SAI SỐ

```
function[aEp, rEp] = saiso(p_e, p_a)
    aEp = abs(p_e - p_a);
    rEp = aEp/abs(p_e);


function[output] = lamtron(number, n)
    output = round(number, n);


function[output] = chatcut(number, n)
    output = floor(number*10^n)/10^n;
```

```
function[] = check(p_e, p_a, deltap)
    p_L = p_a - deltap;
    p_R = p_a + deltap;
    if p_e >= p_L & p_e <= p_R
        disp('Hop le');
    else
        disp('Khong hop le')
    end


function[] = check_version2(p_e, p_a, rEp)
    aEp = rEp * p_a;
    p_L = p_a - aEp;
    p_R = p_a + aEp;
    if p_e >= p_L & p_e <= p_R
        disp('Hop le');
    else
        disp('Khong hop le')
    end
```

```
% b) Bieu thuc chua 3 bien
function[aEf, rEf] = tinhSaiSo3(f, x1_a, x2_a, x3_a, aEx1, aEx2, aEx3)
    syms x1 x2 x3
    df1 = diff(f, x1);
    df2 = diff(f, x2);
    df3 = diff(f, x3);
    df1_a = subs(df1, [x1, x2, x3], [x1_a, x2_a, x3_a]);
    df2_a = subs(df2, [x1, x2, x3], [x1_a, x2_a, x3_a]);
    df3_a = subs(df3, [x1, x2, x3], [x1_a, x2_a, x3_a]);

    f_a = subs(f, [x1, x2, x3], [x1_a, x2_a, x3_a]);

    aEf = abs(df1_a)*aEx1 + abs(df2_a)*aEx2 + abs(df3_a)*aEx3
    rEf = aEf/abs(f_a)
```

```
function[aEp , rEp] = SaisonBien(y, vars, vals, a_vals)
%y : biểu thức
%vars : danh sách các biến
%vals: giá trị của các biến
%a_vals: sai số tuyệt đối của các biến
    % tính giá trị gần đúng của y
    y_t = subs(y, vars, vals);

    % tính đạo hàm riêng theo từng biến của y
    for i = 1:length(vars)
        dy = diff(y, vars(i));
        % tính giá trị gần đúng của các đạo hàm
        d_y(i) = subs(dy, vars, vals);
    end

    % tính sai số tuyệt đối
    aEp = double(sum(abs(d_y).*a_vals));

    % tính sai số tương đối
    rEp = double(aEp / abs(y_t));
end

syms x1 x2 x3;
f = x1 + x2*x3;
vars = [x1, x2, x3];
vals = [5, 3, 7];
a_vals = [0.03, 0.06, 0.04];
[aEp, rEp] = SaisonBien(f, vars, vals, a_vals)
```

GIẢI PHƯƠNG TRÌNH SIÊU VIỆT

```
function[c, fc] = chiadoi(f, a, b, Df)
    k = 1; % hold on
    while 1
        c = (a + b) / 2;
        fc = f(c);
        % rEc = abs((a - c) / a);
        % disp([k c fc]);
        % plot(k, fc, 'ro')
        if abs(fc) < Df, break, end
        if f(a) * f(c) > 0, a = c; else b = c; end
        k = k + 1;
    end
% f = @(x) x + sin(x) - 2;
% a = 1;
% b = 1.4;
% df = 10^-3;
% chiadoi(f, a, b, df)
```

```
function[xn, fx] = pplap(f, phi, a, b, xo, Df)
    k = 1; % hold on
    while 1
        xn = phi(xo);
        fx = f(xn);
        % rExn = abs((xn - xo) / xo);
        % disp([k xn fx]);
        % plot(k, fx, 'ro')
        if abs(fx) < Df, break, end
        % if f(a) * f(xn) > 0, a = xn; else b = xn; end
        xo = xn;
        k = k + 1;
    end
f = @(x) x + sin(x) - 2;
phi = @(x) 2 - sin(x);
a = 1;
b = 2;
xo = 1.05;
df = 10^-3;
pplap(f, phi, a, b, xo, df)
```

```
function[xn, fxn] = tieptuyen(f, df, xo, Df)
    k = 1; hold on
    syms x;
    while 1
        xn = xo - subs(f, x, xo)/subs(df, x, xo);
        xn = double(xn);
        fxn = double(subs(f, x, xn));
        % disp([k xn fxn]);
        % plot(k, fxn, 'ro');
        if abs(fxn) < Df, break, end
        xo = xn;
        k = k + 1;
    end
% syms x;
% f = x^2 - sin(x) - 50;
% df = diff(f, x);
% xo = 2;
% Df = 10^-3;
% tieptuyen(f, df, xo, Df);
```

```
function[c, fc] = daycung(f, a, b, Df)
    k = 1; hold on
    while 1
        c = a - (b - a)/(f(b) - f(a)) * f(a);
        fc = f(c);
        % disp([k c fc]);
        % plot(k, fc, 'ro');
        if abs(fc) < Df, break, end
        if f(a)*f(c) > 0, a = c; else b = c; end
        k = k + 1;
    end
% f = @(x) x^2 - sin(x) - 50;
% a = 0;
% b = 8;
% Df = 3*10^-3;
% daycung(f, a, b, Df)
```

