∝ Euclid formula

 # Elementary Mathematics *(0000)*

(a) = a *(0001)*

a = a *(0002)*

[a] = a *(0003)*

+ = + *(0004)*

− = - *(0005)*

a + 0 = 0 + a = a *(0006)*

a - 0 = a *(0007)*

a - b + b = a *(0008)*

a − b = - b + a *(0009)*

b = (b c) / c *(0010)*

1 = c / c *(0011)*

 # Secondary Mathematics *(0012)*

 # Engineering Analysis *(0013)*

 # differentiation *(0014)*

dx dn 1 (c · x) = c · (dx dn (x)) # A - Z constants ; a - z Expressions *(0015)*

(x + y) ' = x ' + y ' *(0016)*

(x · y) ' = (x ' · y) + (x · y ') *(0017)*

(x / y) ' = ((x ' · y) − (x · y ')) / (y ^{2}) *(0018)*

dv dn = dv dx · dx dn # chain rule *(0019)*

$$(x^{c}) ' = c \cdot x^{c-1} \quad (0020)$$

$$(e^{x}) ' = e^{x} \quad (0021)$$

$$(c^{x}) ' = c^{x} \cdot \ln c \quad (0022)$$

$$(\sin x) ' = \cos x \quad (0023)$$

$$(\cos x) ' = - \sin x \quad (0024)$$

$$(\tan x) ' = \sec^{2} x \quad (0025)$$

$$(\cot x) ' = - \csc^{2} x \quad (0026)$$

$$(\sinh x) ' = \cosh x \quad (0027)$$

$$(\cosh x) ' = \sinh x \quad (0028)$$

$$(\ln x) ' = 1 / x \quad (0029)$$

$$(\log_{a} x) ' = (\log_{a} e) / x \quad (0030)$$

$$(\arcsin x) ' = 1 / (\sqrt{ (1 - x^{2}) }) \quad (0031)$$

$$(\arccos x) ' = - (1 / (\sqrt{ (1 - x^{2}) })) \quad (0032)$$

$$(\arctan x) ' = 1 / (1 + x^{2}) \quad (0033)$$

$$(\operatorname{arccot} x) ' = - 1 / (1 + x^{2}) \quad (0034)$$

 # integration (0035)

$$\int (u \cdot v ') \, dx = (u \cdot v) - \int (u ' \cdot v) \, dx \quad (0036)$$

$$\int (x^{c}) \, dx = ((x^{(c + 1)}) / (c + 1)) + n \text{ , given } n \neq 1 \quad (0037)$$

$$\int (1 / x) \, dx = \ln (|(x)|) + c \quad (0038)$$

$$e^{c x} dx = (1 / c) \cdot (e^{c x}) + n \quad (0039)$$

$$\int$$

$$\int \sin x \, dx = -(\cos x) + c \qquad (0040)$$

$$\int \cos x \, dx = (\sin x) + c \qquad (0041)$$

$$\int \tan x \, dx = -(\ln(|(\cos x)|)) + c \qquad (0042)$$

$$\int \cot x \, dx = \ln(|(\sin x)|) + c \qquad (0043)$$

$$\int \sec x \, dx = \ln(|(\sec x + \tan x)|) + c \qquad (0044)$$

$$\int \csc x \, dx = \ln(|(\csc x - \cot x)|) + c \qquad (0045)$$

$$\int (1 / (x^2 + c^2)) \, dx = (1 / c) \cdot (\arctan(x / c)) + n \qquad (0046)$$

$$\int (1 / \sqrt{(c^2 - x^2)}) \, dx = \arcsin(x / c) + n \qquad (0047)$$

$$\int (1 / \sqrt{(x^2 + c^2)}) \, dx = 1/(\sinh) \cdot (x / c) + n \qquad (0048)$$

$$\int (1 / \sqrt{(x^2 - c^2)}) \, dx = 1/(\cosh) \cdot (x / c) + n \qquad (0049)$$

