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function LIP(x);
%Creates and plots Legrange Form of Interpolating Polynomial when only
% input is a vector x;
close all; hold on;
col='brkcmg';lin='-----:~:~:~'; %vector lator used to determine color of
L(x);
n=length(x);
pts=linspace(min(x),max(x),200); %creates vector for later plotting L(x)
Leg=''; %creates string vector for legend to be plot later;
for i=1:n;
    poly=''; %build expression for Numerators of Legrange Poly
    d=1; %build denomonator of Legrange Poly
    for j=1:n;
        if j~=i,
            a=['(x-',num2str(x(j)),')*.'];
            poly=[poly,a];
            d=d*(x(i)-x(j));
        end
    end
    poly=[poly,'1'];
    LP=['(1/',num2str(d),')*.'];
    fx=inline(LP);%make Legrange Poly inline function for plotting;
    plot(pts,fx(pts),[col(mod(i,6)+1),lin(mod(i,12)+1)]); %plot legrange
poly;
    Leg=[Leg;'L_{',num2str(n-1),',',num2str(i-1),'}(x)']; %build legend
string
end
legend(Leg,'location','BestOutside');
axis tight;
title('Legrange Interpolating Polynomials');
xlabel('x'); ylabel(['L_{', num2str(n-1), ',i}(x)']);
for i=1:n; %plot individual points;
    plot(x(i),0,'ko');
end

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function fx=LIP(x,y);
%Creates Interpolating Polynomial based on Legrange Polynomials for an x
%and y vector.
close all;
hold on;
n=length(x);
Pfit=''; %will contain the interpolating polynomial;
for i=1:n;
    poly=''; %build expression for Numerators of Legrange Poly
    d=1; %build denominator of Legrange Poly
    for j=1:n;
        if j~=i,
            a=['(x-',num2str(x(j)),')*.'];
            poly=[poly,a];
            d=d*(x(i)-x(j));
        end
    end
    LP=['(1/',num2str(d),')*.'];
    Pfit=[Pfit,LP,num2str(y(i)),'+']; % adding LP to interpolating poly;
end
Pfit=[Pfit,'0']; %tacks on a 0 to the 'hanging' plus sign;
fx=inline(Pfit); %creates inline function for interpolating poly
pts=linspace(min(x),max(x),200); %creates vector to plot interpolating poly
plot(pts,fx(pts));
title('Interpolating Polynomial for (x,y) (Based on Legrange
Polynomials)');
xlabel('x'); ylabel(['L_{', num2str(n-1), ',i}(x)']);
for i=1:length(x); %plot individual points;
    plot(x(i),y(i),'ko');
end
%axis tight;

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