3) Determine The Equation Of The Tangent To The Curve Y=3 =5x At X=4 X >y=58x X OC MONS

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Understanding how to find the equation of a tangent to a curve at a specific point is a fundamental concept in calculus. This skill is essential for analyzing the behavior of functions, understanding slopes, and solving real-world problems involving rates of change. In this article, we will explore the step-by-step process of determining the equation of the tangent line to a given curve at a specified point, focusing on the function $Y = 3 + 5x$ at $x=4$. Additionally, we will clarify the other expressions mentioned — such as $y = 58x$ and the phrase "X OC MONS" — to ensure a comprehensive understanding.

Understanding the Problem Statement

The statement appears to contain some typographical or transcription errors, but the core question seems to be:

"Determine the equation of the tangent to the curve $Y=3+5x$ at $x=4$."

The other parts, like "Y=58x" and "X OC MONS," may be extraneous or miswritten, but for clarity, we'll focus on the primary task: finding the tangent line to the linear function $Y=3+5x$ at a point where $x=4$.

Fundamentals of Tangent Lines to Curves

Before proceeding, it's important to understand several key concepts:

1. The Curve and Its Equation

- The curve is described by a function $Y = f(x)$. In our case, $f(x) = 3 + 5x$.

2. The Point of Tangency

- The point at which we find the tangent line is given by the x-coordinate, here $x=4$.
- The corresponding y-coordinate is found by substituting $x=4$ into the function.

3. The Slope of the Tangent Line

- The slope of the tangent line at a point on the curve is given by the derivative $f'(x)$.
- For linear functions like $Y=3+5x$, the derivative is constant.

4. Equation of the Tangent Line

- Once we have the point (x_0, y_0) and the slope m, the tangent line's equation can be written in point-slope form:

$$
y - y_0 = m(x - x_0)
$$

Step-by-Step Solution

Let's go through the steps to find the tangent line to the curve $Y=3+5x$ at $x=4$.

Step 1: Calculate the Point of Tangency

- Find the y-coordinate when $x=4$:

$$
y = 3 + 5(4) = 3 + 20 = 23
$$

- Therefore, the point of tangency is $(4, 23)$.

Step 2: Find the Derivative (Slope of the Curve)

- Since $Y=3+5x$ is a linear function, its derivative is straightforward:

$$
f'(x) = \frac{d}{dx}(3 + 5x) = 5

\]

- The derivative is constant, indicating that the slope of the tangent at any point is 5.

Step 3: Write the Equation of the Tangent Line

- Using the point \((4, 23)\) and the slope \(m=5\), the point-slope form is:

\[
y - 23 = 5(x - 4)
\]

- Simplify to get the slope-intercept form:

\[
y - 23 = 5x - 20
\]

\[
y = 5x + 3
\]

Result: The equation of the tangent line to the curve \(Y=3+5x\) at \(x=4\) is:

\[
\boxed{y = 5x + 3}
\]

Additional Clarifications and Related Concepts

While the primary task has been addressed, there are other elements in the initial statement worth clarifying.

Understanding the Expression \(Y=58x\)

- If the question involves another curve \(Y=58x\), this is a different linear function with slope 58.
- Its derivative is also 58, indicating a constant slope.
- The tangent line to \(Y=58x\) at any point is the line itself, since it's linear.

Comparing the Two Lines

- The line $Y=3+5x$ has slope 5.
- The line $Y=58x$ has slope 58.
- They are parallel if they have the same slope; otherwise, they intersect at some point.

Interpreting "X OC MONS"

- This phrase does not correspond to standard mathematical terminology.
- It might be a typo or encoding error.
- If it was intended to refer to a specific point or concept, more context would be needed.

Applications of Tangent Lines in Calculus

Understanding how to determine tangent lines is vital in various fields:

- **Physics:** Calculating instantaneous velocity as the slope of the position-time graph.
- **Engineering:** Analyzing rates of change in systems.
- **Economics:** Determining marginal cost or revenue at a point.
- **Biology:** Modeling growth rates or reaction rates.

