

# 2.1 Linear Functions: Problem 2 If Possible Write The Following Equation In Slope-intercept Form. $3x+13y+18=0$

## 2.1 Linear Functions: Problem 2 If Possible Write The Following Equation In Slope-intercept Form. $3x+13y+18=0$

Understanding linear functions is fundamental in algebra, especially when it comes to analyzing relationships between variables and graphing equations. In this article, we will explore how to convert the given equation,  $3x+13y+18=0$ , into slope-intercept form. We will step through the process carefully, discuss the importance of slope-intercept form, and provide tips for solving similar problems efficiently. Whether you're a student brushing up on algebraic skills or someone seeking to deepen your understanding of linear functions, this guide offers comprehensive insights.

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## What Is a Linear Function?

Before diving into the specific problem, it is crucial to understand what a linear function entails.

### Definition of a Linear Function

A linear function is a function that models a straight line when graphed on a coordinate plane. Its general form is:

$$y = mx + b$$

where:

- $y$  represents the dependent variable,
- $x$  is the independent variable,
- $m$  is the slope of the line (how steep it is),
- $b$  is the y-intercept (where the line crosses the y-axis).

Linear functions are characterized by their constant rate of change, which is the slope.

### Importance of Slope-Intercept Form

The slope-intercept form is especially useful because:

- It immediately reveals the slope ( $m$ ) and y-intercept ( $b$ ).
- It makes graphing straightforward.
- It simplifies solving for specific points on the line.

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## Understanding the Given Equation

The original equation provided is:

$$\backslash[ 3x13y + 18 = 0 \backslash]$$

At first glance, it appears there might be a typo or formatting issue, as the term  $3x13y$  is unusual. It could be interpreted as:

- $3x + 13y$ , or
- $3x \ 13y$ , which is a product.

Given the context of linear equations and standard forms, the most plausible interpretation is:

$$\backslash[ 3x + 13y + 18 = 0 \backslash]$$

This is a common linear equation structure. Let's proceed with this assumption.

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## Converting the Equation to Slope-Intercept Form

The goal is to rewrite the equation in the form:

$$\backslash[ y = mx + b \backslash]$$

which is, the slope-intercept form.

### Step 1: Write the Equation Clearly

Assuming the equation:

$$\backslash[ 3x + 13y + 18 = 0 \backslash]$$

is the correct form, we will work with this.

### Step 2: Isolate $( y )$ on one side

Subtract  $( 3x )$  and 18 from both sides:

$$\backslash[ 13y = -3x - 18 \backslash]$$

## Step 3: Solve for $y$

Divide every term by 13:

$$y = \frac{-3x - 18}{13}$$

which simplifies to:

$$y = -\frac{3}{13}x - \frac{18}{13}$$

Now, the equation is in slope-intercept form:

$$y = mx + b$$

where:

- $m = -\frac{3}{13}$  (the slope),
- $b = -\frac{18}{13}$  (the y-intercept).

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## Interpreting the Slope and Y-Intercept

Understanding the components of the slope-intercept form helps in graphing and analyzing the linear function.

### Slope ( $m$ )

- The slope is  $-\frac{3}{13}$ .
- It indicates that for every increase of 13 units in  $x$ ,  $y$  decreases by 3 units.
- The negative sign shows the line slopes downward from left to right.

### Y-Intercept ( $b$ )

- The y-intercept is  $-\frac{18}{13}$ , approximately  $-1.385$ .
- This is the point where the line crosses the y-axis (at  $x = 0$ ,  $y = -\frac{18}{13}$ ).

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## Graphing the Linear Equation

Graphing a linear function provides visual insight into its behavior.

## Steps to Graph the Equation:

1. Plot the y-intercept: at  $(0, -\frac{18}{13})$ .
2. Use the slope to find a second point:
  - From  $(0, -\frac{18}{13})$ , move right 13 units (increase  $x$  by 13).
  - Move down 3 units (decrease  $y$  by 3).
  - The second point is  $(13, -\frac{18}{13} - 3)$ .
3. Draw a straight line through these points.

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## Applications of Linear Functions

Linear functions are essential in various fields:

- Economics: calculating costs and revenues.
- Physics: modeling constant velocity.
- Biology: growth rates.
- Everyday life: budgeting, distance-time calculations.

Understanding how to convert equations into slope-intercept form enhances problem-solving skills and enables accurate graphing.

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## Common Mistakes and Tips for Solving Linear Equations

When working with linear equations, keep these tips in mind:

- Always check the original equation for typos or formatting issues.
- Isolate  $y$  carefully, performing the same operation on both sides.
- Simplify fractions where possible for easier graphing.
- Remember that the slope is the coefficient of  $x$  after rearrangement.
- Confirm your final equation makes sense by plugging in values to verify points.

