Formulae of Differentiation قواعد الاشتقاق

	$f(x)$	$f'(x)$	$f(u)$	$f'(u)$
	Non-Chain Rule		Chain Rule	
1	x^n	$n.x^{n-1}$	u^n	$n.u^{n-1}.u'$
2	$sinx$	$cosx$	$sin\,u$	$cos\,u.u'$
3	$cosx$	$-sinx$	$cos\,u$	$-sin\,u.u'$
4	$tanx$	sec^2x	$tan\,u$	$sec^2u.u'$
5	$cotx$	$-csc^2x$	$cot\,u$	$-csc^2u.u'$
6	$secx$	$secx\,.tanx$	$sec\,u$	$sec\,u.tanu.u'$
7	$cscx$	$-cscx.cotx$	$csc\,u$	$-cscu.cotu.u'$
	Inverse Trigonometric Functions			
8	$sin^{-1}x$	$\frac{1}{\sqrt{1-x^2}}$	$sin^{-1}u$	$\frac{u'}{\sqrt{1-u^2}}$
9	$cos^{-1}x$	$-\frac{1}{\sqrt{1-x^2}}$	$cos^{-1}u$	$-\frac{u'}{\sqrt{1-u^2}}$
10	$tan^{-1}x$	$\frac{1}{1+x^2}$	$tan^{-1}u$	$\frac{u'}{1+u^2}$
11	$cot^{-1}x$	$\frac{-1}{1+x^2}$	$cot^{-1}u$	$\frac{-u'}{1+u^2}$
12	$sec^{-1}x$	$\frac{1}{\lvert x\rvert\sqrt{x^2-1}}$	$sec^{-1}u$	$\frac{u'}{\lvert u\rvert\sqrt{u^2-1}}$
13	$csc^{-1}x$	$\frac{-1}{\lvert x\rvert\sqrt{x^2-1}}$	$csc^{-1}u$	$\frac{-u'}{\lvert u\rvert\sqrt{u^2-1}}$
	Exponential and Logarithmic Functions			
14	e^x	e^x	e^u	$e^u.u'$
15	a^x	$a^x.lna$	a^u	$a^u.u'.lna$
16	$ln\,x$	$\frac{1}{x}$	$ln\,u$	$\frac{u'}{u}$
	Product Rule		Quotient Rule	
17	$u.v$	$u.v'+v.u'$	$\frac{u}{v}$	$\frac{v.u'-u.v'}{v^2}$

Formulae of Integration

قواعد التكامل

	Rule القاعدة	General بشكل عام
1	$\int x^n \, dx = \frac{x^{n+1}}{n+1} + c$	$\int (ax+b)^n \, dx = \frac{1}{a \times (n+1)} (ax+b)^{n+1} + c \, , n \neq -1$ $\int (ax+b)^{-1} \, dx = \frac{1}{a} \ln\lvert ax+b \rvert + c$
2	$\int \sin x \, dx = -\cos x + c$	$\int \sin(ax) \, dx = -\frac{1}{a} \cos(ax) + c \, , a \in R$
3	$\int \cos x \, dx = \sin x + c$	$\int \cos(ax) dx = \frac{1}{a} \sin(ax) + c$
4	$\int \sec^2 x \, dx = \tan x + c$	$\int \sec^2(ax) dx = \frac{1}{a} \tan(ax) + c$
5	$\int \csc^2 x \, dx = -\cot x + c$	$\int \csc^2(ax) dx = -\frac{1}{a} \cot(ax) + c$
6	$\int \sec x . \tan x \, dx = \sec x + c$	$\int \sec(ax) . \tan(ax) dx = \frac{1}{a} \sec(ax) + c$
7	$\int \csc x . \cot x \, dx = -\csc x + c$	$\int \csc(ax) . \cot(ax) \, dx = -\frac{1}{a} \csc(ax) + c$
8	$\int \tan x \, dx = -\ln\lvert \cos x \rvert + c = \ln\lvert \sec x \rvert + c$	$\int \tan(ax) \, dx = -\frac{1}{a} \ln\lvert \cos(ax) \rvert + c = \frac{1}{a} \ln\lvert \sec(ax) \rvert + c$
9	$\int \cot x \, dx = \ln\lvert \sin x \rvert + c$	$\int \cot(ax) dx = \frac{1}{a} \ln\lvert \sin(ax) \rvert + c$
10	$\int \frac{1}{1+x^2} . dx = \tan^{-1} x + c$	$\int \frac{1}{a^2+x^2} . dx = \frac{1}{a} \tan^{-1}(\frac{x}{a}) + c$
11	$\int \frac{1}{\sqrt{1-x^2}} dx = \sin^{-1} x + c$	$\int \frac{1}{\sqrt{a^2-x^2}} dx = \sin^{-1}(\frac{x}{a}) + c$
12	$\int \frac{1}{\lvert x \rvert \sqrt{x^2-1}} dx = \sec^{-1} x + c$	$\int \frac{1}{\lvert x \rvert \sqrt{x^2-a^2}} dx = \frac{1}{a} \sec^{-1}(\frac{x}{a}) + c$
13	$\int \frac{-1}{\sqrt{1-x^2}} dx = -\sin^{-1} x + c = \cos^{-1} x + C$	$\int \frac{-1}{\sqrt{a^2-x^2}} dx = -\sin^{-1}\left(\frac{x}{a}\right) + c = \cos^{-1}\left(\frac{x}{a}\right) + C$
14	$\int \frac{1}{1+x^2} . dx = \tan^{-1} x + c$	$\int \frac{1}{a^2+x^2} . dx = \frac{1}{a} \tan^{-1}(\frac{x}{a}) + c$
15	$\int \frac{1}{\sqrt{1-x^2}} dx = \sin^{-1} x + c$	$\int \frac{1}{\sqrt{a^2-x^2}} dx = \sin^{-1}(\frac{x}{a}) + c$
	Formulae for Exponential Function	**قواعد الدالة الأسية**
16	$\int e^x \, dx = e^x + c$	$\int e^{ax} \, dx = \frac{1}{a} e^{ax} + c$
17	$\int a^x \, dx = \frac{a^x}{\ln\lvert a \rvert} + c \quad , \; a \in R - \{0\}$	$\int f'(x) . e^{f(x)} \, dx = e^{f(x)} + c$
	Formulae for Logarithmic Function	**قواعد الدالة اللوغاريتمية**
18	$\int \frac{1}{x} \, dx = \ln\lvert x \rvert + c$	$\int \frac{k}{ax+b} \, dx = \frac{k}{a} \ln\lvert ax+b \rvert + c$
19	$\int \frac{f'(x)}{f(x)} dx = \ln\lvert f(x) \rvert + c$	

