

# WORKSHEET II

19 January 2018

## 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)



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