Summary of the Process

To summarize, here are the key steps involved in finding the equation of a tangent line to a curve:

1. Identify the point of tangency by substituting the x-coordinate into the function.
2. Calculate the derivative of the function to find the slope at that point.

3. Use the point-slope form of a line with the point and slope to write the tangent line's equation.

4. Simplify if necessary to obtain the slope-intercept form.

Applying these steps to the specific problem yields the tangent line \(y=5x+3\) at \(x=4\) on the curve \(Y=3+5x\).

Conclusion

Determining the equation of a tangent line is a fundamental skill in calculus that involves understanding derivatives, points of contact, and line equations. In the case of the linear function \(Y=3+5x\), the process is straightforward because the derivative (slope) is constant. Recognizing the point of tangency and applying the point-slope form provides the tangent line equation efficiently.

The concepts covered here form the foundation for analyzing more complex functions, including nonlinear curves, where derivatives are not constant and require more nuanced calculation. Mastery of these techniques allows for a deeper understanding of the behavior of functions and their applications across various scientific and engineering disciplines.

Remember: Practicing these steps with different functions and points enhances comprehension and prepares you for tackling more advanced calculus problems efficiently.

Frequently Asked Questions

What is the given curve in the problem?

The curve is given by the equation $y = 3 + 5x$.

How do you find the slope of the tangent at x = 4 for the curve y = 3 + 5x?

Since $y = 3 + 5x$ is a linear function, its derivative $dy/dx = 5$. Therefore, the slope at $x = 4$ is 5.

What is the y-coordinate at x = 4 on the curve y = 3 + 5x?

Substituting $x = 4$, $y = 3 + 5(4) = 3 + 20 = 23$.

How do you write the equation of the tangent line at x = 4?

Using point-slope form: $y - y_1 = m(x - x_1)$, where $m = 5$ and $(x_1, y_1) = (4, 23)$, so $y - 23 = 5(x - 4)$.

What is the simplified form of the tangent line's equation at x = 4?

Simplifying, $y - 23 = 5x - 20$, so $y = 5x + 3$.

Are there any additional conditions or information provided in the problem?

The problem mentions X > y = 58x, but it appears to be a typo or extraneous information; the main task is to find the tangent to $y = 3 + 5x$ at $x = 4$, which results in $y = 5x + 3$.

Additional Resources

Determine The Equation Of The Tangent To The Curve Y=3=5x At X=4 X > y=58x OC MONS

Introduction: The Significance of Tangent Lines in Mathematics

In the realm of calculus and analytic geometry, the concept of tangent lines is fundamental. They serve as the first-order approximation to curves at specific points, providing vital insights into the local behavior of functions. Whether in physics, engineering, or pure mathematics, understanding how to determine the equation of a tangent line is a crucial skill. This article delves into a specific problem: finding the tangent to the curve defined by a particular equation at a given point, and analyzing its properties in detail.

The problem statement appears complex at first glance, but breaking it down reveals core calculus principles—derivatives, points of tangency, and the application of the point-slope form of a line. Clarifying the given expressions and ensuring correct interpretation will be key to solving the problem effectively.

Understanding the Problem Statement

Before attempting to find the tangent line, let’s interpret the provided data clearly:

- Curve Equation: The problem states "Y=3=5x," which appears to be a typographical or formatting error. Likely, it intends to specify the curve as Y = 3 + 5x, or perhaps Y = 3x + 5, based on conventional notation.

- Point of Tangency: The tangent is to be determined at x = 4.

- Additional Expression: "X > y=58x OC MONS" seems unconnected or possibly a misprint. It might reference an inequality or other part of a larger problem. Since it's ambiguous, we will focus on the primary task: determining the tangent line to the curve at x=4.

Given the typical structure of such problems, let's proceed under the assumption that the curve is:

Y = 3 + 5x

and that the goal is to find the equation of the tangent line at x = 4.

If the problem intended a different function, such as Y = 58x, or others, the approach remains similar—compute the derivative, evaluate it at the point, then use the point-slope form to find the tangent.

Step 1: Clarify the Function and Identify the Point of Tangency

Defining the Function

Assuming the curve is:

$$ Y = 3 + 5x $$

which is a straight line with slope 5 and y-intercept 3.

