U-Substitution

When you take the derivative of more complex expressions, you frequently use the chain rule to differentiate. The integration equivalent to the chain rule is called u-substitution.

U-substitution allows you to integrate expressions which do not appear integratable.

Step 1: Recognize the pattern: Which term looks like the derivative of the other
(Likewise, which term looks more complicated)

Step 2: Set u as the composite part of the function

Step 3: Find du.

Step 4: Substitute and integrate the new problem

Step 5: Substitute back in for u and add C

1) $\int x\left(x^2-1\right)^5 dx$

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

3) $\int \sqrt{5x-2}\, dx$

4) $\int 4(6x-1)^{2/3}\, dx$

5) $\int x\sqrt{x^2 - 2}\, dx$

6) $\int x^2\sqrt{1-4x^3}\,dx$

7) $\int \frac{x}{\sqrt[3]{2x^2 - 1}}\, dx$

10) $\int (x+2)\sqrt{x-4}\,dx$

11) $\int \frac{x-5}{\sqrt{x-6}}\,dx$

15) $\int \sin^3 x \cos x \, dx$

17) $\int \tan^2 x \sec^2 x \, dx$

19) $\int \frac{\cos x}{\sqrt{1-\sin x}}\,dx$

Try by hand and then verify with the FnINT feature of the graphing Calculator

9. $\int_{2}^{3} \frac{x}{\left(x^2-3\right)^2}\,dx$

Try by hand and then verify with the FnINT feature of the graphing Calculator

11. $\int_{0}^{\pi/2} \cos^3 t \sin t \, dt$