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% mat03.m
%
% Beispiele zu Potenzreihen und Taylorreihen
% Robert Denk 1.2.2005

clear all;
close all;

figure(1);
set(gcf,'Position',[1 440 1024 672]);
x = [-2:2^(-15):2];
g = exp(-1./x.^2);
plot(x,g);
grid
title('Eine Funktion, deren Taylorreihe 0 ist');
legend('exp(-1/x^2)')

figure(2);
set(gcf,'Position',[1 440 1024 672]);
x = [-5:2^(-10):5];
g = 1./(1+x.^2);
plot(x,g);
grid
title('Die Ableitung des arctan');


figure(3);
set(gcf,'Position',[1 440 1024 672]);
set(gcf,'Renderer','zbuffer');
x = [-1:0.05:1];
for n=1:41
    for m=1:41
        z(m,n) = x(n)+i*3*x(m);
    end
end
surf(x,x,abs(1./(1+z.^2)));
xlabel('Re(z)');
ylabel('Im(z)');
zlabel('|1 / (1+z^2) |');
title('Die Ableitung der arctan-Reihe');
axis([-1.2 1.2 -1.2 1.2 -0.2 5]);

figure(4);
x = -10:0.01:10;
set(gcf,'Position',[1 440 1024 672]);
n = 1:2:17;
a = ((-1).^((n-1)/2)).*1./factorial(n);
ax = (ones(length(x),1)*a).*((x'*ones(1,length(n))).^(ones(length(x),1)*n));
p = zeros(length(x),length(n));
