Last time: Integration by substitution: "the Chain Rule"

Today: Integration by parts: "the Product Rule"

Term test 3: Thursday, February 7th, 6:10-8pm.

Homework before Wednesday’s class: watch videos 9.10, 9.11, 9.12.
Use integration by parts (possibly in combination with other methods) to compute:

1. \( \int xe^{-2x} \, dx \)
2. \( \int x^2 \sin x \, dx \)
3. \( \int \ln x \, dx \)
4. \( \int x \arctan x \, dx \)
5. \( \int \sin \sqrt{x} \, dx \)
6. \( \int x^2 \arcsin x \, dx \)
7. \( \int e^{\cos x} \sin^3 x \, dx \)
8. \( \int e^{ax} \sin(bx) \, dx \)
Compute

\[ \int_1^e (\ln x)^4 \, dx \]
Compute

\[ \int_1^e (\ln x)^4 \, dx \quad \text{and} \quad \int_1^e (\ln x)^{10} \, dx \]
Compute

\[ \int_1^e (\ln x)^4 \, dx \quad \text{and} \quad \int_1^e (\ln x)^{10} \, dx \]

There is a more efficient approach. Call

\[ I_n = \int_1^e (\ln x)^n \, dx \]

Use integration by parts on \( I_n \). You will get an equation with \( I_n \) and \( I_{n-1} \). Now solve the previous questions.
The error function

The following function is tabulated.

\[ E(x) = \int_0^x e^{-t^2} dt. \]
The error function

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\[ E(x) = \int_{0}^{x} e^{-t^2} dt. \]

Write the following quantities in terms of \( E \):

1. \[ \int_{1}^{2} e^{-t^2} dt \]
2. \[ \int_{0}^{x} t^2 e^{-t^2} dt \]
3. \[ \int_{0}^{x} e^{-2t^2} dt \]
The error function

The following function is tabulated.

\[ E(x) = \int_0^x e^{-t^2} \, dt. \]

Write the following quantities in terms of \( E \):

1. \( \int_1^2 e^{-t^2} \, dt \)
2. \( \int_0^x t^2 e^{-t^2} \, dt \)
3. \( \int_0^x e^{-2t^2} \, dt \)
4. \( \int_0^1 e^{-t^2+6t} \, dt \)
5. \( \int_{x_1}^{x_2} e^{-\frac{(t-\mu)^2}{\sigma^2}} \, dt \)
6. \( \int_0^x \frac{e^{-t}}{\sqrt{t}} \, dt \)