# 03 – Integrating Inverse Functions

We shall start this lecturette with a reminder of the strategy for integrating $\ln(x)$.

**Example 1**

Evaluate the following integral:

$$\int_1^e \ln(x)\,\mathrm{d}x$$

Now we will extend this idea to be able to integrate any inverse function.

**Theorem 1 (Laisant's Formula)**

For any invertible function $f(x)$,

$$\int f^{-1}(x)\,\mathrm{d}x = xf^{-1}(x) - (F \circ f^{-1})(x) + C$$

**Proof.**                                                                                  □

For the following example, note that $\mathrm{erf}^{-1} x$ is the inverse error function such that if $x = \mathrm{erf}\, y$ then $y = \mathrm{erf}^{-1} x$.

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**Example 2**

Evaluate the following integral:

$$\int_0^a \mathrm{erf}^{-1} x \, \mathrm{d}x$$

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