Point of Tangency

At $x = 4$:

$$Y = 3 + 5 \times 4 = 3 + 20 = 23$$

Thus, the point of tangency is (4, 23).

Note: If, alternatively, the function was Y = 58x, then at $x=4$:

$$Y = 58 \times 4 = 232$$

The tangent line would then pass through (4, 232), with a slope of 58.

For clarity, we will proceed with the initial assumption: Y = 3 + 5x.

Step 2: Calculating the Derivative (Slope of the Tangent Line)

The derivative of a function at a point gives the slope of the tangent line at that point.

For the function:

$$Y = 3 + 5x$$

which is linear, the derivative:

$$\frac{dY}{dx} = 5$$

is constant everywhere, indicating the slope of the tangent line at $x=4$ is 5.

If the function were different, such as $Y = 58x$:

$$\frac{dY}{dx} = 58$$

which is also constant.

Implication: For linear functions, the tangent line is the line itself; for nonlinear functions, the derivative varies with x.

Step 3: Formulating the Equation of the Tangent Line

The general form of a tangent line at a point (x_0, y_0) with slope m:

$$ y - y_0 = m (x - x_0) $$

Applying to our assumed function:

- $x_0 = 4$

- $y_0 = 23$

- $m = 5$

The tangent line equation:

$$ y - 23 = 5 (x - 4) $$

Expanding:

$$ y = 5x - 20 + 23 $$

$$ y = 5x + 3 $$

This confirms that the tangent line coincides with the original line $Y = 3 + 5x$, as expected for a linear function.

Analysis of the Result

Key Observations:

- The tangent line at $x=4$ for a linear function is the same as the function itself, since the slope is constant and the function is a straight line.

- The point of tangency $(4, 23)$ lies exactly on the line $y = 5x + 3$.

- The tangent line's equation is:

$$ y = 5x + 3 $$

which is valid for all x, reflecting the linearity of the function.

Extending the Analysis to Nonlinear Functions

Suppose the original function was intended to be nonlinear, for example:

$$ Y = f(x) $$

where $f(x)$ is more complex, such as $Y = x^2 + 2x + 1$, or $Y = \sin x$, or any other function.

In such cases:

1. Calculate the derivative $f'(x)$: This gives the slope of the tangent at any point x.

2. Evaluate the derivative at $x = x_0$: To find the slope at the point of interest.

3. Find $y_0 = f(x_0)$: The y-coordinate at x_0.

4. Use the point-slope form:

$$ y - y_0 = f'(x_0)(x - x_0) $$

and expand or leave in that form, depending on the context.

Special Cases and Additional Considerations

1. Vertical Tangents: If the derivative at a point $x = x_0$ is infinite or undefined, the tangent line is vertical, with an equation $x = x_0$.

2. Horizontal Tangents: If the derivative at $x = x_0$ is zero, the tangent line is horizontal, $y = y_0$.

3. Multiple Tangents: For certain functions, multiple points may have the same derivative value, leading to multiple tangent lines with the same slope but different points of contact.

Conclusion: Practical Implications and Applications

Determining the equation of a tangent line to a curve at a specific point is a cornerstone of differential calculus, with broad applications across science and engineering. From analyzing the rate of change of physical quantities to optimizing functions, the process involves:

- Understanding the nature of the function (linear or nonlinear).

- Computing derivatives to find slopes.

- Applying the point-slope form of a line.

In our specific case, assuming the function $Y = 3 + 5x$, the tangent line at $x=4$ is the line itself: $y=5x+3$.

In more complex contexts, especially with nonlinear curves, this process becomes more nuanced, requiring careful calculation of derivatives and critical point analysis. Mastery of these concepts empowers mathematicians and scientists to interpret and analyze the behavior of functions with precision and confidence.

Final note: Always verify the original function and the point of tangency before proceeding to calculations, especially in cases where the problem statement might contain typographical errors or ambiguities.

Keywords: tangent line, derivative, point of tangency, calculus, slope, function analysis, point-slope form, nonlinear functions, linear functions

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