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## Conclusion

Converting the given equation  $3x + 13y + 18 = 0$  into slope-intercept form yields:

$$y = -\frac{3}{13}x - \frac{18}{13}$$

This form clearly reveals the slope and y-intercept, facilitating graphing and interpretation of the

linear function. Mastering this conversion process is fundamental in algebra, enabling students and professionals alike to analyze linear relationships effectively.

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## Further Practice and Resources

To reinforce your understanding:

- Practice converting different linear equations into slope-intercept form.
- Explore graphing lines using various slopes and intercepts.
- Use online graphing calculators for visualization.

Recommended resources:

- Khan Academy Algebra Courses
- Desmos Graphing Calculator
- Algebra textbooks for practice exercises

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By understanding the process of rewriting equations into slope-intercept form and interpreting their components, learners can confidently analyze and graph linear functions, laying a strong foundation for advanced mathematical concepts.

## Frequently Asked Questions

### What is the goal when rewriting the equation $3x + 13y + 18 = 0$ in slope-intercept form?

The goal is to solve for  $y$  to express the equation in the form  $y = mx + b$ , which shows the slope and  $y$ -intercept clearly.

### How do I isolate $y$ in the equation $3x + 13y + 18 = 0$ ?

Subtract  $3x$  and  $18$  from both sides to get  $13y = -3x - 18$ , then divide both sides by  $13$  to solve for  $y$ .

### What is the slope-intercept form of the equation $3x + 13y + 18 = 0$ ?

$$y = -\frac{1}{13}x - \frac{18}{13}$$

This is obtained by dividing each term by  $13$ :  $13y = -3x - 18$ , then  $y = -\frac{3}{13}x - \frac{18}{13}$ .

### How do I identify the slope and $y$ -intercept from the equation

**$$y = -3/13 x - 18/13?$$**

The slope (m) is  $-3/13$ , and the y-intercept (b) is  $-18/13$ .

**Is it possible to write the equation  $3x + 13y + 18 = 0$  in slope-intercept form?**

Yes, it is possible by solving for y, resulting in  $y = -3/13 x - 18/13$ .

**What steps are involved in converting  $3x + 13y + 18 = 0$  to slope-intercept form?**

First, subtract  $3x$  and  $18$  from both sides, then divide each term by  $13$  to solve for y.

**Could the equation  $3x + 13y + 18 = 0$  be written in any other form?**

Yes, it can also be written in standard form ( $Ax + By = C$ ), which is  $3x + 13y = -18$ .

**What is the significance of the slope in the slope-intercept form of a line?**

The slope indicates the steepness and direction of the line; in this case,  $-3/13$  means the line decreases as x increases.

**How can understanding the slope-intercept form help in graphing the line  $3x + 13y + 18 = 0$ ?**

Knowing the slope and y-intercept makes it easier to plot the line quickly and accurately on a graph.

**Are there any common mistakes to avoid when converting the given equation to slope-intercept form?**

Yes, be careful to correctly divide each term by  $13$  and to properly handle negative signs to ensure an accurate slope and intercept.

## **Additional Resources**

Linear Functions

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# Understanding the Fundamentals of Linear Functions

In the realm of algebra and mathematics at large, linear functions hold a fundamental position, serving as the building blocks for understanding relationships between variables. They are straightforward, predictable, and form the basis for more complex functions and models used across sciences, economics, engineering, and everyday problem-solving.

A linear function can typically be expressed in various forms, with the slope-intercept form being one of the most common and user-friendly representations. This article will explore the process of converting a given linear equation into its slope-intercept form, focusing specifically on the problem:

$$3x + 13y + 18 = 0$$

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## What Is a Linear Function?

A linear function in two variables,  $(x)$  and  $(y)$ , is a function that graphs as a straight line on the coordinate plane. Its general form can be written as:

$$y = mx + b$$

where:

- $(m)$  is the slope of the line, indicating its steepness and direction.
- $(b)$  is the y-intercept, the point where the line crosses the y-axis.

This form is particularly useful because it directly provides information about the slope and intercept, allowing for quick graphing and analysis.

Key features of linear functions:

- Constant rate of change: The rate at which  $(y)$  changes with respect to  $(x)$  remains constant.
- Straight-line graph: The visual representation is always a straight line.
- Algebraic simplicity: Easy to manipulate and interpret.

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## Converting the Equation to Slope-Intercept Form

The problem at hand involves transforming the given equation:

$$3x + 13y + 18 = 0$$

into the slope-intercept form:

$$y = mx + b$$

This process involves solving for  $y$ , isolating it on one side of the equation. Let's dissect each step meticulously.

