Sample Problem .....

Library : Libaldo.py

- This library include:
  - sympy.py The best symbolic math library for me
  - numpy as np, matplotlib.pyplot as plt IPython.display
  - libaldo_math2.py this module have some util tools for classic math functions
  - libaldo_algorith.py some algorith to manage simple math functions
  - lib_MyEq , this module manage maths Eq
  - lib_MyEqEq , this module will be MyEq=MyEq
- Also include the most used variables like ,x,y,z,alpha,mu.. etc... mayby 150 variables

one example better than a lot tuto..

Sample Problem .....

In [3]:

```
# This scrip initializes all variables.
import sys
sys.path.insert(0, './Libaldo')
from Libaldo import *
```

In [4]:

```
P=MyEq((a+b)*(x+y+z)+(a+b)*(x*2*y-2*z),'P')
```

$$P = (a+b)(2xy-2z) + (a+b)(x+y+z)$$

In [5]:

```
P.factor()
```

$$P = (a+b)(2xy+x+y-z)$$

In [3]:

```
# This scrip initializes all variables.
import sys
sys.path.insert(0, './Libaldo')
from Libaldo import *
```

In [6]:

```
P=MyEq(a*a*b+a*a*c+b*b*a+b*b*c+c*c*a+c*c*b+2*a*b*c,'P')
```

$$P = a^2b + a^2c + ab^2 + 2abc + ac^2 + b^2c + bc^2$$

In [7]:

```
P.factor()
```

$$P = (a+b)(a+c)(b+c)$$

Sample Problem .....

141. Si el MCD de los polinomios

$P(x) = (x^2 - 2x + 1)^4 (x^2 + 3x + 2)^8$

$Q(x) = (x^3 - 3x^2 + 3x - 1)^4 (x + 2)^8$

es $(ax^2 + bx + c)^n$; $a > 0$
halle $abc + n$.

A) −2 B) −1 C) 2
D) 6 E) 10

In [21]:
```
# This scrip initializes all variables.
import sys
sys.path.insert(0, './Libaldo')
from Libaldo import *
```

In [22]:
```
Lshow('If GDC between:')
P=MyEq((x*x-2*x+1)**4*(x*x++3*x+2)**8,'P')
Q =MyEq((x*x*x-3*x*x+3*x-1)**4*(x+2)**8,'Q')
Lshow(' Is:')
M=MyEq((a*x*x+b*x+c)**n,'M')
Lshow(' find : abc+n')
```

$$If\ GDC\ between:$$

$$P = \left(x^2 - 2x + 1\right)^4 \left(x^2 + 3x + 2\right)^8$$

$$Q = (x + 2)^8 \left(x^3 - 3x^2 + 3x - 1\right)^4$$

$$Is:$$

$$M = \left(ax^2 + bx + c\right)^n$$

$$find\ :\ abc + n$$

In [23]:
```
P.factor()
```

$$P = (x - 1)^8 (x + 1)^8 (x + 2)^8$$

In [24]:
```
Q.factor()
```

$$Q = (x - 1)^{12} (x + 2)^8$$

In [25]:
```
GDC(P,Q) # GDC(a,b) return gdc between (a,b)
```

Out[25]: $(x - 1)^8 (x + 2)^8$

In [26]:
```
# GDC(a,b) return gdc between (a,b)
# P.baselist() : if P= (x+a)**a*(y-2)**b*z**c,  return [(x+a),(y-2),z]
# mulitem(ksym): input[a,b,c...] return a*b*c*...
# P=MyEq(expr,'P') return Equation class with name P
A=MyEq(mulitem(baselist(GDC(P,Q))),'A')
```

$A = (x-1)(x+2)$

In [27]:
```python
# Q=MQ(expr1,expr2) return Equation Equallity  class with name Q--> expr1=expr2
B=MQ(A,getbase(M))
```

$(x-1)(x+2) = ax^2 + bx + c$

In [28]:
```python
B.expand()
```

$x^2 + x - 2 = ax^2 + bx + c$

```python
def solve_coef_list(self,*args):
    r'''
    solve variable from  two polinomies with tha same coefficient ,grade orden

    example:
    **********
    a*x*x+b*x+c= 3*x*x+2*x+7+y

    return:  MyEq
    a=3
    b=2
    c=7+y

    '''
```

In [29]:
```python
a,b,c=B.solve_coef_list(a,b,c)
```

$a = 1$

$b = 1$

$c = -2$

In [30]:
```python
a*b*c+8
```

Out[30]: 6

Sample Problem .....