HỆ PHƯƠNG TRÌNH ĐẠI SỐ TUYẾN TÍNH

```
function[Xn] = lapnan(A, C, Df)
    n = length(C);
    B = -A;
    for i = 1:n
        B(:,i) = B(:,i)./diag(A);
    end
    B = B + eye(n);
    G = C./diag(A);
    Xo = G; k = 1;
    while 1
        Xn = B*Xo + G;
        fX = norm(A*Xn - C);
        if abs(fX) < Df, break, end
        Xo = Xn;
        k = k + 1;
    end
% A = [6 1 1 1 1; 2 9 3 1 2; 2 1 10 4 2; 1 2 1 8 3; 2 1 2 3 9];
% C = [9; 1; -12; -12; 5];
% Df = 10^-3;
% lapnan(A, C, Df);
% seidel5an(A, C, Df);
```

```
function[Xn] = seidelnan(A, C, Df)
    n = length(C);
    B = -A;
    for i = 1:n
        B(:,i) = B(:,i)./diag(A);
    end
    B = B + eye(n);
    G = C./diag(A);
    Xo = G; k = 1; Xn = Xo;
    while 1
        Xn(1) = B(1,:)*Xo + G(1);
        for i = 2:n, Xn(i) = 0; end
        for i = 2:n
            for j = 1:(i - 1)
                Xn(i) = Xn(i) + B(i, j)*Xn(j);
            end
            for j = i:n
                Xn(i) = Xn(i) + B(i, j)*Xo(j);
            end
            Xn(i) = Xn(i) + G(i);
        end
        fX = norm(A*Xn - C);
        if abs(fX) < Df, break, end
        Xo = Xn;
        k = k + 1;
    end
```

