

# Given This Equation What Is The Value Of Y At The Indicated Point?

## Given This Equation What Is The Value Of Y At The Indicated Point?

Understanding how to determine the value of  $y$  at a specific point in an equation is a fundamental skill in mathematics, especially in algebra and calculus. Whether you're solving for  $y$  in a linear equation, quadratic, or more complex functions, the process involves substituting known values into the equation and simplifying to find the unknown. This article explores various methods to find  $y$  at given points in different types of equations, providing step-by-step guidance, examples, and tips to enhance your problem-solving skills.

## Fundamentals of Finding Y at a Given Point

Before diving into specific types of equations, it's essential to understand the core concept: substitution. When you are given an equation involving  $y$  and  $x$  (or other variables), and a specific point  $(x, y)$ , the goal is to verify or find the  $y$ -value corresponding to the  $x$ -value provided.

### Basic Steps to Find Y at a Given Point

1. Identify the equation and the given point: Know the exact formula and the values provided for the point.
2. Substitute the known  $x$ -value into the equation: Replace every occurrence of  $x$  with the given  $x$ -value.
3. Simplify the equation: Perform arithmetic operations to solve for  $y$ .
4. Solve for  $y$ : If the equation involves a direct relationship, this step might be straightforward. For more complex equations, algebraic manipulation may be necessary.
5. Verify the solution: Check the calculated  $y$ -value by plugging it back into the original equation to ensure consistency.

## Types of Equations and How to Find Y

Different equations require different approaches. Below, we cover common types and how to find  $y$  at a given point.

# Linear Equations

A linear equation typically has the form:

$$[ y = mx + b ]$$

where  $m$  is the slope and  $b$  is the  $y$ -intercept.

Example:

Given the equation:

$$[ y = 2x + 3 ]$$

and the point ( $x = 4$ ), find  $y$ .

Solution:

- Substitute  $x = 4$ :

$$[ y = 2(4) + 3 ]$$

$$[ y = 8 + 3 ]$$

$$[ y = 11 ]$$

Result:

The  $y$ -value at  $x = 4$  is 11.

Key points:

- Linear equations are straightforward; substitution yields the  $y$ -value directly.
- Always verify by plugging back into the original equation.

# Quadratic Equations

Quadratic equations have the form:

$$[ y = ax^2 + bx + c ]$$

Example:

Given:

$$[ y = x^2 - 4x + 1 ]$$

Find y when  $x = 3$ .

Solution:

- Substitute  $x = 3$ :

$$[ y = (3)^2 - 4(3) + 1 ]$$

$$[ y = 9 - 12 + 1 ]$$

$$[ y = -2 ]$$

Result:

Y at  $x = 3$  is -2.

Note:

Quadratic functions produce parabolas, and the process involves straightforward substitution and calculation.

## Exponential and Logarithmic Equations

For exponential functions:

$$[ y = a \cdot b^x ]$$

and logarithmic functions:

$$[ y = \log_b(x) ]$$

Example (Exponential):

Given:

$$[ y = 5 \times 2^x ]$$

Find y at  $x = 4$ .

Solution:

$$\backslash[ y = 5 \times 2^4 \backslash]$$

$$\backslash[ y = 5 \times 16 \backslash]$$

$$\backslash[ y = 80 \backslash]$$

Example (Logarithmic):

Given:

$$\backslash[ y = \log_{2}(x) \backslash]$$

Find  $y$  when  $x = 8$ .

Solution:

$$\backslash[ y = \log_{2}(8) \backslash]$$

$$\backslash[ y = 3 \backslash] \text{ (since } 2^3 = 8 \text{)}$$

Tip:

Use calculator functions for logs or exponents as needed.

## Advanced Methods for Finding Y

When equations are more complex or involve multiple variables, different strategies are required.

