Integration by Parts: Evaluate the following integrals using integration by parts.

1. \[ \int \cos^3(x) \, dx \]

2. \[ \int \arctan(2x) \, dx \]. You will need to know that the derivative of \( \arctan(x) \) is \( \frac{1}{1 + x^2} \).

3. \[ \int_{1}^{2} (2x + 1)e^{-4x} \, dx \]

4. If \( f(x) \) is any polynomial, the formula for integration by parts tells us that

\[ \int f(x)e^x \, dx = f(x)e^x - \int f'(x)e^x \, dx. \]

Apply integration by parts to the integral on the right hand side several more times. Do you see a pattern? Can you use this pattern to quickly evaluate \( \int x^5e^x \, dx \)?
Evaluate the following integrals using any method from class.

5. $\int x^{11} \cos(x^6) \, dx$

6. $\int_0^1 x^2 \sqrt{e^x} \, dx$

7. $\int \sec x \, dx$. Hint: Try multiplying the integrand by $\frac{\sec x + \tan x}{\sec x + \tan x}$. What is the derivative of the denominator of the new integrand?