Integration

1. Simplify Using Algebra:

   A. Can I put it into power rule form by expanding or distributing terms?

   B. Can I factor the denominator to help cancel Things out?

2. Numerator has a higher order polynomial than denominator.

   Use Polynomial Long Division to simplify

3. Denominator has a higher order polynomial than numerator

   A. Use partial fractions to break up integral into multiple fractions

   B. If the denominator can't be factored complete the square

4. You have a function inside a function

   Try substitution: let w = the inside function

5. You have two functions multiplied

   Try integration by parts:

   usually u = polynomial or ln
   dv = $\sin x$ $\cos x$ e^{ax}.

   - can use for powers of sin and cos or $\sin x e^x$ $\cos x e^x$ - make a copy

HOME WORK 1 SOLUTIONS

Integration Practice Answers.

By Parts $\int x\sin(x)\,dx$

$= -x\cos x + \sin x + C$

u-Sub $\int (2t+7)^{72}\,dt$

$= \frac{1}{2}\left[\frac{1}{73}(2t+7)^{73} + C\right]$

u-sub or parts $\int (t+2)\sqrt{2+3t}\,dt$

$= \frac{2}{9}\left[(t+2)(2+3t)^{3/2} - \frac{2}{5}(2+3t)^{5/2}\right] + C$

By Parts $\int y\ln(y)\,dy$

$= \frac{1}{2}y^2\ln|y| - \frac{1}{4}y^2 + C$

Polynomial long division to simplify $\int \frac{x^3+7x^2+10x+1}{x^2+7x+10}\,dx$

$= \frac{1}{2}x^2 + \frac{1}{3}\ln\left|\frac{x+2}{x+5}\right| + C$

Partial Frac $\int \frac{x+1}{6x+x^2}\,dx$

$= \frac{1}{6}\ln|x| + \frac{5}{6}\ln|x+6| + C$

u-sub + partial frac $\int \frac{x^2+2}{x^2+x}\,dx = x + 1 - 2\ln|x+1| + \ln|x-1|$

hint: First break into smaller more manageable fractions, then evaluate separately.

Factor then u-sub ★ $\int \frac{1}{x^2+4x+4}\,dx$

$= \frac{-1}{x+2} + C$

simplify $\int \frac{x^3\sin(x)}{x\sin(x)}\,dx$

$= \frac{1}{3}x^3 + C$

u-sub ★ $\int \frac{x}{(1+x^2)^2}\,dx = \frac{-1/2}{1+x^2} + C$

~~$= \frac{1}{2}\ln|1+x^2| + C$~~

u-sub $\int x^2(1+2x^3)^2\,dx$

$= \frac{1}{6}\left[\frac{1}{3}(1+2x^3)^3\right] + C$

u-sub $\int xe^{x^2}\,dx$

$= \frac{1}{2}e^{x^2} + C$

$\int e^x\cos(x)\,dx = \frac{1}{2}e^x[\sin x + \cos x] + C$

hint: Integrate by parts twice to make a copy of the integral on the right hand side.

simplify $\int \frac{x^3+x^2+1}{x}\,dx$

$= \frac{1}{3}x^3 + \frac{1}{2}x^2 + \ln|x| + C$

u-sub $\int x\cos(x^2)\,dx$

$= \frac{1}{2}\sin(x^2) + C$

complete the square then u-sub ★ $\int \frac{1}{x^2+4x+5}\,dx$

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