

Let $F(x,y,z)=11x^2y^2+5z^2$. Calculate $F(0,4,5)$. (Write Your Solution Using The Form $(,,)$. Use Symbolic

Understanding the Function $F(x, y, z) = 11x^2y^2 + 5z^2$

In this article, we will explore how to evaluate the function $F(x, y, z) = 11x^2y^2 + 5z^2$ at specific coordinate points. This task involves substituting given values for x , y , and z into the function and simplifying the expression step-by-step. Our primary goal is to compute $F(0, 4, 5)$ and express the solution in the symbolic form $(, ,)$ — that is, as an ordered triple.

Step-by-Step Approach to Calculating $F(0, 4, 5)$

Understanding the Function and Its Components

The function $F(x, y, z) = 11x^2y^2 + 5z^2$ consists of two main terms:

- $11x^2y^2$: a product of squared variables x and y , scaled by 11
- $5z^2$: the square of z , scaled by 5

To evaluate this function at a specific point, we need to substitute the corresponding values of x , y , and z and perform the calculations accordingly.

Substituting the Values $(0, 4, 5)$ into the Function

Step 1: Substitute $x = 0$, $y = 4$, $z = 5$

Replacing variables with their respective values gives:

$$F(0, 4, 5) = 11(0)^2 - (4)^2 + 5(5)^2$$

Step 2: Simplify each term separately

- First term: $11(0)^2$
- Second term: $5(5)^2$

Calculating each component:

1. $0^2 = 0$
2. $4^2 = 16$
3. $5^2 = 25$

Step 3: Plug in the simplified values

$$F(0, 4, 5) = 11(0) - 16 + 5(25)$$

Step 4: Perform the multiplications

1. $11(0) = 0$
2. $5(25) = 125$

Step 5: Add the results

$$F(0, 4, 5) = 0 + 125 = 125$$

Expressing the Solution as an Ordered Triple

The problem statement requests the solution in the symbolic form $(\ , \ , \)$, which represents the point in space where the function is evaluated. Since the function's input is (x, y, z) and the output is a scalar, the ordered triple notation is used to represent the input point.

Therefore, the answer is:

$$(0, 4, 5)$$

Summary of the Calculation Process

Here's a quick summary of the steps involved:

1. Identify the function and the point of evaluation.
2. Substitute the given values into the function.
3. Simplify each term separately.
4. Calculate each squared term.
5. Perform the multiplications and addition.
6. Express the input point as an ordered triple $(\ , \ , \)$.

Additional Tips for Evaluating Multivariable Functions

1. Always double-check substitutions

Errors often occur during substitution, especially with signs or powers. Double-check each step to ensure accuracy.

2. Simplify step-wise

Break down complex expressions into smaller parts, simplifying each step to avoid mistakes.

3. Use parentheses to clarify order of operations

When writing expressions, parentheses help clarify the sequence of calculations, especially in nested operations.

4. Practice with different functions

Evaluating various functions enhances understanding and speed, especially when working with more complex expressions.

Conclusion

Calculating the value of a multivariable function at a given point involves systematic substitution and simplification. In our example, we evaluated $F(0, 4, 5)$ by substituting the point's coordinates into the function and simplifying step-by-step, resulting in the value 125. The input point, expressed as an ordered triple, is $(0, 4, 5)$, which accurately reflects the variables' values used in the calculation.

Mastering this process is essential for students and professionals working in calculus, physics, engineering, and related fields, where functions of multiple variables are commonplace. With practice, evaluating such functions becomes quick and intuitive, allowing for efficient analysis of complex systems and models.

Frequently Asked Questions

What is the value of $F(0,4,5)$ for the function $F(x,y,z)=11x^2 y^2 + 5z^2$?

$F(0,4,5) = (0, 4, 5)$

How do you evaluate $F(0,4,5)$ given $F(x,y,z)=11x^2 y^2 + 5z^2$?

Substitute $x=0$, $y=4$, $z=5$ into the function: $F(0,4,5) = 11(0)^2(4)^2 + 5(5)^2 = 0 + 525 = (0, 4, 5)$

What is the simplified value of F at the point $(0,4,5)$ for the given function?

The simplified value is 125.

Can you compute $F(0,4,5)$ for the function $F(x,y,z)=11x^2 y^2 + 5z^2$?

Yes, $F(0,4,5) = (0, 4, 5)$

What is the result of plugging in $(0,4,5)$ into $F(x,y,z)=11x^2 y^2 + 5z^2$?

The result is $(0, 4, 5)$

How to write the point evaluation of F at $(0,4,5)$ using symbolic notation?

$F(0, 4, 5) = (0, 4, 5)$

Is the value of $F(0,4,5)$ a vector or a scalar?

$F(0,4,5)$ is a scalar value, specifically 125.

What are the steps to calculate $F(0,4,5)$ for the function $F(x,y,z)$?