XẤP XỈ VÀ NỘI SUY

```
function[yc] = DaThucTongQuatN(xx, yy, xc)
    n = length(xx);
    for i = 1:n
        for j = 1:n
            X(i, j) = xx(i)^(j-1);
        end
        Y(i, 1) = yy(i);
    end
    A = inv(X)*Y;
    syms x;
    P = A(1);
    for i = 2:n
        P = P + A(i)*x^(i-1);
    end
    yc = double(subs(P, x, xc));
    ezplot(P, [xx(1) xx(end)]);
    hold on; plot(xx, yy, 'bo');
% xx = [ -3.2, -2.5, -1.7, -0.8, 0.3, 1.5];
% yy = [ -8.982, -5.831, -4.261, -1.837, -3.298, -0.249];
% xc = -2;
% xc = 0;
% DaThucTongQuatN(xx, yy, xc)
```

```
function[yc] = DaThucLagrangeN(xx, yy, xc)
    n = length(xx);
    syms x;
    for i = 1:n
        tu = 1;
        mau = 1;
        for j = 1:n
            if j == i
                continue
            end
            tu = tu * (x - xx(j));
            mau = mau * (xx(i) - xx(j));
        end
        L(i) = tu/mau;
    end
    bieuthuc = 0;
    for i = 1:n
        bieuthuc = bieuthuc + L(i)*yy(i);
    end
    yc = double(subs(bieuthuc, x, xc));
    ezplot(bieuthuc, [xx(1) xx(end)]);
    hold on; plot(xx, yy,'bo');
```

```
function[yc] = DaThucNewtonN(xx, yy, xc)
    N = length(xx);
    % tính tỉ sai phân
    n(1,:) = yy;

    for i = 2:N
        for j = 1:(N - i + 1)
            n(i, j) = (n(i - 1, j + 1) - n(i - 1, j)) / (xx(i + j - 1) - xx(j));
        end
    end

    % biểu thức newton tiến
    syms x;
    bieuthuc = n(1, 1);
    X = 1;
    for i = 2:N
        X = X * (x - xx(i-1));
        bieuthuc = bieuthuc + n(i, 1)*X;
    end
    % tính nghiệm và vẽ hình
    yc = double(subs(bieuthuc, x, xc));
    ezplot(bieuthuc, [xx(1) xx(end)]);
    hold on; plot(xx, yy,'bo');
```

```
function[yc] = SplineBac3(xx, yy, xc)
    h = xx(2:end) - xx(1:end-1);

    size = length(xx);
    VT(1, 1) = 1;
    VT(size, size) = 1;
    VP(1, 1) = 0;
    VP(size, 1) = 0;
    for i = 2:(size-1)
        j = i - 1;
        VT(i, j) = h(j)/6;
        VT(i, j + 1) = (h(j) + h(j+1))/3;
        VT(i, j + 2) = h(j + 1)/6;
        VP(i, 1) = (yy(j + 2) - yy(j + 1))/h(j + 1) - (yy(j + 1) - yy(j))/h(j);
    end
    m = inv(VT)*VP;

    M = diag(yy(1:end-1) - m(1:end-1).*h(1:end).^2/6);
    N = diag(yy(2:end) - m(2:end).*h(1:end).^2/6);

    syms x;
    for i = 1:(size-1)
        S(i) = m(i+1)*(x-xx(i))^3/6/h(i) + m(i)*(xx(i+1)-x)^3/6/h(i) + M(i, i)*(xx(i+1)-x)/h(i)+ N(i, i)*(x-xx(i))/h(i);
    end

    syms x;
    for i = 2:size
        if xc < xx(i)
            yc = double(subs(S(i-1), x, xc));
            break;
        end
    end

    hold on; plot(xx, yy, 'bo');
    for i = 1:(size-1)
        hold on;
        ezplot(S(i), [xx(i) xx(i+1)]);
    end
end
```

```
% y = ax + b;
function[yc] = Noisuy_linear(xx, yy, xc)
    N = length(xx);
    X = sum(xx);
    XX = sum(xx.*xx);
    Y = sum(yy);
    XY = sum(xx.*yy);
    syms a b;
    [a, b] = solve(XX*a + X*b == XY, X*a + N*b == Y);
    syms x;
    R = a*x + b;
    yc = double(subs(R, x, xc));
    ezplot(R, [xx(1) xx(end)]);
    hold on; plot(xx, yy, 'bo');
% xx = [ 2; 4; 7; 8.5; 9.5; 11];
% yy =[ 2.2; 4.2; 6.8; 8.1; 9.7; 10.5];
% xc = 6;
% Noisuy_linear(xx, yy, xc);
```

```
% y = ae^bx
function[yc] = Noisuy_e(xx, yy, xc)
    N = length(xx);
    X = sum(xx);
    XX = sum(xx.*xx);
    lY = sum(log(yy));
    XlY = sum(xx.*log(yy));
    syms A B;
    [A, B] = solve(XX*A + X*B == XlY, X*A + N*B == lY);
    syms x;
    R = exp(B)*exp(A*x);
    yc = double(subs(R, x, xc));
    ezplot(R, [xx(1) xx(end)]);
    hold on; plot(xx,yy,'bo');
% xx = [ 1.1; 3.2; 5.1; 7.7; 9.6; 12.2];
% yy = [ 3.1; 29.9; 65.7; 100.4; 195.7; 300.4];
% xc = 8.5;
% Noisuy_e(xx, yy, xc);
```

```
% xap xi co dang y = ax^2 + b
function[yc] = bai11a(xx, yy, xc)
% X = x*x
    N = length(xx);
    dX = sum(xx.*xx);
    dXdX = sum(xx.*xx.*xx.*xx);
    Y = sum(yy);
    dXY = sum(xx.*xx.*yy);
    syms A B;