for i=1:length(n)
    p(:,i) = sum(ax(:,1:i),2);
    plot(x,sin(x),x,p(:,i),'r');
    grid;
    axis([-10 10 -4 4]);
    title('Die Taylorpolynome des Sinus');
    legend('sin',['P' num2str(n(i))]);
    M(i) = getframe;
end
```

```
plot(x,sin(x),x,p(:,1:4));
legend('sin(x)', 'p1','p2','p3','p4');
axis([-10 10 -4 4]);
grid

figure(5);
set(gcf,'Position',[1 440 1024 672]);
axis([-10 10 -4 4]);
title('Die Taylorpolynome des Sinus');
movie(M,1,1);

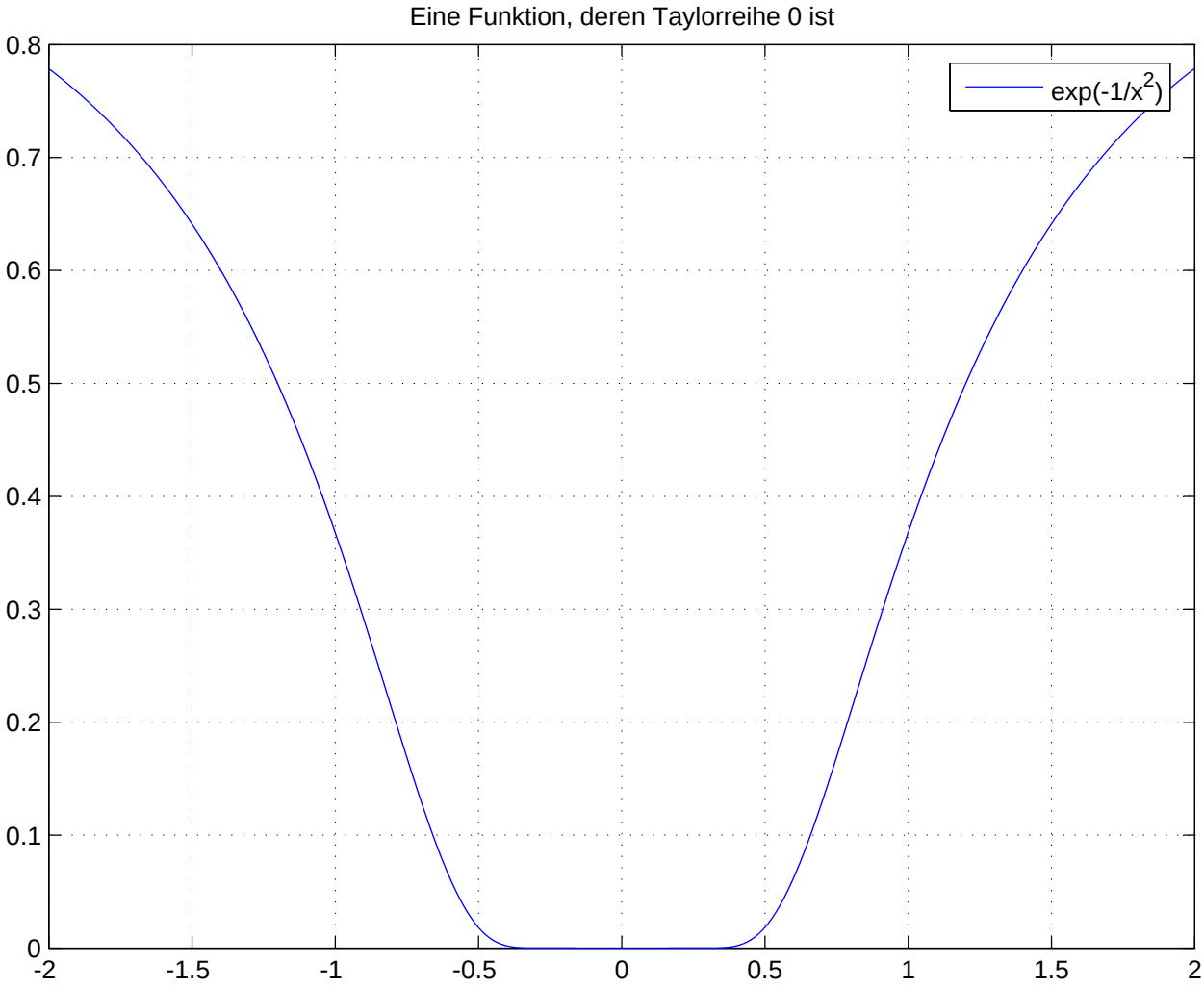
clear M;

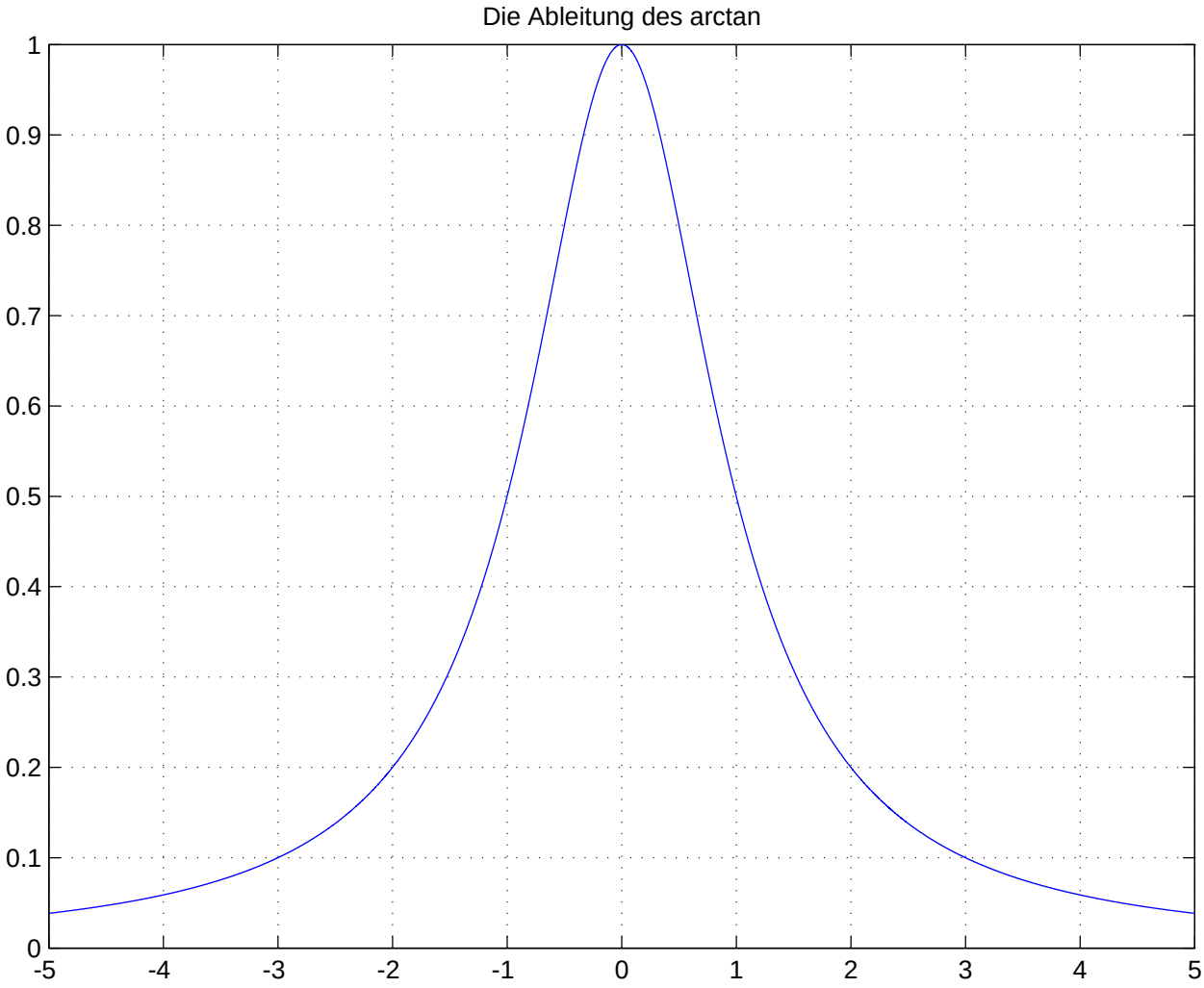