Hallar el M.C.D. de los polinomios

$Q(a,b) = ab(ab+a+b+2) + a + b + 1$

$R(a,b) = ab[a(a+1)+b(a+1)+1] + a^2+a+b$

$S(a,b) = [a^2b-a+ a^2-b+ab^2-b^2](a+1)$

In [42]:
```python
# This scrip initializes all variables.
import sys
sys.path.insert(0, './Libaldo')
from Libaldo import *
```

In [50]:
```python
Lshow('Find GDC between Q,R,S')
Q=MyEq(a*b*(a*b+a+b+2)+a+b+1,'Q')
R=MyEq(a*b*(a*(a+1)+b*(a+1)+1)+a*a+a+b,'R')
S=MyEq((a*a*b-a+a*a-b+a*b*b-b*b)*(a+1),'S')
```

$Find\ GDC\ between\ Q, R, S$

$Q = ab\left(ab + a + b + 2\right) + a + b + 1$

$R = a^{2} + ab\left(a\left(a + 1\right) + b\left(a + 1\right) + 1\right) + a + b$

$S = \left(a + 1\right)\left(a^{2}b + a^{2} + ab^{2} - a - b^{2} - b\right)$

In [51]:
```
Q.expand()
R.expand()
S.expand()
```

$Q = a^{2}b^{2} + a^{2}b + ab^{2} + 2ab + a + b + 1$

$R = a^{3}b + a^{2}b^{2} + a^{2}b + a^{2} + ab^{2} + ab + a + b$

$S = a^{3}b + a^{3} + a^{2}b^{2} + a^{2}b - ab - a - b^{2} - b$

In [52]:
```
Q.factor()
R.factor()
S.factor()
```

$Q = \left(a + 1\right)\left(b + 1\right)\left(ab + 1\right)$

$R = \left(a + 1\right)\left(a + b\right)\left(ab + 1\right)$

$S = \left(a - 1\right)\left(a + 1\right)\left(a + b\right)\left(b + 1\right)$

In [53]:
```
# GDC(a,b) return gdc between (a,b)
GDC(Q,GDC(R,S))
```

Out[53]: $a + 1$

Sample Problem .....

Sean los polinomios

$P(x) = x^4 + mx - 9x^2 + n$ y otro $Q(x)$ cuyo

M.C.D. (P,Q) es $x^2 - 5x + 6$

Calcular $\dfrac{m}{n}$

In [69]:
```
# This scrip initializes all variables.
import sys
sys.path.insert(0, './Libaldo')
from Libaldo import *
```

In [70]:
```
Lshow('  GDC between Q(x) and P(x) is ')
```

```
D=MyEq(x*x-5*x+6,'D')
Lshow(' P(x) is ')
P=MyEq(x**4+m*x-9*x*x+n,'P')
Lshow('find m/n ')
```

$GDC\ between\ Q(x)\ and\ P(x)\ is$

$D = x^2 - 5x + 6$

$P(x)\ is$

$P = mx + n + x^4 - 9x^2$

$find\ m/n$

Como el M.C.D. es un factor común a P(x) y Q(x) $\Rightarrow$ P(x) $\div$ (x^2 - 5x + 6) es exacta, esto implica que:

$$P(2) = 0 \quad \wedge \quad P(3) = 0$$

In [71]:
```
m=P.solve(m,x=2)
```

$m = 10 - \frac{n}{2}$

In [72]:
```
P.upgrade(m)
```

$P = n + x^4 - 9x^2 + x\left(10 - \frac{n}{2}\right)$

In [73]:
```
n=P.solve(n,x=3)
```

$n = 60$

In [74]:
```
m.upgrade(n)
```

$m = -20$

In [75]:
```
m/n
```

Out[75]: $-\frac{1}{3}$

Sample Problem .....

¿Cuál será aquel polinomio que con $P(x) = (x^2-9)^2(x+2)$ tenga como M.C.D x^2+5x+6; además: $\sqrt{\text{m.c.m.}} = x^4 - 13x^2+36$?

In [114…
```
Lshow('  MCM between Q(x) and P(x) is ')
A=MyEq( x*x+5*x+6,'A')
Lshow('and P(x) is ')
P=MyEq( (x*x-9)**2*(x+2),'P')
Lshow('also sqrt of GDC (Q,P) is ')
R=MyEq(x**4-13*x*x+36,'R')

Lshow('find Q(x) ')
```

$MCM\ between\ Q(x)\ and\ P(x)\ is$

$A = x^2 + 5x + 6$

$and\ P(x)\ is$

$P = (x+2)\left(x^2-9\right)^2$

$also\ sqrt\ of\ GDC\ (Q, P)\ is$

$R = x^4 - 13x^2 + 36$

$find\ Q(x)$

In [115…
```
P.expand()
```

$P = x^5 + 2x^4 - 18x^3 - 36x^2 + 81x + 162$

In [116…
```
P.factor()
```

$P = (x-3)^2(x+2)(x+3)^2$

In [117…
```
A.factor()
R.factor()
```

$A = (x+2)(x+3)$

$R = (x-3)(x-2)(x+2)(x+3)$

In [ ]:
```
# in spanish MCD = GDS and mcm is MCM
```

$$P(x) \,.\, Q(x) = \text{M.C.D.}(P,Q) \,.\, \text{m.c.m.}(P,Q)$$

$$\Rightarrow Q(x) = \frac{\text{M.C.D.}(P,Q) \,.\, \text{m.c.m.}(P,Q)}{P(x)}$$

In [111…

```
Q=MyEq(A*R*R/P(),'Q')
```

$Q = (x-2)^2 (x+2)^2 (x+3)$

Sample Problem .....