### Implicit Equations

Some equations do not explicitly solve for  $y$  but relate  $x$  and  $y$ , e.g.,

$$\backslash[ x^2 + y^2 = 25 \backslash]$$

To find  $y$  at a specific  $x$ :

- Substitute  $x$  into the equation.
- Rearrange to solve for  $y$ :

$$\backslash[ y^2 = 25 - x^2 \backslash]$$

$$\backslash[ y = \pm \sqrt{25 - x^2} \backslash]$$

Example:

Given  $x = 3$ :

$$\sqrt{y = \pm \sqrt{25 - 9}} = \pm \sqrt{16} = \pm 4$$

Result:

Y can be 4 or -4 at  $x = 3$ .

## Using Calculus: Derivatives and Tangents

In calculus, to find the y-value at a specific point on a curve:

- Use the equation to find the y-coordinate directly if the point is given.
- If the point is not specified, and you have x, plug into the function.
- For tangent lines, derivatives help find the slope at a point.

## Practical Applications and Examples

Understanding how to find y at a point is crucial across various disciplines.

Application in Physics

- Calculating displacement at a given time using position equations.

Application in Economics

- Determining profit or revenue at specific production levels.

Application in Engineering

- Analyzing stress or strain at certain points in materials.

Step-by-Step Example: Real-World Problem

Problem:

A car's fuel efficiency is modeled by the equation:

$$y = -0.05x + 15$$

where  $y$  is miles per gallon and  $x$  is the number of miles driven. Find the fuel efficiency after driving 100 miles.

Solution:

- Substitute  $x = 100$ :

$$y = -0.05 \times 100 + 15$$

$$y = -5 + 15$$

$$y = 10$$

Interpretation:

After 100 miles, the car's fuel efficiency drops to 10 miles per gallon.

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## Tips for Accurate Calculations

- Always double-check your substitutions.
- Simplify step-by-step to avoid errors.
- Use calculator functions carefully, especially with exponents and logs.
- When dealing with square roots, consider both positive and negative solutions if applicable.
- Verify your results by plugging the  $y$ -value back into the original equation.

## Common Mistakes to Avoid

- Forgetting to consider both positive and negative roots in quadratic or radical equations.
- Misreading the given point or the equation.
- Mixing units or not maintaining consistent units.
- Rushing through calculations leading to arithmetic errors.

## Conclusion

Finding the value of  $y$  at a given point in an equation is a foundational skill that applies across various mathematical contexts. Whether dealing with simple linear functions or more complex implicit equations, the key is systematic substitution and careful calculation. Mastering these techniques enhances problem-

solving efficiency and deepens understanding of how equations model real-world phenomena. Practice with diverse examples to build confidence, and always verify your solutions for accuracy. With these skills, you'll be well-equipped to analyze equations and interpret their values at specific points effectively.

## Frequently Asked Questions

**Given the equation  $y = 2x + 5$ , what is the value of  $y$  when  $x = 3$ ?**

When  $x = 3$ ,  $y = 2(3) + 5 = 6 + 5 = 11$ .

**For the equation  $y = x^2 - 4x + 7$ , what is  $y$  at the point where  $x = 2$ ?**

Substituting  $x = 2$ ,  $y = (2)^2 - 4(2) + 7 = 4 - 8 + 7 = 3$ .

**Given the linear equation  $y = -3x + 10$ , what is the value of  $y$  at  $x = 4$ ?**

Plugging in  $x = 4$ ,  $y = -3(4) + 10 = -12 + 10 = -2$ .

**If the quadratic equation is  $y = x^2 + 6x + 9$ , what is  $y$  when  $x = -3$ ?**

At  $x = -3$ ,  $y = (-3)^2 + 6(-3) + 9 = 9 - 18 + 9 = 0$ .

**Given the equation  $y = 5x - 2$ , what is the value of  $y$  at the point where  $x = 0$ ?**

When  $x = 0$ ,  $y = 5(0) - 2 = 0 - 2 = -2$ .

**For the equation  $y = 3x^2 - x + 4$ , what is  $y$  at  $x = 1$ ?**

Substituting  $x = 1$ ,  $y = 3(1)^2 - 1 + 4 = 3 - 1 + 4 = 6$ .