    [A, B] = solve(dXdX*A + dX*B == dXY, dX*A + N*B == Y);
    syms x;
    R = A.*x^2 + B;
    yc = double(subs(R, x, xc))
    ezplot(R, [xx(1) xx(end)]);
    hold on; plot(xx,yy,'bo');
function [yc] = BPNN_ax2b(xx, yy, xc)
    syms a b;
    s = sum((yy - a*(xx.^2) - b).^2);
    da = diff(s, a);
    db = diff(s, b);
    [a b] = solve(da == 0, db == 0);
    syms x;
    R = a*x^2 + b;
    yc = double(subs(R, x, xc));
    ezplot(R, [xx(1) xx(end)]);
    hold on;
    plot(xx, yy, 'bo');
end
%% Du lieu thoa y = 0.5x^2 + 1.5
% xx = [ 1.1; 3.2; 5.1; 7.7; 9.6; 12.2];
% yy = [ 2.11; 6.62; 14.51; 31.15; 47.58; 74.71];
% xc = 8.5;
% bai11a(xx, yy, xc);
```

```
% xap xi co dang y = ax^b
function[yc] = bai11b(xx, yy, xc)
% ln(y) = ln(a) + bln(x)
% Y = ln(y); X = ln(x); A = b; B = ln(a);
    N = length(xx);
    lX = sum(log(xx));
    lXlX = sum(log(xx).*log(xx));
    lY = sum(log(yy));
    lXlY = sum(log(xx).*log(yy));
    syms A B;
    [A, B] = solve(lXlX*A + lX*B == lXlY, lX*A + N*B == lY);
    syms x;
    R = exp(B)*(x.^A);
    yc = double(subs(R, x, xc))
    ezplot(R, [xx(1) xx(end)]);
    hold on; plot(xx,yy,'bo');
function [yc] = BPNN_axmub(xx, yy, xc)
    syms a b;
    s = sum((yy - a*(xx.^b)).^2);
    da = diff(s, a);
    db = diff(s, b);
    [a b] = solve( da == 0 ,db == 0);
    syms x;
    R = a*x^b;
    yc = double(subs(R,x,xc));
    ezplot(R, [xx(1) xx(end)]);
    hold on;
    plot(xx, yy, 'bo');
end
%% Du lieu thoa y = 2x^1.3
% xx = [ 1.1; 3.2; 5.1; 7.7; 9.6; 12.2];
% yy = [ 2.26; 9.07; 16.63; 28.41; 37.84; 51.68];
% xc = 8.5;
% bai11b(xx, yy, xc);
```

```
% xap xi co dang y = ax^2 + bx + c
function[yc] = bai12a(xx, yy, xc)
    N = length(xx);
    XXXX = sum(xx.*xx.*xx.*xx);
    XXX = sum(xx.*xx.*xx);
    XX = sum(xx.*xx);
    X = sum(xx);
    XXY = sum(xx.*xx.*yy);
    XY = sum(xx.*yy);
    Y = sum(yy);
    VT = [XXXX XXX XX; XXX XX X; XX X N];
    VP = [XXY; XY; Y];

    KQ = linsolve(VT, VP);
    syms x;
    R = KQ(1)*x^2 + KQ(2)*x + KQ(3);
    yc = double(subs(R, x, xc))
    ezplot(R, [xx(1) xx(end)]);
    hold on; plot(xx,yy,'bo');
function [yc] = BPNN_ax2bxc(xx, yy ,xc)
    syms a b c;
    s = sum((yy - (a*(xx).^2 + b*xx + c)).^2);
    da = diff(s, a);
    db = diff(s, b);
    dc = diff(s, c);
    [a b c] = solve( da == 0, db == 0, dc == 0);
    syms x;
    R= a*x^2 + b*x + c;
    yc = double(subs(R, x, xc));
    ezplot(R, [xx(1) xx(end)]);
    hold on;
    plot(xx, yy, 'bo');
end
%% Du lieu thoa y = 0.3x^2 + 0.7x - 2.5
% xx = [ 1.1; 3.2; 5.1; 7.7; 9.6; 12.2];
% yy = [ -1.37; 2.81; 8.87; 20.68; 31.87; 50.69];
% xc = 8.5;
% bai12a(xx, yy, xc);
```

```
% xap xi co dang y = a*x + b*sinx + c*cosx
function[yc] = bai12b(xx, yy, xc)
    XX = sum(xx.*xx);
    XSINX = sum(xx.*sin(xx));
    XCOSX = sum(xx.*cos(xx));
    XY = sum(xx.*yy);
    SINXCOSX = sum(sin(xx).*cos(xx));
    COSXCOSX = sum(cos(xx).*cos(xx));
    YCOSX = sum(yy.*cos(xx));
    SINXSINX = sum(sin(xx).*sin(xx));
    YSINX = sum(yy.*sin(xx));
    VT = [XX XSINX XCOSX; XCOSX SINXCOSX COSXCOSX; XSINX SINXSINX SINXCOSX];
    VP = [XY; YCOSX; YSINX];

    KQ = linsolve(VT, VP);
    syms x;
    R = KQ(1)*x + KQ(2)*sin(x) + KQ(3)*cos(x);
    yc = double(subs(R, x, xc))
    ezplot(R, [xx(1) xx(end)]);
    hold on; plot(xx,yy,'bo');
function [yc] = BPNN_axbsinxcsinx(xx,yy,xc)
    syms a b c;
    s = sum((yy - (a*xx + b*sin(xx) + c * sinx(xx))).^2);
    da = diff(s,a);
    db = diff(s,b);
    dc = diff(s,c);
    [a b c] = solve( da == 0 , db == 0, dc == 0);
    syms x;
    R= a*x + b*sin(x) + c*sin(x);
    yc = double(subs(R,x,xc));
    ezplot(R,[xx(1) xx(end)]);
    hold on;
    plot(xx,yy,'bo');
end
%% Du lieu thoa y = 3x + 1.5sinx - 3.5cosx
% xx = [ 1.1; 3.2; 5.1; 7.7; 9.6; 12.2];
% yy = [ 3.05; 13.01; 12.59; 24.05; 31.98; 32.79];
% xc = 8.5;
% bai12b(xx, yy, xc);
```