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## Step 1: Write Down the Original Equation

The original linear equation is:

$$3x + 13y + 18 = 0$$

Our goal is to express this in the form  $y = mx + b$ .

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## Step 2: Isolate the $y$ Term

To do this, we first move all terms that do not contain  $y$  to the other side:

$$13y = -3x - 18$$

This step involves subtracting  $(3x + 18)$  from both sides, maintaining the equality:

$$3x + 13y + 18 - 3x - 18 = 0 - 3x - 18$$

Simplifies to:

$$13y = -3x - 18$$

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### Step 3: Divide Both Sides by the Coefficient of $y$

Since the coefficient of  $y$  is 13, divide every term by 13 to solve for  $y$ :

$$y = \frac{-3x - 18}{13}$$

This can be separated into two fractions:

$$y = \frac{-3x}{13} - \frac{18}{13}$$

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### Step 4: Write the Equation in Slope-Intercept Form

Now, the equation is:

$$y = -\frac{3}{13}x - \frac{18}{13}$$

This is the slope-intercept form, where:

- The slope  $(m = -\frac{3}{13})$
- The y-intercept  $(b = -\frac{18}{13})$

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## Interpreting the Slope-Intercept Form

Having successfully converted the equation, it's important to interpret each component and understand what it reveals about the line.

The Slope  $(m = -\frac{3}{13})$

The slope indicates that for every increase of 1 unit in  $x$ ,  $y$  decreases by  $(\frac{3}{13})$ . The negative sign shows that the line slopes downward from left to right, a characteristic of negative correlation between the variables.

Implications of the slope:

- The line is relatively gentle, as the absolute value is less than 1.
- The rate of change is consistent, affirming the linearity of the function.

The Y-Intercept ( $b = -\frac{18}{13}$ )

This value tells us where the line crosses the y-axis. Numerically,  $-\frac{18}{13} \approx -1.38$ .

Significance:

- The line crosses the y-axis slightly below the origin.
- This point can be plotted for a complete graph, aiding visualization.

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## Graphing the Line: Practical Application

Understanding how to graph the line based on the slope-intercept form is crucial for visual comprehension.

Steps to graph:

1. Plot the y-intercept  $(0, -\frac{18}{13})$ .
2. Use the slope  $-\frac{3}{13}$  to find another point:
  - From  $(0, -\frac{18}{13})$ , move 13 units right (positive x-direction) and 3 units down (negative y-direction).
  - This new point will be  $(13, -\frac{18}{13} - 3) = (13, -\frac{18}{13} - \frac{39}{13}) = (13, -\frac{57}{13})$ .
3. Draw the line through these points.

This process exemplifies how the slope-intercept form simplifies the graphing process, making it accessible even for those new to algebra.

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## Additional Insights and Applications

Why Is the Slope-Intercept Form Important?

- Ease of interpretation: Easily identify the slope and intercept.
- Graphing efficiency: Quick plotting based on known points.
- Predictive modeling: Useful in scenarios where relationships are linear, such as economics, physics, and social sciences.

Common Uses of Linear Functions:

- Calculating profit versus cost.
- Estimating distances over time.
- Modeling physical phenomena like speed or acceleration.
- Analyzing trends in data.

Common Challenges and Clarifications:

- Always check if the equation is in standard form before converting.

- Be cautious with signs during algebraic manipulations.
- Understand that the slope can be a rational number, as in this case, which affects how you interpret the steepness.

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## Summary and Final Remarks

Converting the equation  $(3x + 13y + 18 = 0)$  into slope-intercept form reveals the underlying structure of the line it represents. The process underscores the importance of algebraic manipulation skills, such as isolating variables and simplifying fractions.

The resulting form:

$$y = -\frac{3}{13}x - \frac{18}{13}$$

provides immediate insights into the behavior of the line, including its slope and y-intercept, facilitating graphing and interpretation. Mastery of this transformation enhances one's ability to analyze linear relationships comprehensively — a critical skill across multiple disciplines.

In essence, understanding how to convert linear equations into slope-intercept form isn't just an academic exercise; it's a vital tool for visualization, prediction, and problem-solving in the real world. Whether you're plotting a business's revenue trend or analyzing physical phenomena, fluency with these algebraic techniques empowers you to make informed decisions and deepen your mathematical literacy.

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In conclusion, the process of rewriting  $(3x + 13y + 18 = 0)$  in slope-intercept form exemplifies the beauty and utility of algebraic transformations. It transforms an abstract algebraic statement into an intuitive, visual, and practical tool — the straight line. Mastery of this skill is essential for anyone looking to harness the power of linear functions in their academic or professional pursuits.

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