

- this week's HW assignment now posted

- overview of using tables; see Schaum's outline Series: Mathematical Handbook of Formulas + Tables

Ch. 7.3
in H.H.
Table
of
Integrals

ex $\int x^5 \ln x \, dx$

$$= \frac{1}{6} x^6 \ln x - \frac{1}{36} x^6 + C \therefore$$

simple 'by the numbers'
example
use III-13

refers to entry
in back of H.H.
book 'short table'
of integral

ex $\int (x^3 + 5)^2 \, dx$ (which entry to use?)

$$= \int (x^6 + 10x^3 + 25) \, dx$$

→ don't be tricked! do some
simple algebra to expand
out and use I-1

$$= \frac{1}{7} x^7 + \frac{10}{4} x^4 + 25x + C \therefore$$

ex $\int \sin^2 w \cos^4 w \, dw$

use trig. sub. (as suggested
by IV-23) so to use
either IV-17 or
IV-18

$$= \int (1 - \cos^2 w) \cos^4 w \, dw$$

$$= \int \cos^4 w \, dw - \int \cos^6 w \, dw$$

Solution here will involve several iterations to
reduce integrals to something simple enough to
solve explicitly

Two ways to Approach:

[pg. 2]

ex $\int u^5 \ln(5u) du$

(just like before, w/ a substitution)

OR, algebraically simplify the integrand:

$$\ln(5u) = \ln 5 + \ln u$$

this integral is what we already solved!

$$\rightarrow = \ln 5 \int u^5 du + \int u^5 \ln u du$$

$$= \ln 5 \cdot \frac{1}{6} u^6 + \frac{1}{6} u^6 \ln u - \frac{1}{36} u^6 + C$$

$$= \frac{1}{6} u^6 \ln 5u - \frac{1}{36} u^6 + C$$

ex $\int \frac{1}{y^2 + 4y + 5} dy = \int \frac{1}{(y+a)(y+b)} dy$

so to use
V-26

→ need to be a bit more clever algebra-wise:

Complete the square: $y^2 + 4y + 5 = y^2 + 4y + 4 + 1 = (y+2)^2 + 1$

NOTE:
already did
this example
on 9/25!!

$$= \int \frac{1}{(y+2)^2 + 1} dy$$

let $x = y+2$ (now use a substitution and use V-24)
 $dx = dy$

$$= \int \frac{1}{x^2 + 1} dx$$

$$= \arctan x + C = \arctan(y+2) + C$$

→ brush up on some basic algebra skills

algebraic manipulations:

- substitution
- complete the square
- multiply things out
- re-substitution (a.g. ~~simple~~)
- long division

ex $\int \frac{t^2+1}{t^2-1} dt$

use 'long division' to simplify:

$$\frac{t^2+1}{t^2-1} = 1 + \frac{2}{t^2-1} \quad (\text{multiply out to check!})$$

$$\begin{array}{r} 1 \\ t^2-1 \overline{) t^2+1} \\ \underline{t^2-1} \\ 2 \end{array}$$

$$\rightarrow \int \frac{t^2+1}{t^2-1} dt = \int \left[1 + \frac{2}{t^2-1} \right] dt$$

$$= \int dt + 2 \int \frac{1}{t^2-1} dt \quad (\text{use II-26 after factoring})$$

$$= t + 2 \int \frac{1}{(t+1)(t-1)} dt \quad \begin{array}{l} a=1 \\ b=-1 \end{array}$$

$$= t + 2 \left[\frac{1}{2} (\ln|t-1| - \ln|t+1|) \right] + c$$

$$= t + \ln|t-1| - \ln|t+1| + c = t + \ln \frac{|t-1|}{|t+1|} + c$$

→ good idea to try to practice 'long division':

ex show that

$$\frac{3x^3 - 7x^2 + 17x - 3}{x^2 - 2x + 5} = 3x - 1 + \frac{2}{x^2 - 2x + 5}$$

ex show that $\frac{x^5+3}{x^3+2x^2+5x-2} = x^2-2x-1 + \frac{14x^2+x+1}{x^3+2x^2+5x-2}$

i.e., $x^3+2x^2+5x-2 \overline{) x^5+0x^4+0x^3+0x^2+0x+3}$

$$\begin{array}{r} x^2-2x-1 \\ x^5+0x^4+0x^3+0x^2+0x+3 \\ \underline{x^5+2x^4+5x^3-2x^2+0+0} \\ -2x^4-5x^3+2x^2+0+3 \\ \underline{-2x^4-4x^3-10x^2+4x+0} \\ -x^3+12x^2-4x+3 \\ \underline{-x^3-2x^2-5x+2} \\ 14x^2+x+1 \end{array}$$

check your algebra
by multiplying
out!!