$$\int (\sin^2 x) \, dx = (1 / 2) \cdot x - ((1 / 4) \cdot \sin 2 x) + c \quad (0050)$$

$$\int (\cos^2 x) \, dx = (1 / 2) \cdot x + ((1 / 4) \cdot \sin 2 x) + c \quad (0051)$$

$$\int (\tan^2 x) \, dx = \tan x - x + c \quad (0052)$$

$$\int (\cot^2 x) \, dx = - (\cot x) - x + c \quad (0053)$$

$$\int (\ln x) \, dx = x \ln x - x + c \quad (0054)$$

$$\int (e^{a x} \cdot \sin b x) \, dx = (e^{a x} / (a^2 + b^2)) \cdot (a \sin b x - b \cos b x) + c \quad (0055)$$

$$\int (e^{a x} \cdot \cos b x) \, dx = (e^{a x} / (a^2 + b^2)) \cdot (a \cos b x + b \sin b x) + c \quad (0056)$$

 # Polar Coords (0057)

$x = r \cdot (\cos \theta)$ (0058)

$y = r \cdot (\sin \theta)$ (0059)

$r = \sqrt{ (x^2 + y^2) }$ (0060)

$\theta = \arctan (y / x)$ (0061)

$dx \, dy = r \, dr \, d\theta$ (0062)

 # Series (0063)

$$1 / (1 - x) = \sum_{m=0}^{\infty} (x^m) \text{ , given } |(x)| < 1 \quad (0064)$$

$$\sum_{m=0}^{\infty}$$

$$e^{x} = \sum_{m=0}^{\infty} (x^{m} / m !) \quad (0065)$$

$$\sin x = \sum_{m=0}^{\infty} (({}^{-}1^{m} \cdot x^{(2m+1)}) / ((2m + 1) !)) \quad (0066)$$

$$\cos x = \sum_{m=0}^{\infty} (({}^{-}1^{m} \cdot x^{(2m)}) / ((2m) !)) \quad (0067)$$

$$\ln (1 - x) = {}^{-}\sum_{m=0}^{\infty} ((x^{m}) / m) \text{ , given } (|(x)| < 1) \quad (0068)$$

$$\arctan x = \sum_{m=0}^{\infty} ({}^{-}1^{m} \cdot (x^{(2 \cdot m + 1)}) / (2 \cdot m + 1)) \text{ , given } (|(x)| < 1) \quad (0069)$$

Vectors (0070)

$$a \cdot b = (a_{1} \cdot b_{1}) + (a_{2} \cdot b_{2}) + (a_{3} \cdot b_{3}) \quad (0071)$$

$$a \times b = \begin{bmatrix} i & j & k \\ a_{1} & a_{2} & a_{3} \\ b_{1} & b_{2} & b_{3} \end{bmatrix} \quad (0072)$$

$$\nabla f = (\partial f / \partial x) \vec{i} + (\partial f / \partial y) \vec{j} + (\partial f / \partial z) \vec{k} \quad (0073)$$

$$\nabla \cdot v = (\partial v_{1} / \partial x) + (\partial v_{2} / \partial y) + (\partial v_{3} / \partial z) \quad (0074)$$

$$\nabla \times v = \begin{bmatrix} i & j & k \\ (\partial / \partial x) & (\partial / \partial y) & (\partial / \partial z) \\ v_1 & v_2 & v_3 \end{bmatrix} \quad (0075)$$

 # SI units (0076)

$e = 2.718281828459045$ (0077)

$\sqrt{e} = 1.648721270700128$ (0078)

$e^2 = 7.389056098930650$ (0079)

$\pi = 3.141592653589793$ (0080)

$\pi^2 = 9.869604401089358$ (0081)

$\sqrt{\pi} = 1.772453850905516$ (0082)

$\log_{10} \pi = 0.497149872694133$ (0083)

$\ln \pi = 1.144729885849400$ (0084)

