# Substitution

6 questions | 12 marks

Equivalent correct methods earn the corresponding marks.

**1.** Find $\int 2x/(x^2+1)\,dx$. [2 marks]

Use u=x squared+1.

The integral becomes $\int du/u$; u is positive.

**Answer:** $\ln(x^2+1)+C$.

**2.** Find $\int \cos x \sin^3 x\,dx$. [2 marks]

Set u=sin x and du=cos x dx.

Integrate u cubed.

**Answer:** $\sin^4 x/4+C$.

**3.** Find $\int x/\sqrt{4+x^2}\,dx$. [2 marks]

Use u=4+x squared and x dx=du/2.

Integrate $u^{-1/2}/2$.

**Answer:** $\sqrt{4+x^2}+C$.

**4.** Find $\int (3x+1)^5\,dx$. [2 marks]

Use u=3x+1, dx=du/3.

Integrate u to the fifth and divide by 3.

**Answer:** $(3x+1)^6/18 + C$.

**5.** Find $\int e^{2x}/(1+e^{2x})\,dx$. [2 marks]

Use u=1+exp(2x); du=2exp(2x)dx.

Integrate du/(2u).

**Answer:** $\frac{1}{2}\ln(1+e^{2x}) + C$.

**6.** Evaluate $\int_0^2 x(1+x^2)\,dx$. [2 marks]

With u=1+x squared, the limits become 1 and 5.
$\frac{1}{2}\int_1^5 u\,du = (25-1)/4 = 6$.

**Answer:** 6.