figure(6);
x = -10:0.01:10;
set(gcf,'Position',[1 440 1024 672]);
n = 0:12;
a = 1./factorial(n);
ax = (ones(length(x),1)*a).*((x'*ones(1,length(n))).^(ones(length(x),1)*n));
p = zeros(length(x),length(n));
for i=1:length(n)
    p(:,i) = sum(ax(:,1:i),2);
    plot(x,exp(x),x,p(:,i),'r');
    grid;
    axis([-10 10 -100 500]);
    title('Die Taylorpolynome der exp-Funktion');
    legend('exp',['P' num2str(n(i))]);
    M(i) = getframe;
end
plot(x,exp(x),x,p(:,1:4));
legend('exp(x)', 'p1','p2','p3','p4');
axis([-10 10 -100 500]);
grid

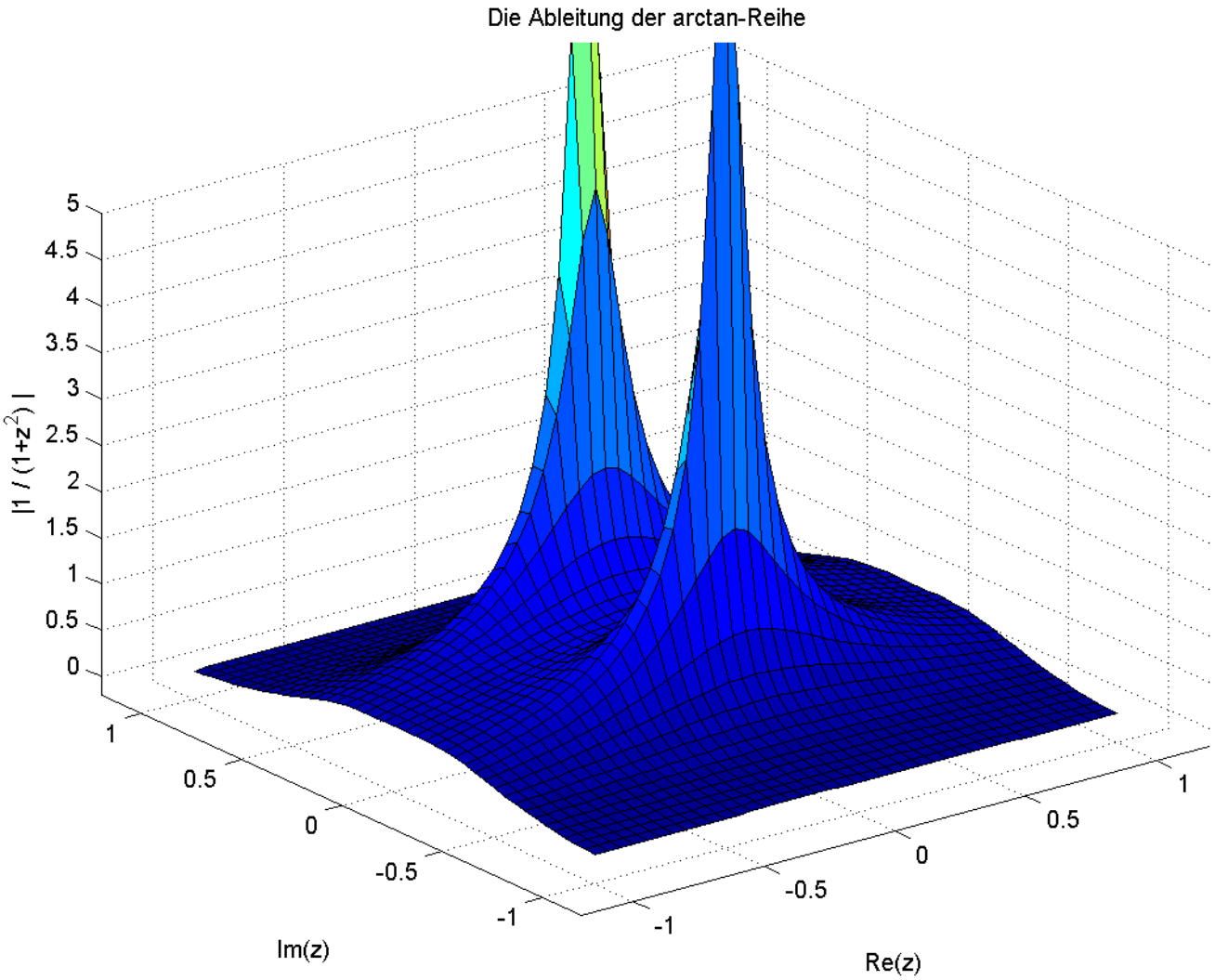
figure(7);
set(gcf,'Position',[1 440 1024 672]);
axis([-10 10 -100 500]);
title('Die Taylorpolynome der exp-Funktion');
movie(M,1,1);

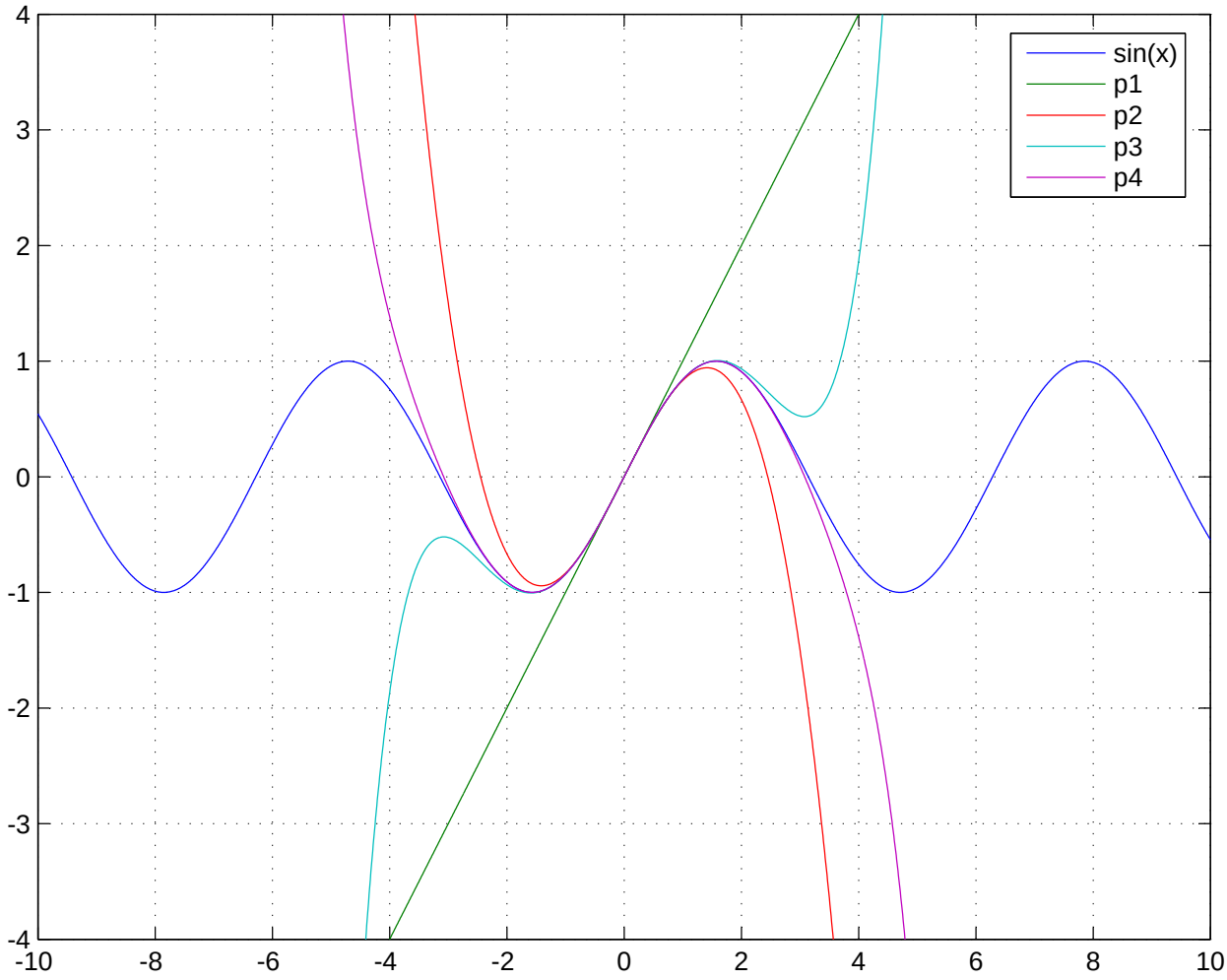
figure(8);
set(gcf,'Position',[1 440 1024 672]);
x = 0:0.005:1;
f = abs(x-0.5);
% f = exp(x);
nmax = 10;
p = zeros(nmax,length(x));
for n=1:nmax
    xk = 0:1/n:1;
    fk = abs(xk-0.5);
    % fk = exp(xk);
    t = zeros(n+1,length(x));
    for k = 0:n