$\log_{10} e = 0.434294481903251$ (0085)

$\ln 10 = 2.302585092994045$ (0086)

$\sqrt{2} = 1.414213562373095$ (0087)

$\sqrt[3]{2} = 1.259921049894873$ (0088)

$\sqrt{3} = 1.732050807568877$ (0089)

$\sqrt[3]{3} = 1.442249570307408$ (0090)

$\ln 2 = 0.693147180559945$ (0091)

$\ln 3 = 1.098612288668109$ (0092)

$\gamma = 0.577215664901523$ (0093)

$\ln \gamma = -(0.549539312981644)$ (0094)

$1° = 0.017453292519943 \text{ rad}$ (0095)

$$1\ \mathrm{rad} = 57.295779513083230^\circ = 57^\circ\ 17'\ 44.806''\ (57 \cdot 27'\ 44.806'') \quad (0096)$$

Signal Processing (0097)

Calculus (0098)

Reciprocal identities (0099)

$$\sin x = 1 / (\csc x) \quad (0100)$$

$$\csc x = 1 / (\sin x) \quad (0101)$$

$$\sec x = 1 / (\cos x) \quad (0102)$$

$$\cos x = 1 / (\sec x) \quad (0103)$$

$$\tan x = 1 / (\cot x) \quad (0104)$$

$$\cot x = 1 / (\tan x) \quad (0105)$$

Tangent & Cotangent identities (0106)

$$\tan x = (\sin x) / (\cos x) \quad (0107)$$

$$\cot x = (\cos x) / (\sin x) \quad (0108)$$

Pythagorean identities (0109)

$$\sin^2 x + \cos^2 x = 1 \quad (0110)$$

$$1 + (\tan^2 x) = \sec^2 x \quad (0111)$$

$$1 + (\cot^2 x) = \csc^2 x \quad (0112)$$

function identities (0113)

$$\sin((\pi / 2) - x) = \cos x \quad (0114)$$

$$\csc((\pi / 2) - x) = \sec x \quad (0115)$$

$$\sec((\pi / 2) - x) = \csc x \quad (0116)$$

$$\cos((\pi / 2) - x) = \sin x \quad (0117)$$

$$\tan((\pi / 2) - x) = \cot x \quad (0118)$$

$$\cot\left(\left(\pi / 2\right) - x\right) = \tan x \quad (0119)$$

 # Reduction formulas (0120)

$$\sin\left(^{-} x\right) = {}^{-} \sin x \quad (0121)$$

$$\csc\left(^{-} x\right) = {}^{-} \csc x \quad (0122)$$

$$\sec\left(^{-} x\right) = \sec x \quad (0123)$$

$$\cos\left(^{-} x\right) = \cos x \quad (0124)$$

$$\tan\left(^{-} x\right) = {}^{-} \tan x \quad (0125)$$

$$\cot\left(^{-} x\right) = {}^{-} \cot x \quad (0126)$$

 # Sum & difference formulas (0127)

$$\sin\left(u \pm v\right) = \sin u \cos v \pm \cos \sin v \quad (0128)$$

$$\cos\left(u \pm v\right) = \cos u \cos v \pm \sin u \sin v \quad (0129)$$

$$\tan\left(u \pm v\right) = \left(\tan u \pm \tan v\right) / \left(1 \mp \left(\tan u \tan v\right)\right) \quad (0130)$$

 # Double - angle formulas (0131)

$$\sin\left(2 \cdot u\right) = 2 \sin u \cos u \quad (0132)$$

$$\cos\left(2 \cdot u\right) = \cos^{2} u - \sin^{2} u - \sin^{2} u = 2 \cdot \left(\cos^{2} y\right) - 1 = 1 - 2 \sin^{2} u \quad (0133)$$

$$\tan\left(2 \cdot u\right) = \left(2 \cdot \tan u\right) / \left(1 - \tan^{2} u\right) \quad (0134)$$