Washer Formula قاعدة الحلقات	Shell Formula قاعدة الاصداف
$V = \pi \int_a^b (R^2 - r^2) dx$	$V = 2\pi \int_a^b h(x).r(x)\, dx$
Arc Length طول المنحنى	Integration By Parts التكامل بالأجزاء
$S = \int \sqrt{1 + [f'(x)]^2}\, dx$	$\int u.dv = uv - \int v.du$

Integration by Substitution التكامل بالتعويض

$\int g(x).(f(x))^n.dx$ *where* $f(x)$ *is* ***not linear function,*** ***Let*** $u = f(x)$	$\int g(x).sin(f(x)).dx$ where f(x) is **not linear function,** Let $u = f(x)$

Integration by Parts التكامل بالأجزاء

$\int g(x).(f(x))^n.dx$ ***where f(x) is linear function i.e.*** $f(x) = ax + b$, ***Let*** $u = g(x)$, $dv = (f(x))^n$	$\int g(x).sin(f(x)).dx$ where f(x) is **linear function,** Let $u = g(x)$, $dv = sin(f(x))$

Trigonometrical Formulae متطابقات هامه

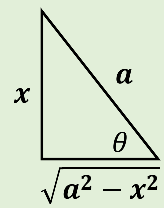
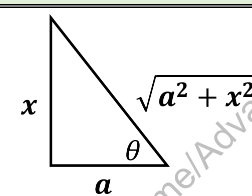
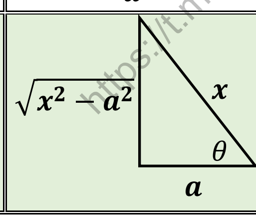
1) $sin^2x + cos^2x = 1$	2) $sin\ 2x = 2sin\ x\ .cos\ x$
$sin^2x = 1 - cos^2x$	$sin4x = 2sin\ 2x\ .cos\ 2x$
$cos^2x = 1 - sin^2x$	$sin\ 10x = 2\ sin\ 5x.cos\ 5x$
$tan^2x + 1 = sec^2x$ *and* $sec^2x - tan^2x = 1$	$cos2x = 2cos^2x - 1$ $= 1 - 2\ sin^2x$ $= cos^2x - sin^2x$
$cot^2x + 1 = csc^2x$ *and* $csc^2x - cot^2x = 1$	Sinh $x = \frac{e^x - e^{-x}}{2}$; Cosh $x = \frac{e^x + e^{-x}}{2}$

$\int sin^2x\ dx$	$\int cos^2x\ dx$
use $sin^2x = \frac{1}{2}(1 - cos\ 2x)$	*use* $cos^2x = \frac{1}{2}(1 + cos2x)$
$\int tan^2x\ dx$	$\int cot^2x\ dx$
use $tan^2x = sec^2x - 1$	*use* $cot^2x = csc^2x - 1$

$\int sin^3x\,dx$, *use* $sin^3x = sinx\ .sin^2x$	$\int cos^3x\,dx$, *use* $cos^3x = cosx\ .cos^2x$
use $sin^2x = 1 - cos^2x$	*use* $cos^2x = 1 - sin^2x$

Trigonometrical Formulae متطابقات هامه

$\sin A.\cos B = \frac{1}{2}[\sin(A-B) + \sin(A+B)]$	$\sin A . \sin B = \frac{1}{2}[\cos(A-B) - \cos(A+B)]$
$\cos A . \cos B = \frac{1}{2}[\cos(A-B) + \cos(A+B)]$	

Integral of type	Substitution	Figure
$\int \sqrt{a^2 - x^2}\, dx$	$x = a \sin \theta$	
$\int \sqrt{a^2 + x^2}\, dx$	$x = a \tan \theta$	
$\int \sqrt{x^2 - a^2}\, dx$	$x = a \sec \theta$	

التكامل بالكسور الجزئية Integration using Partial Fractions

تذكر في الكسور الجزئية

1) $$\frac{1}{x^2 - 3x + 2} = \frac{1}{(x-1)(x-2)} = \frac{A}{x-1} + \frac{B}{x-2}$$

2) $$\frac{4x^2 + 3x + 1}{x^2(x+1)} = \frac{A}{x} + \frac{B}{x^2} + \frac{D}{x+1}$$

3) $$\frac{3x+2}{x(x^2+1)} = \frac{A}{x} + \frac{Bx + D}{x^2 + 1}$$

4) $$\frac{x^2 - x + 2}{(x-1)^3(x^2+x+1)^2} = \frac{A}{x-1} + \frac{B}{(x-1)^2} + \frac{D}{(x-1)^3} + \frac{Ex+F}{x^2+x+1} + \frac{Gx+H}{(x^2+x+1)^2}$$