x - 2 and y = -x - 2 are straight, with slopes of 1 and -1 respectively, intersecting at (0, -2).

Finding Intersection Points

Intersection of $y = x - 2$ and $y = -x - 2$

Set the equations equal:

$x - 2 = -x - 2$

Solve for x:

$x + x = -2 + 2$

$2x = 0$

$x = 0$

Find y:

$y = x - 2 = 0 - 2 = -2$

Intersection point: $(0, -2)$

This point is also on $y = |x| - 2$.

Intersection of $y = x - 2$ and $y = |x| - 2$

- For $x \geq 0$:

$y = x - 2$ and $y = x - 2$ (since $|x| = x$)

They coincide; thus, for $x \geq 0$, the line $y = x - 2$ overlaps with the right arm of the V-shaped graph.

- For $x \leq 0$:

$y = x - 2$ and $y = -x - 2$ (since $|x| = -x$)

Set equal:

$x - 2 = -x - 2$

$x + x = -2 + 2$

$2x = 0 \rightarrow x = 0$

At $x = 0$, $y = -2$

So, the lines intersect at (0, -2).

Similarly, the line $y = -x - 2$ overlaps with the left arm of the V for $x \leq 0$.

Conclusion: The lines $y = x - 2$ and $y = -x - 2$ intersect at the vertex (0, -2), which is also the vertex of the absolute value graph.

Summary and Geometric Insights

- The graph of $y = x - 2$ is a straight line with positive slope, crossing the y-axis at (0, -2).
- The graph of $y = -x - 2$ is a straight line with negative slope, crossing the y-axis at (0, -2).
- Both lines intersect at the point (0, -2), which is the vertex of the V-shaped graph y

Frequently Asked Questions

How can I identify the points that satisfy the equation y = x - 2 on the coordinate plane?

To find points satisfying $y = x - 2$, choose various x-values, calculate y using the equation, and plot the points (x, y). All points lying on the line $y = x - 2$ are those where y equals x minus 2. For example, at $x=0$, $y=-2$; at $x=2$, $y=0$.

What is the geometric representation of the equation y = -x - 2 on the coordinate plane?

The equation $y = -x - 2$ represents a straight line with slope -1 and y-intercept at -2. It slopes downward from left to right, crossing the y-axis at (0, -2). To plot points, pick values for x, calculate y, and mark those points.

How do I graph the graph of $y = |x| - 2$ on the coordinate plane?

The graph of $y = |x| - 2$ is a V-shaped graph centered at the origin, shifted down by 2 units. To plot, evaluate y for various x-values: for $x \geq 0$, $y = x - 2$; for $x < 0$, $y = -x - 2$. Plot these points and connect them to form the V shape.

Which points satisfy both $y = x - 2$ and $y = -x - 2$ simultaneously?

Points satisfying both equations are where the lines intersect. Set $x - 2 = -x - 2$, which simplifies to $2x = 0$, so $x=0$. Substitute $x=0$ into either equation: $y=-2$. Thus, the intersection point is $(0, -2)$.

Are there points common to all three graphs $y = x - 2$, $y = -x - 2$, and $y = |x| - 2$?

Yes. The point $(0, -2)$ lies on all three graphs. For $y = x - 2$ and $y = -x - 2$, intersection is at $(0, -2)$. For $y = |x| - 2$, substituting $x=0$ yields $y = 0 - 2 = -2$, confirming the point is on all three.

How can I distinguish between the graphs of $y = x - 2$, $y = -x - 2$, and $y = |x| - 2$ visually?

$Y = x - 2$ and $y = -x - 2$ are straight lines with slopes 1 and -1, crossing at $(0, -2)$. The graph $y = |x| - 2$ is a V-shape with its vertex at $(0, -2)$. The key visual difference is that $|x|$ creates a 'V', while the other two are straight lines.

Additional Resources

On The Same Coordinate Plane, Mark All Points (x,y) Such That (A) Y=x-2, (B) Y=-x-2, (C) Y=|x|-2

Understanding the geometric representation of algebraic equations is fundamental in both mathematics education and practical applications such as engineering, physics, and computer graphics. When working on the Cartesian coordinate plane, plotting different functions provides visual insight into their behavior, properties, and relationships. This article explores three specific equations—$Y = x - 2$, $Y = -x - 2$, and $Y = |x| - 2$—by analyzing their graphs, characteristics, and how to accurately mark all points that satisfy each equation on the same coordinate plane.

Introduction to the Equations and Their Significance

Before diving into the plotting process, it's essential to understand what each equation represents and why studying them collectively is meaningful.

- Y = x - 2: A linear function with a slope of 1 and a y-intercept at -2. Its graph is a straight line rising diagonally, indicating a consistent rate of change.

- Y = -x - 2: Another linear function, but with a slope of -1, creating a line that descends diagonally, crossing the y-axis at -2.

- Y = |x| - 2: An absolute value function, forming a "V" shape that opens upward, shifted downward by 2 units.

Plotting all three on the same coordinate plane allows us to compare their slopes, intercepts, and overall shape, revealing relationships and intersections that can deepen understanding of piecewise functions and their graphing.

Understanding Each Equation's Graph

1. Graphing Y = x - 2

This is a linear function characterized by a slope of 1 and a y-intercept at (0, -2).

- Slope (m): 1, indicating that for every 1 unit increase in x, y increases by 1.

