***TECHNIQUES OF INTEGRATION***

***(BC TOPICS)***

**INTEGRATION BY PARTS**: Use to integrate the product of unrelated functions.



To determine which function should be *u*, whichever comes first in the acronym below should be your *u*.

L logarithns

I inverse trig

A algebraic

T trig

E exponential

**TABULAR METHOD** is a form of integration by parts. Only use it when one function is an integer

power of *x* – and even then, it’s not always appropriate.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Yes!***     |  |  |  | | --- | --- | --- | |  | and its derivs | and its integrals | | + | 2*x* |  | | - | 2 |  | | + | 0 |  | | ***No!***     |  |  |  | | --- | --- | --- | |  | and its derivs | and its integrals | | + | 2*x* |  | | - | 2 |  | | + | 0 |  |   Since we can only integrate ln *x* with integration by parts (*u* = ln *x* and *dv = dx*), tab method is not appropriate. |

***TRIG INTEGRALS***

1. **Odd powers of sine**: Save one factor of sine, then convert the rest to cosine using the identity .
2. **Odd powers of cosine**: Save one factor of cosine, then convert the rest to cosine using the identity .
3. **Even powers of sine and cosine**: Make repeated use of the identities and 
4. **Even power of secant**: Save  and convert the rest to tan *x* using the identity .
5. **Odd powers of tangent**: Save  and convert the rest to sec x using .
6. **Even power of tangent, no secant:** Convert one  to . Repeat if necessary.
7. **Odd power of secant, no tangent:** Use integration by parts with .
8. **When all else fails, convert everything to sines and cosines.**

***INTEGRATION WITH PARTIAL FRACTIONS***: If the denominator of the integrand is a factorable polynomial, you may need partial fractions.

 



Let x = 2:  → 

Let x = 5  → 



***IMPROPER INTEGRALS***: Use limits to evaluate definite integrals with discontinuities. If this limit does not exist, the integral is said to **diverge**.

1. Infinite discontinuity at upper or lower bound

, so this integral diverges

1. Integrand is undefined at upper or lower bound



1. Integrand has a discontinuity in the interior of the upper and lower bound

….etc.