Replace $x=0$, $y=4$, $z=5$ into F : $F=11(0)^2(4)^2 + 5(5)^2 = 0 + 125 = 125$

What is the importance of substituting specific values into a function like $F(x,y,z)$?

It allows us to evaluate the function at particular points to find specific values or analyze behavior.

What is the symbolic form of the point used to evaluate the function F?

(0, 4, 5)

Additional Resources

Understanding and Calculating the Function $F(x, y, z) = 11x^2y^2 + 5z^2$

When working with multivariate functions such as $F(x, y, z) = 11x^2y^2 + 5z^2$, a fundamental skill in calculus and algebra is evaluating the function at specific points. In this guide, we'll thoroughly explore how to calculate $F(0, 4, 5)$, demonstrating the process step-by-step, and providing insights into the structure and behavior of the function. This comprehensive approach will help you understand not just the calculation, but also the significance of each component within the function.

Understanding the Function Structure

Before jumping into the calculation, it's essential to analyze the structure of $F(x, y, z) = 11x^2y^2 + 5z^2$. The function is composed of two terms:

- Term 1: $11x^2y^2$ — a product of squared variables x and y , scaled by 11.
- Term 2: $5z^2$ — a quadratic term in z , scaled by 5.

This structure hints at the following properties:

- The function depends quadratically on x , y , and z .
- The interaction between x and y is multiplicative, implying that the behavior of F depends on the combination of these two variables.
- The function is always non-negative because squares are non-negative, and the coefficients are positive.

Step-by-Step Calculation of $F(0, 4, 5)$

Let's proceed systematically to evaluate $F(0, 4, 5)$.

Step 1: Write down the given point

The point provided is $(x, y, z) = (0, 4, 5)$.

Step 2: Substitute the point into the function

Replacing x, y, and z with the given values:

$$F(0, 4, 5) = 11(0)^2(4)^2 + 5(5)^2$$

Step 3: Calculate each component separately

- Calculate $(0)^2$:

$$(0)^2 = 0$$

- Calculate $(4)^2$:

$$(4)^2 = 16$$

- Calculate $(5)^2$:

$$(5)^2 = 25$$

Step 4: Simplify each term

- First term:

$$11 \cdot 0 \cdot 16 = 11 \cdot 0 = 0$$

- Second term:

$$5 \cdot 25 = 125$$

Step 5: Sum the results

$$F(0, 4, 5) = 0 + 125 = 125$$

Final result:

$$F(0, 4, 5) = (0, 4, 5) = 125$$

Expressing the Result in Tuple Notation

When asked to write the solution in tuple form, especially for functions of multiple variables, the usual notation is:

$$(x, y, z) = (0, 4, 5)$$

and the calculated value is:

$$F(0, 4, 5) = 125$$

In some contexts, you might see the entire calculation written as:

$$F(0, 4, 5) = (0, 4, 5) = 125$$

which directly links the point and the function value.

Additional Insights into the Function

Behavior at different points

- When $x = 0$ or $y = 0$, the first term $11x^2y^2$ becomes zero, and the function reduces to $5z^2$.
- When $z = 0$, the function simplifies to $11x^2y^2$, which is zero if either x or y is zero.
- The function is always non-negative, reaching zero only if all squared terms are zero (i.e., $x = 0$, $y = 0$, $z = 0$).

Graphical interpretation

While plotting a 3-variable function can be complex, understanding the contributions:

- The first term $11x^2y^2$ dominates in regions where x and y are large.
- The second term $5z^2$ dominates when z is large.
- The function forms a paraboloid opening upward in all directions.

Practical Applications of Evaluating Multivariate Functions

Understanding how to evaluate functions like $F(x, y, z)$ is vital across various fields:

- **Physics:** To calculate potential energy, field strengths, or other scalar quantities depending on multiple variables.
- **Economics:** For functions modeling cost, utility, or profit based on multiple factors.
- **Data Science:** For loss functions or cost functions involving multiple features.

Summary and Key Takeaways

- To evaluate $F(x, y, z) = 11x^2y^2 + 5z^2$ at a point, substitute the point's coordinates into the function.
- Calculate each squared term separately for clarity.
- Simplify each component and sum for the final value.
- When expressing the solution, write the point in tuple form and the function's value succinctly.
- Recognize the behavior and properties of the function based on its structure.

Conclusion

Calculating the value of a multivariable function at a specific point may seem straightforward, but understanding its structure and implications enhances your mathematical intuition. In this case, evaluating $F(0, 4, 5)$ involved straightforward substitution and basic algebra, leading to the conclusion that $F(0, 4, 5) = 125$. Such exercises are foundational in mastering calculus, optimization, and mathematical modeling, empowering you to analyze complex systems with confidence.

Let F X Y Z 11x 2y 2 5z 2 Calculate F 0 4 5 Write Your Solution Using The Form Use Symbolic

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