Good afternoon: warm up

ax^n

$$5\int \frac{1}{5}\,-15\csc 3x\cot 3x \cdot e^{\csc 3x}\,dx$$

want: $-3\csc 3x \cdot \cot 3x$

$5\int$ [redacted] $e^{\csc 3x}\,dx$

will randomize after warmup

$$5\left[e^{\csc 3x} + C\right]$$

$$5e^{\csc 3x} + C$$

Each group gets a set of 4 problems
Pick 1 to do
Pick 1 to check someone's work on

30 mins

Once 'rough draft' is done, copy onto chart paper for 'gallery walk'

Be sure group # is on chart paper for easy navigation
Return all markers to where you found them

What happens when the reverse chain rule fails?
When we can't "tweak" the problem to make it work?

u-substitution

$$\int x\sqrt{4x+3}\,dx$$

want: 4

Always try reverse chain rule first
If the chain differs by more than just a coefficient, try u-sub

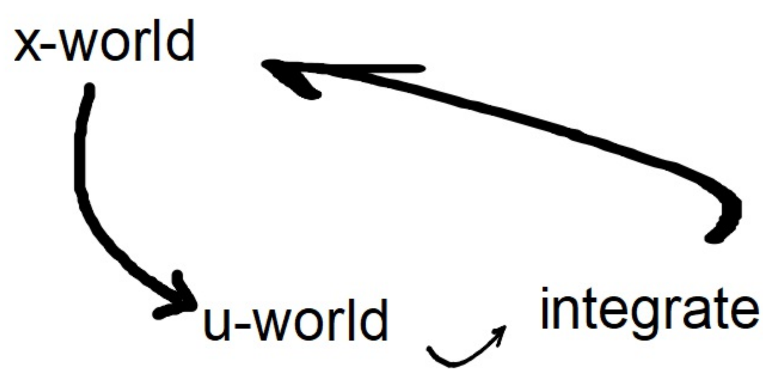
note, u-sub can also solve any problem that the reverse chain rule can do.

Basic Premise

Shift from an 'x' problem to a 'u' problem, recalibrating the question

1. Assume new variable u is something based on x
2. Based on assumption, make 2 new deductions for x and dx
3. Rewrite original in terms of u and du, not x and dx

Solve the easier 'u' problem, then reshift back to the x variable



[redacted]

$$\int x\sqrt{2x-1}\,dx$$

$$\int x\,(2x-1)^{\frac{1}{2}}\,dx$$

want: 2 :(

① Assume that $\boxed{u=2x-1}$ (Set u = inside)

② Make 2 deductions from assumption.

- $\boxed{\frac{u+1}{2}=x}$ (Solve for x)
- $u=2x-1$ (take deriv. of u; solve for dx)

$$\frac{du}{dx}=2 \rightarrow du=2\,dx \rightarrow \boxed{\frac{du}{2}=dx}$$

$$\int x(2x-1)^{\frac{1}{2}}\,dx$$

$$\int \frac{u+1}{2}(u)^{\frac{1}{2}}\cdot\frac{\cancel{dx}}{2}\ \frac{1}{2}\cdot du$$

$$\int \frac{1}{4}(u+1)u^{\frac{1}{2}}\,du$$

$$\frac{1}{4}\int (u^1+1)u^{\frac{1}{2}}\,du$$

$$\frac{1}{4}\int u^{\frac{3}{2}}+u^{\frac{1}{2}}\,du$$

rev. power rule

$$\frac{1}{4}\left[\frac{2}{5}u^{5/2}+\frac{2}{3}u^{3/2}+C\right]$$

$$\frac{2}{20}u^{5/2}+\frac{2}{12}u^{3/2}+C$$

replace w/ initial assumption.

$$\boxed{\frac{1}{10}(2x-1)^{5/2}+\frac{1}{6}(2x-1)^{3/2}+C}$$

$$\int \frac{3x}{4x-2}\,dx$$

Bonus Content (exclusive mcalc.weebly.com DLC)

$$\int 3x \cdot \frac{1}{4x-2}\,dx$$

want: 4 :(

Let $\boxed{u = 4x-2}$

$\boxed{\frac{u+2}{4} = x}$ $\frac{du}{dx} = 4 \rightarrow du = 4dx \rightarrow \boxed{\frac{du}{4} = dx}$

$= \frac{1}{4}du$

$$\int 3x \cdot \frac{1}{4x-2}\,dx$$

$$\int 3 \cdot \left(\frac{u+2}{4}\right) \cdot \frac{1}{u} \cdot \frac{1}{4}du$$

(gather constants)

$$\int \frac{3}{16}(u+2) \cdot \frac{1}{u} \cdot du$$

(distribute)

$$\frac{3}{16}\int 1 + \frac{2}{u}\,du$$

$$\frac{3}{16} \cdot \left[u + 2\ln|u| + C\right]$$

$\int \frac{1}{x}dx = \ln|x| + C$

$$\frac{3}{16}u + \frac{6}{16}\ln|u| + C$$

$$\frac{3}{16}(4x-2) + \frac{3}{8}\ln|4x-2| + C$$

:)

Hidden Easter Egg

$$\int \frac{3x+1}{\sqrt{4x+1}}\,dx$$

$$\int (3x+1)(4x+1)^{-\frac{1}{2}}\,dx$$

want: 4 :(

Let $\boxed{u = 4x+1}$ → $\boxed{\frac{1}{4}(u-1) = x}$

→ $\frac{du}{dx} = 4 \rightarrow \frac{du}{4} = dx \rightarrow \boxed{\frac{1}{4}du = dx}$

$$\int (3x+1)(4x+1)^{-\frac{1}{2}}\,dx$$

$$\int \left(3\left(\tfrac{1}{4}(u-1)\right)+1\right)(u)^{\frac{1}{2}} \cdot \tfrac{1}{4}\,du$$

$$\int \left(\tfrac{3}{4}(u-1)+1\right)\left(u^{1/2}\right)\left(\tfrac{1}{4}\right)du$$

$$\frac{1}{4}\int \frac{3}{4}(u-1)u^{1/2} + u^{1/2}\,du$$

$$\frac{3}{16}\int (u^1-1)u^{\frac{1}{2}} + u^{\frac{1}{2}}\,du$$

$$\frac{3}{16}\int u^{\frac{3}{2}} \underbrace{- u^{\frac{1}{2}} + u^{\frac{1}{2}}}_{\text{cancel!}}\,du$$

$$\frac{3}{16}\int u^{3/2}\,du$$

$$\frac{3}{16}\left[\frac{2}{5}u^{5/2} + C\right]$$

$$\frac{3}{40}u^{5/2} + C$$

$$\frac{3}{40}(4x+1)^{5/2} + C$$

whew.

X-games mode.

HW: p. 512 #15-42 mult of 3

#33 is tricky

#36 hint: let $u = \ln(\cos(x))$