

WORKSHEET VI

INTEGRATION BY PARTS

1. Using *integration by parts*, find the indefinite integral of each of the following functions.

(a) $x \sin x$

(b) $x^2 \sin x$

(c) $x \ln x$

(d) $\ln x$

(e) $(\ln x)^2$

(f) $x e^{3x}$

(g) $\arctan x$

(h) $e^x \sin x$

(i) $(\ln x)/x$

(j) $\arcsin(2x)$

(k) $\cos(\ln x)$

(l) $(\ln x)^4/x$

(m) $x \arctan(x^2)$

(n) $\sec^3 x$

(o) $x \cosh x$

2. (a) Derive the reduction formula:

$$\int \sec^n x \, dx = \frac{1}{n-1} \sec^{n-2} x \tan x + \frac{n-2}{n-1} \int \sec^{n-2} x \, dx$$

(b) Using this reduction formula, compute anti-derivatives of $\sec^4 x$ and of $\sec^5 x$.

3. (a) Derive the reduction formula:

$$\int x^n \sin x \, dx = -x^n \cos x + n \int x^{n-1} \cos x \, dx$$

(b) Using this reduction formula, compute an anti-derivative of $x^3 \sin x$.

Common integration is only the memory of differentiation.

- [Augustus de Morgan](#) (1806 – 1871)



Nature laughs at the difficulties of integration.

- [Pierre-Simon de Laplace](#) (1749 - 1827)