 # Power reducing formula (0135)

$$\sin^{2} u = \left(1 - \cos\left(2 \cdot u\right)\right) / 2 \quad (0136)$$

$$\cos^{2} u = \left(1 + \cos\left(2 \cdot u\right)\right) / 2 \quad (0137)$$

$$\tan^{2} u = \left(1 - \cos\left(2 \cdot u\right)\right) / \left(1 + \cos\left(2 \cdot u\right)\right) \quad (0138)$$

 # Sum - to - product formulas (0139)

$$\sin u + \sin v = 2 \cdot \sin\left(\left(u + v\right) / 2\right) \cdot \cos\left(\left(u - v\right) / 2\right) \quad (0140)$$

$$\sin u - \sin v = 2 \cdot \cos\left(\left(u + v\right) / 2\right) \cdot \sin\left(\left(u - v\right) / 2\right) \quad (0141)$$

$$\cos u + \cos v = 2 \cdot \cos ((u + v) / 2) \cdot \cos ((u - v) / 2) \quad (0142)$$

$$\cos u - \cos v = - 2 \cdot \cos ((u + v) / 2) \cdot \sin ((u - v) / 2) \quad (0143)$$

 # Product - to - Sum formulas (0144)

$$\sin u \cdot \sin v = (1 / 2) \cdot \cos (u - v) - \cos (u + v) \quad (0145)$$

$$\cos u \cdot \cos v = (1 / 2) \cdot \cos (u - v) + \cos (u + v) \quad (0146)$$

$$\sin u \cdot \cos v = (1 / 2) \cdot \sin (u + v) + \cos (u - v) \quad (0147)$$

$$\cos u \cdot \sin v = (1 / 2) \cdot \sin (u - v) - \sin (u - v) \quad (0148)$$

 # Trigonometric functions , given $\theta = (0 < \theta < (\pi / / 2))$ (0149)

let $x =$ *coord* $x \in x$ *plane and* $y =$ *coord* $y \in y$ *plane and* (0150)

let $r = \sqrt{ (x^2 + y^2) }$ *then* (0151)

$$\sin \theta = y / r \quad (0152)$$

$$\cos \theta = x / y \quad (0153)$$

$$\tan \theta = y / x \quad (0154)$$

$$\csc \theta = y / r \quad (0155)$$

$$\sec \theta = r / x \quad (0156)$$

$$\tan \theta = x / y \quad (0157)$$

 # Factors & zeros of polynamials (0158)

let $p (x) = a_n x^n + a_{(n - 1)} x^{(x - 1)} + \ldots + a_1 x + a_0$ *, if* ($p (a) == 0$) *then a isa zero of* $p (x)$ *and* $(x - a)$ *isa factor of* $p (x)$ (0159)

 # Fundamental theorem of algebra (0160)

let $f (n) = (a^n)$ *then* (0161)

polynomial hasa $f (n)$ *hasa zeros ==* n *and zeros isa (imaginary* $\vee$ *real) , and* (0162)

$$\text{polynominal hasa real hasa degree \% 2 != 0 and polynominal hasa real hasa zeros == (n \% 2 != 0)} \quad (0163)$$

Quadratic formula (0164)

$$\text{if } p(x) = a x^2 + b x + c \text{ and } (0 \leq b^2 - 4 a c) \text{ then } p(x) \text{ hasa real hasa zeros} = (-b \pm \sqrt{ (b^2 - 4 a c) }) / (2 a) \quad (0165)$$