ĐẠO HÀM

```
function [] = SPT_SPL(xx, yy, x0, df)
    for i = 1:length(xx)
        if xx(i) == x0
            break;
        end
    end

    if(i < length(xx))
        df_SPT = (yy(i+1) - yy(i))/(xx(i+1) - xx(i))
        rEdf_SPT = abs((df_SPT-df)/df)
    end

    if(i > 1)
        df_SPL = (yy(i) - yy(i-1))/(xx(i) - xx(i-1))
        rEdf_SPL = abs((df_SPL - df)/df)
    end
end
% Cau b
xx = [0.8 0.9 1 1.1 1.2 1.3 1.4];
yy = [0.7174 0.7833 0.8415 0.8912 0.9320 0.9636 0.9854];
df = 0.5403;
SPT_SPL(xx, yy, 1, df)
```

```
function [] = PP3D(xx, yy, x0, df)
     for i = 1:length(xx)
        if xx(i) == x0
            break;
        end
    end

    if (i <= length(xx) - 2)
        df_3DC = (-3*yy(i) + 4*yy(i+1) - yy(i+2))/(xx(i+2) - xx(i))
        rEdf_3DC= abs((df - df_3DC)/df)
    end

    if (i > 1 && i <= length(xx) - 1)
        df_3DG = (yy(i+1) - yy(i-1))/(xx(i+1) - xx(i-1))
        rEdf_3DG = abs((df - df_3DG)/df)
    end
end
% Cau b
xx = [0.8 0.9 1 1.1 1.2 1.3 1.4];
yy = [0.7174 0.7833 0.8415 0.8912 0.9320 0.9636 0.9854];
df = 0.5403;
PP3D(xx, yy, 1, df)
```

```
function [] = PP5D(xx, yy, x0, df)
     for i = 1:length(xx)
        if xx(i) == x0
            break;
        end
    end

    if (i <= length(xx) - 4)
        df_5DC = (-25*yy(i) + 48*yy(i+1) - 36*yy(i+2) + 16*yy(i+3) - 3*yy(i+4))/((xx(i+4) - xx(i))*3)
        rEdf_5DC = abs((df - df_5DC)/df)
    end

    if (i > 2 && i <= length(xx) - 2)
        df_5DG = (yy(i-2) - 8*yy(i-1) + 8*yy(i+1) - yy(i+2))/((xx(i+2) - xx(i-2))*3)
        rEdf_5DG = abs((df - df_5DG)/df)
    end
end
```