**Given  $y = -x + 8$ , what is  $y$  when  $x$  equals 5?**

At  $x = 5$ ,  $y = -5 + 8 = 3$ .

**For the equation  $y = (1/2)x + 7$ , what is  $y$  at  $x = 10$ ?**

Plugging in  $x = 10$ ,  $y = (1/2)(10) + 7 = 5 + 7 = 12$ .

**If  $y = 4x^3 - x$ , what is the value of  $y$  at  $x = 2$ ?**

At  $x = 2$ ,  $y = 4(2)^3 - 2 = 4(8) - 2 = 32 - 2 = 30$ .

**Given the linear equation  $y = 7x + 3$ , what is the value of  $y$  at  $x = -1$ ?**

When  $x = -1$ ,  $y = 7(-1) + 3 = -7 + 3 = -4$ .

## Additional Resources

Given This Equation What Is The Value Of Y At The Indicated Point?

In the realm of mathematics, equations serve as the foundational language for expressing relationships between variables. Whether in engineering, physics, economics, or pure mathematics, understanding how to determine the value of a variable—particularly  $y$ —at specific points is essential. This question, "Given this equation, what is the value of  $y$  at the indicated point?" is both fundamental and nuanced, often requiring careful analysis and problem-solving techniques. In this article, we will explore how mathematicians and students approach this problem, dissecting the process step-by-step, and highlighting key concepts such as substitution, solving for variables, and interpreting the significance of "indicated points" within various types of equations.

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Understanding the Question: The Significance of the "Indicated Point"

Before delving into the methods of calculating  $y$ , it is crucial to interpret what the question entails. When asked, "Given this equation, what is the value of  $y$  at the indicated point," the focus is on:

- The Equation: A mathematical relationship involving  $x$  and  $y$  (e.g., linear, quadratic, exponential, etc.).
- The Indicated Point: Usually specified by an  $x$ -coordinate (and sometimes  $y$ ), or a particular condition (e.g., where the curve intersects a certain point).

Key Takeaways:

- The indicated point typically provides the  $x$ -value (or  $x$  and  $y$ ) at which the problem asks us to evaluate  $y$ .
- To find  $y$  at that point, we need to substitute the known  $x$ -value into the equation and solve for  $y$ .
- If the point is given explicitly with both coordinates, the problem may involve verifying if that point lies on the curve or solving for  $y$  given  $x$ .

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## Step 1: Analyzing the Given Equation

The first step is to carefully analyze the structure and form of the given equation. Common types include:

- Linear Equations: e.g.,  $y = mx + b$
- Quadratic Equations: e.g.,  $y = ax^2 + bx + c$
- Exponential or Logarithmic Equations: e.g.,  $y = a b^x$
- Implicit Equations: e.g.,  $x^2 + y^2 = r^2$  (circle)

Why does the type matter? Because each type offers different methods for solving. For example, linear equations are straightforward to evaluate, while quadratic equations may require solving quadratic formulas.

Example: Suppose the equation is  $y = 2x + 3$ . If the indicated point has  $x = 4$ , then to find  $y$ , we substitute  $x=4$  into the equation.

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## Step 2: Identifying the Indicated Point

The problem likely provides a specific point or a condition:

- Explicit Point: e.g.,  $(x, y) = (3, ?)$
- Given  $x$ -value: e.g., Find  $y$  when  $x=2$
- Given  $y$ -value: e.g., Find  $x$  when  $y=5$  (less common in this context)
- Special Conditions: e.g., the point lies on the curve and satisfies certain constraints

Understanding the point's nature is critical. If the point's  $x$ -coordinate is given, our task is to evaluate  $y$  at that  $x$ . If both  $x$  and  $y$  are given, we might verify whether the point satisfies the equation.

Example: The indicated point is  $x=5$ . Our task: find  $y$  at  $x=5$ .

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## Step 3: Substituting the Point into the Equation

Once the equation and the point are clear, the next step is substitution:

1. Plug in the known  $x$ -value into the equation.
2. Simplify the resulting expression to find  $y$ .

Example:

Given the equation  $y = 3x - 4$ , and the point  $x=2$ ,

- Substitution:  $y = 3(2) - 4 = 6 - 4 = 2$
- Result:  $y=2$  at  $x=2$

This process is straightforward for linear equations, but can become more involved for complex ones.

