Name: ________________________________ Date: ____________

AP Calculus AB: Integrating Using U-Substitution Ms. Loughran

Do Now:

1. $\int \frac{dt}{t\sqrt{2t}} =$ $\frac{1}{\sqrt{2}}\int \frac{dt}{t\sqrt{t}} = \frac{1}{\sqrt{2}}\int t^{-3/2}\,dt = \frac{1}{\sqrt{2}} \cdot -2t^{-\frac{1}{2}} + C$

$\frac{-2}{\sqrt{2t}} + C$

Classwork:

1. $\int 2x(x^2+1)^{23}\,dx$

$u = x^2+1$

$du = 2x\,dx$

$\int u^{23}\,du$

$\frac{1}{24}u^{24} + C$

$\frac{1}{24}(x^2+1)^{24} + C$

2. $\int \frac{3x\,dx}{\sqrt{4x^2+5}}$

$u = 4x^2+5$

$du = 8x\,dx$

$\frac{du}{8} = x\,dx$

$\int 3 \cdot \frac{du}{8} \cdot u^{-\frac{1}{2}}$

$\frac{3}{8}\int u^{-\frac{1}{2}}\,du$

$\frac{3}{\cancel{8}_{4}} \cdot \cancel{2}u^{\frac{1}{2}} + C$

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

$\frac{3}{4}\sqrt{4x^2+5} + C$

Steps:

find u:

1. look for a piece of the original integrand whose derivative is also in the integrand (try denominator, anything raised to a power, anything under a radical)

2. set u = that piece, take the derivative of u with respect to the variable in the expression

3. use u and du to replace the original integral and your new integral should be easier to work with

4. integrate

5. replace u (don't forget +C if it's an indefinite integral)

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

$u = x^3 - 4$

$du = 3x^2 dx$

$\frac{du}{3} = x^2 dx$

$\frac{1}{3} \int \frac{1}{u} \, du$

$\frac{1}{3} \ln |u| + C$

$\frac{1}{3} \ln |x^3 - 4| + C$

4. $\int x(2 - x^2)^3 \, dx$

$u = 2 - x^2$

$du = -2x \, dx$

$\frac{du}{-2} = x \, dx$

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

$-\frac{1}{2} \cdot \frac{u^4}{4} + C$

$-\frac{1}{8} (2 - x^2)^4 + C$

5. $\int \sin x \, e^{\cos x} \, dx$

$u = \cos x$

$du = -\sin x \, dx$

$-du = \sin x \, dx$

$-\int e^u \, du = -e^u + C$

$-e^{\cos x} + C$

Last night's hw was a DeltaMath assignment.