Last time: Integration by substitution: “the Chain Rule”

Today: Integration by parts: “the Product Rule”

Term test 3: Thursday, February 3, 4-8pm.

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. $\int xe^{-2x} \, dx$
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. $\int e^{ax} \sin(bx) \, dx$
Persistence

Compute

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

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.
Persistence

Compute

\[ \int_{1}^{e} (\ln x)^4 \, dx \]

\[ \int_{1}^{e} (\ln x)^{10} \, dx \]
Persistence

Compute

- $\int_{1}^{e} (\ln x)^4 \, dx$
- $\int_{1}^{e} (\ln x)^{10} \, dx$

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. \[ \int_{0}^{\infty} t^2 e^{-t^2} dt \]
3. \[ \int_{0}^{\infty} e^{-2t^2} dt \]
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. \[ \int_0^x \frac{e^{-t}}{\sqrt{t}} \, dt \]