1 Integration by Parts

$$\int u\,dv = uv - \int v\,du$$

2 Integration of Trigonometric Functions

Moar antiderivatives

$$\int \sec(x)\,dx = \ln|\sec(x) + \tan(x)| + C$$
$$\int \csc(x)\,dx = \ln|\csc(x) - \tan(x)| + C$$

Trigonometric Substitution

$\int f(\sqrt{1-x^2})\,dx$	$x = \sin\theta$ or $\cos\theta$
$\int f(\sqrt{a^2+x^2})\,dx$	$x = a\tan\theta$
$\int f(\sqrt{a^2-x^2})\,dx$	$x = a\sin\theta$ or $a\cos\theta$
$\int f(x\sqrt{x^2-a^2})\,dx$	$x = a\sec\theta$

Useful properties/identities

If you see $\int \sin(A)\cos(B)\,dx$, remember that

$$\sin(A+B) = \sin A\cos B + \sin A\cos B$$
$$\sin(A-B) = \sin A\cos B - \sin A\cos B$$

That means that

$$\sin(A+B) + sin(A-B) = 2\sin A\cos B$$

If you see $\int \sin^a(A)\cos^b(A)\,dx$, remember that

$$\sin^2(A) + \cos^2(A) = 1$$

and

$$\cos^2(2A) = 2\cos^2(A) - 1$$

so

$$\cos^2(A) = \frac{1 + \cos(2A)}{2}$$
$$\sin^2(A) = \frac{1 - \cos(2A)}{2}$$

If you see any integral with $\tan^a(A)$ and $\sec^b(A)$, remember that

$$\tan^2(A) + 1 = \sec^2(A)$$

$$\int f(\sin x, \cos x)dx$$
$$= \int f(\sin x)\cos x dx = \int f(u)du, u = \sin x$$

$$\int f(\sec x, \tan x)dx$$
$$= \int f(\cos x)\sin x dx = -\int f(u)du, u = \cos x$$

$$\int f(\csc x, \cot x)dx$$
$$= \int \cos^5 x \sin^3 x dx = \int \cos^5 x \sin^2 x \sin x dx$$
$$= \int \cos^5 x(1-\cos^2 x)\sin x dx$$
$$= -\int u^5(1-u^2)du, u = \cos x$$
$$= -\frac{u^6}{6} + \frac{u^8}{8} + c$$

$$\int f(\tan x)\sec^2 x dx = \int f(u)du, u = \tan x$$

$$\int f(\sec x)\sec x \tan x dx = \int f(u)du, u = \sec x$$

$$\int \sec^4 x dx = \int \sec^2 x \sec^2 x dx$$
$$= \int (1+\tan^2 x)\sec^2 x dx$$
$$= \int (1+u^2)du = u + \frac{u^3}{3} + c, u = \tan x$$

$$\int \sec x dx = \ln\sec x + \tan x + c$$

$$I = \int \sec^3 x dx = uv - \int v du$$
Through IBP: $u = \sec x, du = \sec x \tan x dx, v = \tan x, dv = \sec^2 x dx$
$$= \int \sec x \tan x - \int \sec x \tan^2 x dx$$
$$= \int \sec x \tan x - \int \sec x(\sec^2 x - 1)dx$$
$$= \int \sec x \tan x - \int \sec^3 x dx - \int \sec x dx$$
$$= \int \sec x \tan x + \int \sec x dx - I$$