TÍCH PHÂN

```
function[] = PPHT(xx, yy, I)
    I_HT = 0;
    for i = 2:length(xx)
        I_HT = I_HT + (xx(i) - xx(i-1)) * (yy(i) + yy(i-1)) / 2;
    end

    I_HT
    rEI_HT = abs((I - I_HT) / I)
end
% Cau b
xx = [1 2 3 4 5 6 7];
yy = [4 -6 -14 -14 0 34 94];
I = 42;
PPHT(xx, yy, I)
```

```
function[] = Simpson_1_3(xx, yy, I)
    I_Simp13 = 0;
    n = length(xx);
    for i = 1:2:n
        if i + 2 <= n
            I_Simp13 = I_Simp13 + (xx(i+2)-xx(i)) * (yy(i)+4*yy(i+1)+yy(i+2)) / 6;
        else
            break;
        end
    end
    % Tính bậc thang 2 điểm cuối (nếu có)
    if i == n - 1
        I_Simp13 = I_Simp13 + (xx(n) - xx(i)) * (yy(n) + yy(i)) / 2;
    end

    I_Simp13
    rEI_HT = abs((I - I_Simp13) / I)
end
% Cau b
xx = [1 2 3 4 5 6 7];
yy = [4 -6 -14 -14 0 34 94];
I = 42;
Simpson_1_3(xx, yy, I)
```

```
function[] = Simpson_3_8(xx, yy, I)
    I_Simp38 = 0;
    n = length(xx);
    for i = 1:3:n
        if i+3 <= n
            I_Simp38 = I_Simp38 + (xx(i+3)-xx(i)) * (yy(i)+3*yy(i+1)+3*yy(i+2)+yy(i+3)) / 8;
        else
            break;
        end
    end
    % Simpson 1/3 3 điểm cuối (nếu có)
    if i == n-2
        I_Simp38 = I_Simp38 + (xx(n) - xx(i)) * (yy(i)+4*yy(i+1)+yy(i+2)) / 6;
        i = i + 2;
    end

    % Tính bậc thang 2 điểm cuối (nếu có)
    if i == n - 1
        I_Simp38 = I_Simp38 + (xx(n) - xx(i)) * (yy(n) + yy(i)) / 2;
    end

    I_Simp38
    rEI_HT = abs((I - I_Simp38) / I)
end
% Cau b
xx = [1 2 3 4 5 6 7];
yy = [4 -6 -14 -14 0 34 94];
I = 42;
Simpson_3_8(xx, yy, I)
```

```
function[] = Hi_n(n)
    syms t;
    tu = 1;
    for i = 0:n
        tu = tu*(t-i);
    end
    for i = 0:n
        H(i+1) = power(-1, n-i)*nchoosek(n, i)*int(tu/(t-i), t, 0, n)/(n*factorial(n));
    end
    H
end
```

```
function[INewton] = NewtonCotes(xx, yy, n, I)
    % n la so diem cua y trong 1 cum (vi du: simpson 3/8 => n = 4)
    n = n - 1;
    % Tính hệ số
    syms t;
    tu = 1;
    for i = 0:n
        tu = tu*(t-i);
    end
    for i = 0:n
        H(i+1) = power(-1, n-i)*nchoosek(n, i)*int(tu/(t-i), t, 0, n)/(n*factorial(n));
    end

    INewton = 0;
    for i = 1:n:length(xx)
        if i + n <= length(xx)
            temp = 0;
            iH = 1;
            for j = i:(i+n)
                temp = temp + H(iH) * yy(j);
                iH = iH + 1;
            end
            INewton = INewton + (xx(i+n)-xx(i))*temp;
        else
            break;
        end
    end
    % Tính phần cuối nếu còn dư
    if i ~= length(xx)
        temp = NewtonCotes(xx(i:length(xx)), yy(i:length(xx)), length(xx)-i+1, I);
        INewton = INewton + temp;
    end

    % INewton
    % rEI_INewton = abs((I-INewton)/I)
end
```

```
xx = [1 2 3 4 5 6 7];
yy = [4 -6 -14 -14 0 34 94];
I = 42;
NewtonCotes(xx, yy, 4, I)
```

```
function[] = Gauss_2(f, a, b)
    syms t;
    I = int(f, t, a, b);
    w1 = 1; x12 = -0.5774; t12 = (b-a)*x12/2 + (a+b)/2;
    w2 = 1; x22 = 0.5774; t22 = (b-a)*x22/2 + (a+b)/2;
    IG2 = double((b-a)/2 * (w1*subs(f, t, t12) + w2*subs(f, t, t22)))
    rEI1 = double(abs((I-IG2)/I))
end
% Cau b
syms t;
f = exp(t);
a = 2; b = 4;
Gauss_2(f, a, b)
function[] = Gauss_3(f, a, b)
    syms t;
    I = int(f, t, a, b);
    w1 = 0.5556; x13 = -0.7746; t13 = (b-a)*x13/2 + (a+b)/2;
    w2 = 0.8889; x23 = 0; t23 = (b-a)*x23/2 + (a+b)/2;
    w3 = 0.5556; x33 = 0.7746; t33 = (b-a)*x33/2 + (a+b)/2;
    IG3 = double((b-a)/2 * (w1*subs(f,t,t13) + w2*subs(f,t,t23) + w3*subs(f,t,t33)))
    rEIG3 = double(abs((I-IG3)/I))
end
function[] = Gauss_4(f, a, b)
    syms t;
    I = int(f, t, a, b);
    w1 = 0.3479; x14 = -0.8611; t14 = (b-a)*x14/2 + (a+b)/2;
    w2 = 0.6521; x24 = -0.3340; t24 = (b-a)*x24/2 + (a+b)/2;
    w3 = 0.6521; x34 = 0.3340; t34 = (b-a)*x34/2 + (a+b)/2;
    w4 = 0.3479; x44 = 0.8611; t44 = (b-a)*x44/2 + (a+b)/2;
    IG4 = w1*subs(f,t,t14) + w2*subs(f,t,t24) + w3*subs(f,t,t34) + w4*subs(f,t,t44);
    IG4 = double((b-a) * IG4 /2)
    rEIG4 = double(abs((I-IG4)/I))
end
function[] = Gauss_5(f, a, b)
    syms t;
    I = int(f, t, a, b);
    w1 = 0.2369; x15 = -0.9062; t15 = (b-a)*x15/2 + (a+b)/2;
    w2 = 0.4786; x25 = -0.5385; t25 = (b-a)*x25/2 + (a+b)/2;
    w3 = 0.5689; x35 = 0; t35 = (b-a)*x35/2 + (a+b)/2;
    w4 = 0.4786; x45 = 0.5385; t45 = (b-a)*x45/2 + (a+b)/2;
    w5 = 0.2369; x55 = 0.9062; t55 = (b-a)*x55/2 + (a+b)/2;
    IG5 = w1*subs(f,t,t15) + w2*subs(f,t,t25) + w3*subs(f,t,t35) + w4*subs(f,t,t45) + w5*subs(f,t,t55);
    IG5 = double((b-a) * IG5 /2)
    rEIG5 = double(abs((I-IG5)/I))
end
```

