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The substitution method is a powerful technique in solving integrals, especially when dealing with complex functions. Here's a step-by-step explanation of how to use the substitution method:

Steps to Solve Integrals by Substitution Method:

1. **Identify the Function to Substitute**: Look for a function within the integral whose derivative (or a multiple of the derivative) is also present. This function is often denoted by u.

2. **Substitute**: Let $u = g(x)$, where $g(x)$ is the function you've identified. Then, calculate $\frac{du}{dx} = g'(x)$, and rearrange this as $du = g'(x)dx$.

3. **Rewrite the Integral**: Replace all occurrences of x-dependent terms in the integral with u-dependent terms. This includes replacing dx with $\frac{du}{g'(x)}$ based on the substitution.

4. **Simplify the Integral**: Now, the integral should be in terms of u, making it easier to evaluate.

5. **Integrate**: Solve the integral with respect to u.

6. **Back-Substitute**: After finding the integral in terms of u, substitute back $u = g(x)$ to express the solution in terms of x.

7. **Add the Constant of Integration**: Don't forget to add the constant C, since the process of integration typically involves indefinite integrals.

Example:

Let's go through an example to illustrate the substitution method.

Integral: $\int (2x)e^{x^2}dx$

1. **Identify the substitution**: Notice that e^{x^2} is the exponential of x^2, and its derivative is $2x$. So, let's choose $u = x^2$.

2. **Substitute**: If $u = x^2$, then $du = 2xdx$. Now the integral becomes:

$$\int e^u du$$

3. **Simplify and integrate**: The integral of e^u is simply e^u. So we get:

$$e^u + C$$

4. **Back-substitute**: Substitute $u = x^2$ back into the solution:

$$e^{x^2} + C$$

Thus, the integral $\int (2x)e^{x^2} dx$ simplifies to: $e^{x^2} + C$

This is the result after applying the substitution method.

If you have specific integrals or need more examples, feel free to ask!

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