        t(k+1,:) = nchoosek(n,k)*fk(k+1)*(x.^(k*ones(size(x)))).*((1-x).^((n-k)*ones(size(x))));
    end
    t = sum(t,1);
    p(n,:) = t;
```

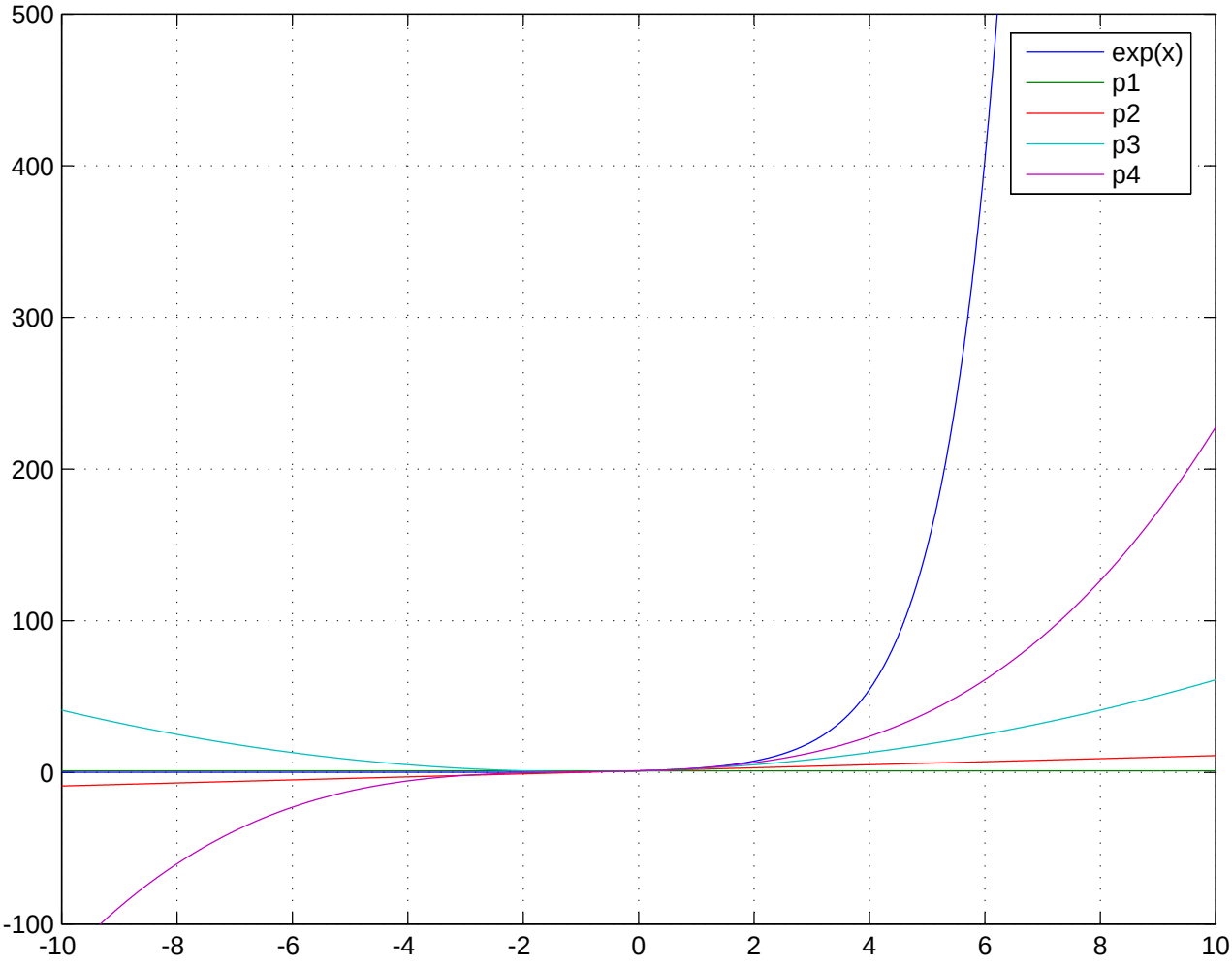
```
116 end;
117 plot(x,f,x,p);
118 grid;
119 title('Die Bernstein-Polynome');
120 legend(num2str([0:nmax]'))
121
122
123
124 figure(8);
125 figure(6);
126 figure(4);
127 figure(3);
128 figure(2);
129 figure(1);
130
```

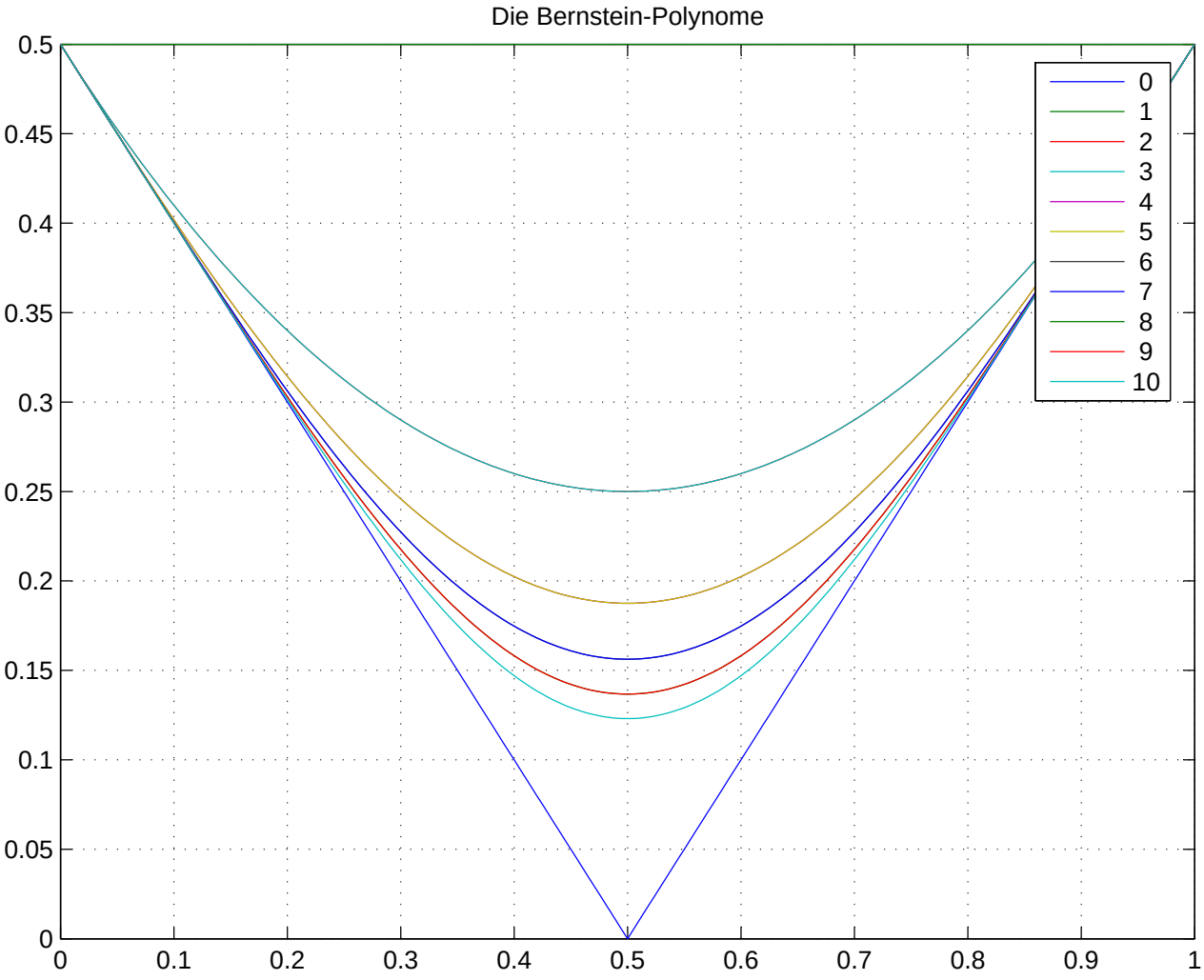

Eine Funktion, deren Taylorreihe 0 ist
exp(-1/x^2)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2


Die Ableitung des arctan
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-5
-4
-3
-2
-1
0
1
2
3
4
5


Die Ableitung der arctan-Reihe
|1 / (1+z^2) |
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1
0.5
0
-0.5
-1
Im(z)
-1
-0.5
0
0.5
1
Re(z)


sin(x)
p1
p2
p3
p4
4
3
2
1
0
-1
-2
-3
-4
-10
-8
-6
-4
-2
0
2
4
6
8
10


500
400
300
200
100
0
-100
-10
-8
-6
-4
-2
0
2
4
6
8
10
exp(x)
p1
p2
p3
p4


Die Bernstein-Polynome
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
1
2
3
4
5
6
7
8
9
10