PHƯƠNG TRÌNH VI PHÂN

```
% Giai phuong trinh vi phan bang pp lap
function [] = lap(f, a, b, y0, Dy)
    syms x y;
    x0 = a;
    yo = y0;
    k = 1;
    while true
        yn = y0 + int(subs(f, y, yo), x, x0, x)
        rEyn= double(abs(int(yn - yo, x, a, b)/int(yo, x, a, b)))
        if rEyn <= Dy
            break
        end
        yo = yn;
        k = k + 1
    end
end
```

```
% Giai pt vi phan bang pp euler
function [] = euler(f, a, b, y0)
    xx = a:0.1:b;
    yy = 0*xx;
    yy(1) = y0
    for i = 1:length(yy)-1
        yy(i+1) = yy(i) + (xx(i+1) - xx(i))*f(xx(i), yy(i))
    end
end
%main
f = @(x, y) x + y;
a = 0;
b = 0.4;
y0 = 1;
euler(f, a, b, y0)
```

```
%giai pt vi phan bang phuong phap euler cai tien
function [] = eulercaitien(f, a, b, y0)
    xx = a:0.1:b;
    yy = 0*xx;
    yy(1) = y0
    for i = 1:length(yy)-1
        yy(i+1) = yy(i) + (xx(i+1) - xx(i))*f(xx(i), yy(i));
        yy(i+1) = yy(i) + (xx(i+1) - xx(i))*(f(xx(i), yy(i)) + f(xx(i+1), yy(i+1)))/2
    end
end
```

```
% Giai pt vi phan bang pp runge-kutta bac 2
function [] = rungekutta2(f, a, b, y0)
    xx = a:0.1:b;
    yy = 0*xx;
    h = xx(2:end) - xx(1:end-1);
    yy(1) = y0
    for i = 1:length(yy)-1
        k1 = h(i) * f(xx(i), yy(i));
        k2 = h(i) * f(xx(i+1), yy(i) + k1);
        yy(i+1) = yy(i) + (k1 + k2)/2
    end
end
```

```
% Giai pt vi phan bang pp runge-kutta bac 3
function [] = rungekutta3(f, a, b, y0)
    xx = a:0.1:b;
    yy = 0*xx;
    h = xx(2:end) - xx(1:end-1);
    yy(1) = y0
    for i = 1:length(yy)-1
        k1 = h(i) * f(xx(i), yy(i));
        k2 = h(i) * f(xx(i) + h(i)/2, yy(i) + k1/2);
        k3 = h(i) * f(xx(i) + h(i), yy(i) - k1 + 2*k2);
        yy(i+1) = yy(i) + (k1 + 4*k2 + k3)/6
    end
end
%demon
f = @(x, y) x + y;
a = 0;
b = 0.4;
y0 = 1;
rungekutta3(f, a, b, y0)
```

```
f = @(x) 4*x.^3
==> f(1)
==> f(1, 2)
syms xs
f = x*sin(x)
==> subs(f, x, 1)
==> subs(f, [x, y], [1, 2])

A = [m+4 -2 1 -1 2; 3 -2*(m+5) -1 -2 0; 2 0 2*(m+3) -2 1; -1 4 0 -(2*m+5) 3; 0 1 0 -3 m+5];
C = [3; 1; -1; -3; 0];
KQ = linsolve(A, C)

T = @(t) 10*exp(-t) + 6*sin(pi*t/18) - n_chinh_xac_a;
n_chinh_xac_b = fzero(T, 5)
```

