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

Today: Integration by parts: "the Product Rule"

Term test 3: Friday, February 10, 4-6pm.

Homework before Wednesday’s class: watch videos 9.7, as well as 9.8, 9.9.
Use integration by parts (possibly in combination with other methods) to compute:

1. $\int x e^{-2x} \, dx$
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

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

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. \( \int_0^x \frac{e^{-t}}{\sqrt{t}} dt \)