$$y = (\cos(3x))^{\tan(5x)}$$

$$\ln(y) = \tan(5x)\ln(\cos(3x))$$

$$\frac{y'}{y} = 5\sec^2(5x)\ln(\cos(3x)) + \tan(5x)\cdot\frac{-3\sin(3x)}{\cos(3x)}$$

$$y' = \left(5\sec^2(5x)\ln(\cos(3x)) + \tan(5x)\cdot\frac{-3\sin(3x)}{\cos(3x)}\right)(\cos(3x))^{\tan(5x)}$$

$$y = \ln\left(\frac{(x+5)^4(x-7)^3}{\sqrt{x+2}}\right)$$

$$= 4\ln(x+5) + 3\ln(x-7) - \frac{1}{2}\ln(x+2) \longrightarrow$$

$$y' = \frac{4}{x+5} + \frac{3}{x-7} - \frac{1}{2(x+2)}$$

$$\frac{\infty}{\infty}, \quad \frac{0}{0}, \quad 0\cdot\infty, \quad 1^{\infty}, \quad \boxed{0^{\infty}}$$

meh

$$\left(1+\frac{1}{x}\right)^x \xrightarrow{x\to\infty} e$$

$$1^{\infty}$$

7.4 #77

$$\int \frac{\sin(2x)}{1+\cos^2(x)}\,dx \qquad \int \frac{du}{u}$$

"Play around"

$\sin(2x) = 2\sin x\cos x$

converted $\sin(2x)$ into $2\sin x\cos x$

$$\int \frac{2\sin x\cos x}{1+\cos^2 x}\,dx$$

$$\frac{d}{dx}\left[2\sin x\cos x\right] = 2\cos^2 x - 2\sin^2 x = 2(\cos^2 x - \sin^2 x)$$
$$= 2\cos(2x)$$

Looking for a u & a du.

$$\frac{d}{dx}\left[1+\cos^2 x\right] = 2\cos(x)\cdot(-\sin x) = \frac{du}{dx}$$

$\to u$ $\quad -2\sin x\cos x\,dx = du$

$$\text{So } \int \frac{\sin(2x)\,dx}{1+\cos^2 x} = \int \frac{2\sin x\cos x}{1+\cos^2 x}\,dx$$

$$= -\int \frac{-2\sin x\cos x}{1+\cos^2 x}\,dx = -\int \frac{du}{u}$$

$$= -\ln|1+\cos^2 x| + C$$

$$= -\ln\left|\frac{2}{2} + \frac{1+\cos(2x)}{2}\right| + C$$

$$= -\ln\left|\frac{3+\cos(2x)}{2}\right| + C$$

All the same

All good.

$$= -\ln|3+\cos(2x)| + \ln|2| + C$$

$$= -\ln|3+\cos(2x)| + \hat{C}$$

$$\int \frac{\sin(2x)}{1+\cos^2 x}\,dx$$

Converted $\cos(x)$ to $\cos(2x)$

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

$$1+\cos^2(x) = 1+\frac{1+\cos(2x)}{2} = \frac{3+\cos(2x)}{2}$$

$$= \int \frac{\sin(2x)}{\frac{3+\cos(2x)}{2}}\,dx = 2\int \frac{\sin(2x)}{3+\cos(2x)}\,dx$$

$$= -\int \frac{-2\sin(2x)}{3+\cos(2x)}\,dx = -\int \frac{du}{u} = -\ln|3+\cos(2x)|+c$$

$$\frac{d}{dx}\left[x^2 \sinh^{-1}(2x)\right]$$

-3

$$\frac{d}{dx}\left[\sinh^{-1}(x)\right] = \frac{1}{\sqrt{1+x^2}}$$

$$= 2x\sinh^{-1}(2x) + x^2 \cdot \frac{1}{\sqrt{1+(2x)^2}} \cdot 2$$

$$\frac{d}{dx}\left[\sinh^{-1}(2x)\right] = \frac{d}{d(2x)}\left[\sinh^{-1}(2x)\right] \cdot \frac{d}{dx}\left[2x\right]$$

$$\frac{d}{dx}\left[f(g(x))\right] = \frac{df}{dg} \cdot \frac{dg}{dx}$$

$t = 3u$ is Ken's idea. I like it.

$u = \frac{t}{3}$

$$\int_4^6 \frac{dt}{\sqrt{t^2-9}} = \int_4^6 \frac{dt}{\sqrt{t^2-3^2}}$$

$t = 4 \Rightarrow u = \frac{4}{3}$

$t = 6 \Rightarrow u = 2$

$$t^2 - 3^2 = 3^2u^2 - 3^2$$
$$= 3^2(u^2-1)$$

$dt = 3du$

$\sqrt{3^2(u^2-1)} = 3\sqrt{u^2-1}$

$$= \int_{\frac{4}{3}}^{2} \frac{3\,du}{3\sqrt{u^2-1}} = \int_{\frac{4}{3}}^{2} \frac{du}{\sqrt{u^2-1}}$$

$$= \cosh^{-1}(u)\Big]_{\frac{4}{3}}^{2} = \cosh^{-1}(2) - \cosh^{-1}\left(\frac{4}{3}\right)$$

= See pg 466 to turn this into something in terms of logs.

$\sqrt{u^2-2^2}$

Sep 14-12:39 PM