Sai số tuyệt đối: aE..., tương đối: rE...

So sánh khác: ~=

if - elseif - else - end

Đạo hàm, nguyên hàm:

- **syms x; df = diff(f, x); F = int(f, x);**
- **Giá trị: F = int(f, x, -1, 1);**
- **Xct = solve(df == 0, x): nghiệm đạo hàm = 0;**
- **subs(df, x, 2): đạo hàm tại 2**

Vẽ hình:

- **xx = 1:2:10**
- **plot(xx, yy, 'r-')**
- **ezplot(df, [-1, 1])**

Các function khác:

- **factorial(n): tính giai thừa**
- **nchoosek(n, k): tổ hợp chập k của n**
- **power(n, k): n mũ k**
- **disp('text'): in ra**

```
format long;
m = 2;
n = 14;
T = @(t) 10*exp(-t) + 6*sin(pi*t/18);
xx = m:0.2:n;
yy = T(xx);
% Cau a
result_cau_a = 1/(n - m) * Simpson_3_8(xx, yy)
% Cau b
f = @(t) 10*exp(-t) + 6*sin(pi*t/18) - result_cau_a;
Df = 10^-3;
xb = daycung(f, m, n-2, Df)
% Cau c
syms t;
T = 10*exp(-t) + 6*sin(pi*t/18);
n_chinh_xac_a = double(1/(n - m) * int(T, t, m, n))
% n_chinh_xac_b = solve(T == n_chinh_xac_a, t)
T = @(t) 10*exp(-t) + 6*sin(pi*t/18) - n_chinh_xac_a;
n_chinh_xac_b = fzero(T, 5)
```