Algebra, Calculus I and II formulas

$$\frac{1}{\sqrt{a}-\sqrt{b}} = \frac{1}{\sqrt{a}-\sqrt{b}} \cdot \frac{\sqrt{a}+\sqrt{b}}{\sqrt{a}+\sqrt{b}} = \frac{\sqrt{a}+\sqrt{b}}{a-b}, \quad (a-b)(a+b) = a^2 - b^2$$

$(a \pm b)^2 = a^2 \pm 2ab + b^2$, $(a \pm b)^3 = a^3 \pm 3a^2b + 3ab^2 \pm b^3$,

$ax^2 + bx + c = 0$, then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, tangent line: $y - f(a) = f'(a)(x-a)$

derivative $f'(a) = \lim\limits_{h \to 0} \dfrac{f(a+h) - f(a)}{h} = \lim\limits_{x \to a} \dfrac{f(x) - f(a)}{x - a}$,

$(\sin x)^2 + (\cos x)^2 = 1$, $\sin(2x) = 2 \sin x \cos x$, $\cos(2x) = \cos^2 x - \sin^2 x$,

$\sin^2 x = \dfrac{1 - \cos(2x)}{2}$, $\cos^2 x = \dfrac{1 + \cos(2x)}{2}$, $\lim\limits_{x \to 0} \dfrac{\sin x}{x} = 1$, $\lim\limits_{x \to 0} (1+x)^{1/x} = e$,

$(x^n)' = nx^{n-1}$, $(e^x)' = e^x$, $(a^x)' = a^x \ln a$, $(\sin x)' = \cos x$, $(\cos x)' = -\sin x$,

$(\tan x)' = (\sec x)^2$, $(\cot x)' = -(\csc x)^2$, $(\sec x)' = \sec x \tan x$, $(\csc x)' = -\csc x \cot x$,

$(\ln x)' = \dfrac{1}{x}$, $(\log_a x)' = \dfrac{1}{x \ln a}$, $(\sin^{-1} x)' = \dfrac{1}{\sqrt{1-x^2}}$, $(\tan^{-1} x)' = \dfrac{1}{1+x^2}$,

$(f \cdot g)' = f'g + fg'$, $\left(\dfrac{f}{g}\right)' = \dfrac{f'g - gf'}{g^2}$, $[f(g(x))]' = f'(g(x)) \cdot g'(x)$,

Distance function: $s(t) = s(0) + \int_0^t v(s)ds$, velocity function $v(t) = v(0) + \int_0^t a(s)ds$.

When $a(t) = a$, then $s(t) = s(0) + v(0)t + \dfrac{1}{2}at^2$, $v(t) = v(0) + at$.

indefinite integral (antiderivative) table:

$\int x^n dx = \frac{1}{n+1}x^{n+1} + C$	$\int \sin x dx = -\cos x + C$	$\int \cos x dx = \sin x + C$
$\int \frac{1}{x} dx = \ln \lvert x \rvert + C$	$\int a^x dx = \frac{1}{\ln a} a^x + C$	$\int e^x dx = e^x + C$
$\int \sec^2 x dx = \tan x + C$	$\int \csc^2 x dx = -\cot x + C$	$\int \sec x \tan x dx = \sec x + C$
$\int \csc x \cot x dx = -\csc x + C$	$\int \frac{1}{\sqrt{1-x^2}} dx = \sin^{-1} x + C$	$\int \frac{1}{1+x^2} dx = \tan^{-1} x + C$

Substitution: $\displaystyle\int f(g(x))g'(x)dx = \int f(u)du$, where $u = g(x)$; or $\displaystyle\int_a^b f(g(x))g'(x)dx = \int_{g(a)}^{g(b)} f(u)du$

Integral by parts: $\displaystyle\int u dv = uv - \int v du$, $\displaystyle\int u(x)v'(x)dx = u(x)v(x) - \int v(x)u'(x)dx$,

$$\int_a^b u(x)v'(x)dx = u(x)v(x)|_a^b - \int_a^b v(x)u'(x)dx$$

<u>Geometry formulas</u>: area of triangle: $A = \dfrac{1}{2}ah$, area of rectangle: $A = ab$,

area of disk: $A = \pi r^2$, circumference of circle: $C = 2\pi r$, surface area of sphere: $A = 4\pi r^2$,

volume of sphere: $V = \dfrac{4}{3}\pi r^3$, volume of circular cylinder: $V = \pi r^2 h$,

volume of circular cone: $V = \dfrac{1}{3}\pi r^2 h$