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#### Step 4: Handling More Complex Equations

When the equation is nonlinear or implicit, the process requires additional steps:

- Quadratic Equations: May involve solving quadratic formulas after substitution.
- Implicit Equations: Might require algebraic manipulation or graphing to find the  $y$  value.
- Multiple Solutions: Some equations yield more than one  $y$  for a given  $x$ , so all solutions must be considered.

Example: For  $y^2 = x + 1$ , and  $x=3$ ,

- Substitute:  $y^2 = 3 + 1 = 4$
- Solve:  $y = \pm\sqrt{4} = \pm 2$
- Conclusion:  $y=2$  or  $y=-2$  at  $x=3$

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#### Step 5: Verifying the Solution

After calculating the  $y$  value(s), verify if the solution aligns with the original problem statement:

- Ensure substitution was correct.
- Confirm if the problem asks for positive solutions only or all real solutions.
- Check if the indicated point matches the calculated  $x$  and  $y$ .

Verification helps prevent common errors such as miscalculations or misinterpretations of the problem.

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#### Practical Examples

Let's examine some real-world scenarios and typical equations to illustrate the process:

##### Example 1: Linear Equation

Equation:  $y = 5x - 7$

Indicated point:  $x=3$

- Substitution:  $y = 5(3) - 7 = 15 - 7 = 8$

Answer:  $y=8$  at  $x=3$

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Example 2: Quadratic Equation

Equation:  $y = x^2 - 4x + 1$

Indicated point:  $x=2$

- Substitution:  $y = (2)^2 - 4(2) + 1 = 4 - 8 + 1 = -3$

Answer:  $y=-3$  at  $x=2$

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Example 3: Implicit Equation

Equation:  $x^2 + y^2 = 25$

Indicated point:  $x=4$

- Substitute:  $4^2 + y^2 = 25 \rightarrow 16 + y^2 = 25$

- Solve:  $y^2 = 9 \rightarrow y = \pm 3$

Answer:  $y=3$  or  $y=-3$  at  $x=4$

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Addressing Ambiguous or Complex Problems

Some questions might involve more advanced concepts like derivatives, slopes, or tangent lines. For example:

- Finding  $y$  at a given point on a curve: may involve evaluating the function at a specific  $x$ .
- Using derivatives: to find the slope at that point and then determining  $y$  accordingly.

In such cases, understanding the context and the nature of the "indicated point" is crucial. Sometimes, the problem might involve solving for  $x$  when  $y$  is given, which requires rearranging the equation.

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### Significance of the Process in Broader Contexts

Calculating  $y$  at a given point isn't just an academic exercise; it has practical applications:

- Engineering: determining stress or strain at a certain point.
- Physics: calculating position, velocity, or acceleration at specific times.
- Economics: evaluating cost or revenue functions at certain levels of output.
- Computer Graphics: plotting points on a curve or shape.

Mastering this process enables professionals and students alike to interpret data, develop models, and solve real-world problems efficiently.

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### Conclusion

The question "Given this equation, what is the value of  $y$  at the indicated point?" encapsulates a fundamental skill in mathematics: substituting known values into an equation to find unknowns. Whether dealing with simple linear equations or complex implicit functions, the core process involves understanding the equation's form, carefully substituting known values, simplifying, and verifying solutions.

As we've explored, the key steps include analyzing the given equation, identifying the indicated point, performing substitution, solving for  $y$ , and verifying the results. This systematic approach not only ensures accuracy but also deepens understanding of the relationships between variables.

In the broader scope, such skills underpin advanced mathematical modeling, scientific analysis, and engineering design, making them indispensable tools in the modern scientific toolkit. Whether you're a student grappling with algebra or a professional applying mathematics to real-world challenges, mastering how to determine  $y$  at specific points is a crucial step toward mathematical fluency and problem-solving excellence.

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