Special factors (0166)

$$x^2 - a^2 = (x - a) \cdot (x + a) \quad (0167)$$

$$x^3 + a^3 = (x + a) \cdot (x^2 - a x + a^2) \quad (0168)$$

$$x^3 - a^3 = (x - a) \cdot (x^2 + a x + a^2) \quad (0169)$$

$$x^4 - a^4 = (x^2 - a^2) \cdot (x^2 + a^2) \quad (0170)$$

Binomial theorem (0171)

$$(x + y)^n = (x^n + n x^{(n-1)}) \cdot y + ((n \cdot (n - 1)) / 2 !) \cdot (x^{(n-2)} \cdot y^2) + \ldots + n \cdot x \cdot y^{(n-1)} + y^n \quad (0172)$$

$$(x - y)^n = (x^n - n x^{(n-1)}) \cdot y + ((n \cdot (n - 1)) / 2 !) \cdot (x^{(n-2)} \cdot y^2) - \ldots \pm n \cdot x \cdot y^{(n-1)} \mp y^n \quad (0173)$$

Rational zero theorem (0174)

$$\text{let } p(x) = \sum_{n=0}^{\infty} (a_n x^n + a_{(n-1)} x^{(n-1)}) + \sum_{x=0}^{n} (a_1 x + a_0) \text{ likewise} \quad (0175)$$

$$\text{let } p(x) = (a_n \cdot x^n + a_{(n-1)} \cdot x^{(n-1)} + \ldots + a_1 \cdot x + a_0) \quad (0176)$$

given a_0 hasa r and r isa factor of a_0 (0177)

given a_n hasa s and s isa factor of a_n (0178)

and p (x) hasa coefficient and coefficient isa integer (0179)

then p (x) hasa zero that isa rational x with with $x = r / s$ (0180)

Factoring by grouping (0181)

$$a\,c\,x^{3} + a\,d\,x^{2} + b\,c\,x + b\,d = a\,x^{2}\,(c\,x + d) = (a\,x^{2} + b)\cdot(c\,x + d) \quad (0182)$$

 # Arithmetic operations (0183)

$$a\cdot b + a\cdot c = a\cdot(b + c) \quad (0184)$$

$$(a / b) / (c / d) = (a\cdot d) / (b\cdot c) \quad (0185)$$

$$a\cdot(b / c) = a\cdot(b + c) \quad (0186)$$

$$(a / b) + (c / d) = (a\cdot d + b\cdot c) / (b\cdot d) \quad (0187)$$

$$(a / b) / c = a / (b\cdot c) \quad (0188)$$

$$(a - b) / (c - d) = -((b - a) / (d - c)) \quad (0189)$$

$$(a + b) / c = (a / c) + (b / c) \quad (0190)$$

$$a / (b / c) = (a\cdot c) / b \quad (0191)$$

$$(a\cdot b + a\cdot c) / a = b + c \quad (0192)$$

 # Exponents and radicals (0193)

$$\sqrt[2]{x} = \sqrt{(x)} \quad (0194)$$

$$a^{0} = 1 \text{ , given } a \neq 0 \quad (0195)$$

$$(a / b)^{x} = (a^{x}) / (b^{x}) \quad (0196)$$

$$(a\cdot b)^{x} = (a^{x})\cdot(b^{x}) \quad (0197)$$

$$\sqrt[n]{(a^{m})} = a^{(m / n)} \quad (0198)$$

$$(a^{x})\cdot(a^{y}) = a^{(x + y)} \quad (0199)$$

$$a^{(-x)} = 1 / (a^{x}) \quad (0200)$$

$$\sqrt{a} = a^{(1 / 2)} \quad (0201)$$

$$\sqrt[n]{(a\cdot b)} = (\sqrt[n]{a})\cdot(\sqrt[n]{b}) \quad (0202)$$

$$(a^{x}) / (a^{y}) = a^{(x - y)} \quad (0203)$$

$$(a^{x})^{y} = a^{(x \cdot y)} \quad (0204)$$

$$\sqrt[n]{a} = a^{(1 / n)} \quad (0205)$$

$$\sqrt[n]{(a / b)} = (\sqrt[n]{a}) / (\sqrt[n]{b}) \quad (0206)$$

 # Linear Algebra (0207)

 # Basics (0208)

given Vector isa array from 0 to m (Vector [m]) then (0209)

Matrix isa Vector from 0 to n (Matrix [m] [n]) (0210)