Hallar el valor numérico del M.C.D. de los polinomios

$$F(x) = x^6 + 2x^5 + x^4 + x + 1$$
$$P(x) = 2x^4 + 7x^2 + 9x^2 + 7x + 2$$

Para $x = \sqrt{2} + 1$

In [1]:

```
# This scrip initializes all variables.
import sys
sys.path.insert(0, './Libaldo')
from Libaldo import *
```

In [2]:

```
F=MyEq(x**6+2*x**5+x**4+x+1,'F')
P=MyEq(2*x**4+7*x**3+9*x*x+7*x+2,'P')
Lshow('  find MCM   F(x) and P(x) when x=sqrt(2)+1 ')
```

$F = x^6 + 2x^5 + x^4 + x + 1$

$P = 2x^4 + 7x^3 + 9x^2 + 7x + 2$

$find\ MCM\ F(x)\ and\ P(x)\ when\ x = sqrt(2) + 1$

In [3]:

```
F.factor()
P.factor()
```

$F = (x+1)\left(x^2 + x + 1\right)\left(x^3 - x + 1\right)$

$P = (x+2)(2x+1)\left(x^2 + x + 1\right)$

In [5]:

```
R=MyEq(GDC(P,F),'R')
```

$R = x^2 + x + 1$

In [7]:
```
expand(R(x=sqrt(2)+1))
```

Out[7]: $3\sqrt{2}+5$

Sample Problem .....

Si la fracción

$$\frac{(a-3)x+(2a-5b+3)y+(5b-2)}{3x-5y+3}$$

adopta un valor constante para cualquier valor de x e y. Hallar el valor de la constante.

In [51]:
```
# This scrip initializes all variables.
import sys
sys.path.insert(0, './Libaldo')
from Libaldo import *
```

In [56]:
```
Lshow('F(x)/P(x) is constant for whatever value in x and y and equal k  ')
F=MyEq((a-3)*x+(2*a-5*b+3)*y+5*b-2,'F')
P=MyEq(3*x-5*y+3,'P')
Lshow('find k')
```

$F(x)/P(x)\ is\ constant\ for\ whatever\ value\ in\ x\ and\ y\ and\ equal\ k$

$F=5b+x\left(a-3\right)+y\left(2a-5b+3\right)-2$

$P=3x-5y+3$

$find\ k$

In [31]:
```
Q=MQ(F,P*k)
```

$5b+x\left(a-3\right)+y\left(2a-5b+3\right)-2=k\left(3x-5y+3\right)$

In [32]:
```
Q.expand('R')
```

$5b+x\left(a-3\right)+y\left(2a-5b+3\right)-2=3kx-5ky+3k$

In [34]:
```
e1=MyEq(a-3-3*k,'e1')
e2=MyEq(2*a-5*b+3+5*k,'e2')
e3=MyEq(5*b-2-3*k,'e3')
```

$e1=a-3k-3$

$e2=2a-5b+5k+3$

$$e3 = 5b - 3k - 2$$

In [35]:
```
a=e1.solve(a)
```

$$a = 3k + 3$$

In [36]:
```
e2.upgrade(a)
```

$$e2 = -5b + 11k + 9$$

In [37]:
```
b=e2.solve(b)
```

$$b = \frac{11k}{5} + \frac{9}{5}$$

In [38]:
```
a.upgrade(b)
```

$$a = 3k + 3$$

In [39]:
```
e3.upgrade(a,b)
```

$$e3 = 8k + 7$$

In [40]:
```
k=e3.solve(k)
```

$$k = -\frac{7}{8}$$

Sample Problem .....

