

Calculus II

Integrals of the form $\int e^{ax} dx$

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Example (Substitution Rule)

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Substitute: $\int e^{3x} dx = \int e^u ?$

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Find $\int e^{3x} dx$.

Let $u = 3x$.

Then $du = 3dx$

$$dx = \frac{1}{3} du.$$

Substitute: $\int e^{3x} dx = \int e^u \frac{1}{3} du$

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Let $u = 3x$.

Then $du = 3dx$

$$dx = \frac{1}{3} du.$$

Substitute:
$$\int e^{3x} dx = \int \frac{1}{3} e^u du$$
$$= ?$$

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Find $\int e^{3x} dx$.

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Then $du = 3dx$

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Substitute:
$$\begin{aligned}\int e^{3x} dx &= \int \frac{1}{3} e^u du \\ &= \frac{1}{3} e^u\end{aligned}$$

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Find $\int e^{3x} dx$.

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Substitute:
$$\begin{aligned}\int e^{3x} dx &= \int \frac{1}{3} e^u du \\ &= \frac{1}{3} e^u + C\end{aligned}$$

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Find $\int e^{3x} dx$.

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Then $du = 3dx$

$$dx = \frac{1}{3} du.$$

$$\begin{aligned}\text{Substitute: } \int e^{3x} dx &= \int \frac{1}{3} e^u du \\ &= \frac{1}{3} e^u + C \\ &= \frac{1}{3} e^{3x} + C.\end{aligned}$$