- Y-intercept: (-0, -2), the point where the line crosses the y-axis.

Plotting Steps:

1. Identify the y-intercept at (0, -2) and mark it on the plane.

2. Use the slope to find a second point: from (0, -2), move right 1 unit (x=1), then up 1 unit to y= -1. Mark (1, -1).

3. Connect these points with a straight line extending in both directions.

Characteristics:

- The line passes through quadrants II and IV.

- It has a positive, constant slope, so it rises from left to right.

2. Graphing Y = -x - 2

This is also linear but with a negative slope of -1 and the same y-intercept at (0, -2).

- Slope: -1, meaning as x increases, y decreases.

- Y-intercept: (0, -2).

Plotting Steps:

1. Mark the point (0, -2).

2. For a second point, from (0, -2), move right 1 unit (x=1), then down 1 unit to y= -3, marking (1, -3).

3. Draw a straight line through these points.

Characteristics:

- The line descends from left to right, crossing quadrants II and IV, but in a downward slope.

- It is the mirror image of the first line across the y-axis.

3. Graphing Y = |x| - 2

This absolute value function creates a "V" shape.

- Vertex: At the point where the expression inside the absolute value is zero, i.e., x=0. The y-coordinate is -2, so the vertex is at (0, -2).

- Shape: The graph opens upward, with two linear “arms” extending in both directions.

Plotting Steps:

1. Mark the vertex at (0, -2).

2. For x > 0:

- When x=1, y=|1|-2=1-2=-1.

- When x=2, y=2-2=0.

3. For $x < 0$:

- When $x=-1$, $y=|-1|-2=1-2=-1$.

- When $x=-2$, $y=2-2=0$.

4. Plot these points: (-2, 0), (-1, -1), (0, -2), (1, -1), (2, 0).

5. Connect these points with straight lines forming a "V" shape.

Characteristics:

- The vertex at (0, -2) acts as the minimum point.

- The arms are symmetric about the y-axis.

Plotting All Points on the Same Coordinate Plane

Having understood each graph individually, the next step involves plotting all three simultaneously. This process helps visualize their intersections, relative positions, and the nature of their solutions.

Step-by-Step Approach:

1. Draw the coordinate axes, labeling units clearly.

2. Plot the line $Y = x - 2$:

- Mark points at (0, -2) and (1, -1).

- Draw a straight line through these points, extending across the plane.

3. Plot the line $Y = -x - 2$:

- Mark points at (0, -2) and (1, -3).

- Draw this line intersecting the first line at some points.

4. Plot the absolute value graph $Y = |x| - 2$:

- Mark points at (-2, 0), (-1, -1), (0, -2), (1, -1), and (2, 0).

- Connect these points with straight lines to form the "V".

Analyzing Intersections:

Once all points are plotted, examine where the graphs intersect:

- Line $Y = x - 2$ and $Y = -x - 2$: Find their intersection point(s):

Set $x - 2 = -x - 2$

$x + x = 0$

$2x=0$

$x=0$

Substitute $x=0$ into one of the lines:

$y=0-2= -2$

Intersection at $(0, -2)$.

- Line $Y = x - 2$ and $Y = |x| - 2$:

For $x \geq 0$:

- $Y = x - 2$

- $Y= x - 2$

- $Y= x - 2$

- $Y= |x| - 2= x - 2$

They are the same line for $x \geq 0$, so they intersect along the entire arm where $x \geq 0$.

For $x \leq 0$:

- $Y= x - 2$

- $Y= -x - 2$

- $Y= |x| - 2= -x - 2$

- The line $Y = x - 2$ and the arm of the absolute value graph for $x \leq 0$ intersect only at $x=-2$:

At $x=-2$:

$Y = -2 - 2 = -4$

$Y = |-2| - 2 = 2 - 2 = 0$ (No match). So, they intersect only at the vertex (0, -2).

- Line $Y = -x - 2$ and $Y = |x| - 2$:

For $x \geq 0$:

- $Y = -x - 2$

- $Y = x - 2$

- Set equal: $-x - 2 = x - 2$

- $-x - 2 = x - 2$

- Add x to both sides: $-2 = 2x - 2$

- Add 2: $0 = 2x$

- $x = 0$

At $x=0$, $Y = -0 - 2 = -2$, matching the vertex.

For $x \leq 0$:

- $Y = -x - 2$

- $Y = -x - 2$

- They are identical, so they intersect along the arm extending to negative x.

Summary of key points:

- The lines $Y=x-2$ and $Y=-x-2$ intersect at (0, -2).

- The absolute value graph shares the vertex at (0, -2) with both lines.

- The positive arm of the absolute value graph coincides with $Y = x - 2$ for $x \geq 0$.

- The negative arm of the absolute value graph coincides with Y= -x - 2 for x ≤ 0.

Visual Implication:

Plotting all three functions on the same plane reveals that:

- All three graphs intersect at the point (0, -2).

- The two linear functions are mirror images across the y-axis, crossing at the vertex.

- The absolute value graph forms a "V" with its vertex at the same intersection point, enveloping parts of both lines.

Practical Applications and Educational Value

This exercise isn't merely about graphing; it offers insight into the behavior of linear and absolute value functions. Recognizing points of intersection helps in solving systems of equations, which is fundamental in fields like physics for equilibrium analysis, economics for cost-profit models, and engineering for system design.

From an educational standpoint, visualizing these functions enhances

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