La fracción $\frac{7x - 1}{1 - 5x + 6x^2}$ se obtuvo sumando las fracciones: $\frac{A}{1 - 3x}$, $\frac{B}{1 - 2x}$ calcular los valores de A y B

In [18]:
```
# This scrip initializes all variables.
import sys
sys.path.insert(0, './Libaldo')
from Libaldo import *
```

In [19]:
```
Lshow('find A and B if...')
Q=MQ((7*x-1)/(1-5*x+6*x*x),A/(1-3*x)+B/(1-2*x))
```

$$find\ A\ and\ B\ if...$$

$$\frac{7x - 1}{6x^2 - 5x + 1} = \frac{A}{1 - 3x} + \frac{B}{1 - 2x}$$

In [20]:
```
Q.factor()
```

$$\frac{7x-1}{(2x-1)(3x-1)} = \frac{-2Ax+A-3Bx+B}{(2x-1)(3x-1)}$$

In [21]:
```
Q.Mul(2*x-1)
```

$$\frac{7x-1}{3x-1} = \frac{-2Ax+A-3Bx+B}{3x-1}$$

In [22]:
```
Q.crossMul() # Q.crossMul() return.. if Q= (a/b=c/d).. return a*d=b*c
```

$$(3x-1)(7x-1) = (3x-1)(-2Ax+A-3Bx+B)$$

In [23]:
```
Q.expand()
```

$$21x^2-10x+1 = -6Ax^2+5Ax-A-9Bx^2+6Bx-B$$

In [24]:
```
A,B=Q.solve_coef_list(A,B)
```

$$A = 4$$

$$B = -5$$

Sample Problem .....

Descomponer en fracciones parciales

$$\frac{9}{(x-1)(x+2)^2}$$

Transfor partial fractions

In [10]:
```
# This scrip initializes all variables.
import sys
sys.path.insert(0, './Libaldo')
from Libaldo import *
```

In [11]:
```
P=MyEq(9/((x-1)*(x+2)**2),'P')
```

$$P = \frac{9}{(x-1)(x+2)^2}$$

In [12]:
```
partialfraction(P,A,B,C)
```

Out[12]:

$$\frac{A}{x+2} + \frac{B}{\left(x+2\right)^{2}} + \frac{C}{x-1}$$

In [13]:

```
e2=MQ(partialfraction(P,A,B,C),P)
```

$$\frac{A}{x+2} + \frac{B}{\left(x+2\right)^{2}} + \frac{C}{x-1} = \frac{9}{\left(x-1\right)\left(x+2\right)^{2}}$$

In [14]:

```
e2.factor('L')
```

$$\frac{Ax^{2} + Ax - 2A + Bx - B + Cx^{2} + 4Cx + 4C}{\left(x-1\right)\left(x+2\right)^{2}} = \frac{9}{\left(x-1\right)\left(x+2\right)^{2}}$$

In [15]:

```
Q=MQ(numer(e2.L),numer(e2.R))
```

$$Ax^{2} + Ax - 2A + Bx - B + Cx^{2} + 4Cx + 4C = 9$$

In [16]:

```
Q.sortdegree()
```

$$-2A - B + 4C + x^{2}\left(A + C\right) + x\left(A + B + 4C\right) = 9$$

In [17]:

```
A,B,C=Q.solve_coef_list(A,B,C)
```

$$A = -1$$

$$B = -3$$

$$C = 1$$

In [20]:

```
e2=MQ(partialfraction(P,A,B,C),P)
```

$$-\frac{1}{x+2} - \frac{3}{\left(x+2\right)^{2}} + \frac{1}{x-1} = \frac{9}{\left(x-1\right)\left(x+2\right)^{2}}$$

Sample Problem .....

Descomponer en fracciones parciales

$$\frac{2x^{3}+x^{2}+2x-1}{x^{4}-1}$$

Transfor partial fractions

In [21]:

```
# This scrip initializes all variables.
import sys
sys.path.insert(0, './Libaldo')
from Libaldo import *
```

In [22]:
```
P=MyEq((2*x**3+x*x+2*x-1)/(x**4-1),'P')
```

$$P = \frac{2x^3 + x^2 + 2x - 1}{x^4 - 1}$$

In [23]:
```
P.factor()
```

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

In [25]:
```
P2=MyEq(partialfraction(P,A,C*x+D,B),'P2')
```

$$P2 = \frac{A}{x+1} + \frac{B}{x-1} + \frac{Cx+D}{x^2+1}$$

In [26]:
```
e2=MQ(numer(factor(partialfraction(P,A,C*x+D,B))),2*x**3+x*x+2*x-1)
```

$$Ax^3 - Ax^2 + Ax - A + Bx^3 + Bx^2 + Bx + B + Cx^3 - Cx + Dx^2 - D = 2x^3 + x^2 + 2x - 1$$

In [27]:
```
e2.sortdegree()
```

$$-A + B - D + x^3(A + B + C) + x^2(-A + B + D) + x(A + B - C) = 2x^3 + x^2 + 2x - 1$$

In [28]:
```
A,B,C,D=e2.solve_coef_list(A,B,C,D)
```

$A = 1$

$B = 1$

$C = 0$

$D = 1$

In [ ]:
```
P2.upgrade(A,B,C,D)
```

$$P2 = \frac{1}{x^2+1} + \frac{1}{x+1} + \frac{1}{x-1}$$