MTH2210A-RAPPORT DE LABORATOIRE

```
Laboratoire 0: Exemple de  rapport de laboratoire
               Utilisation des cellules et de la fonction publish
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Date:
```

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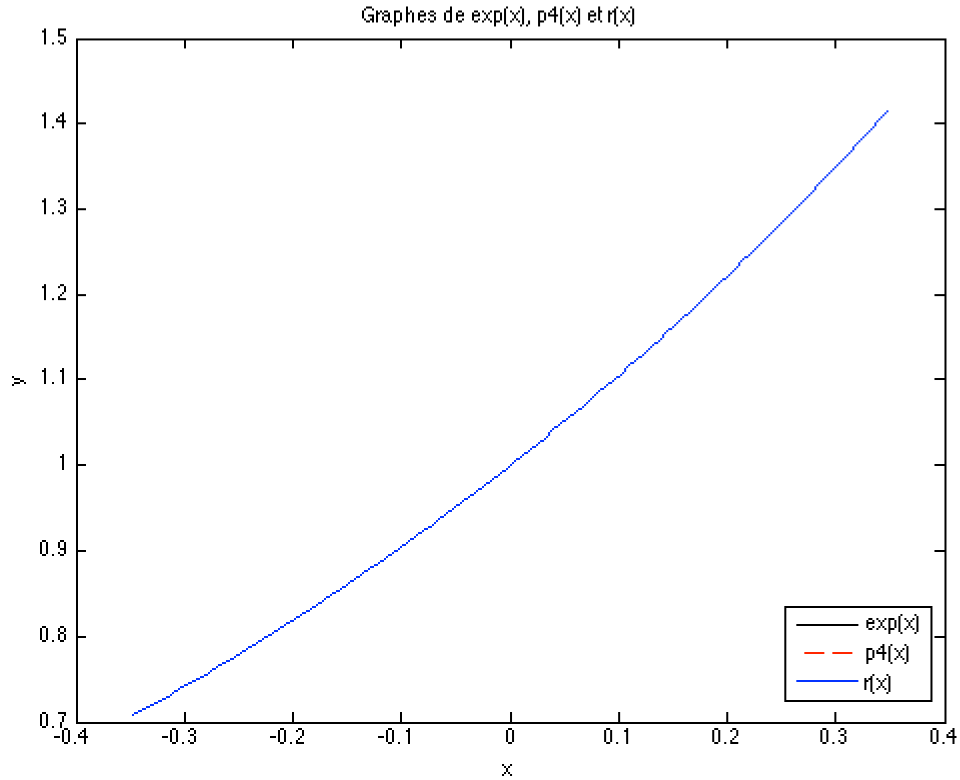
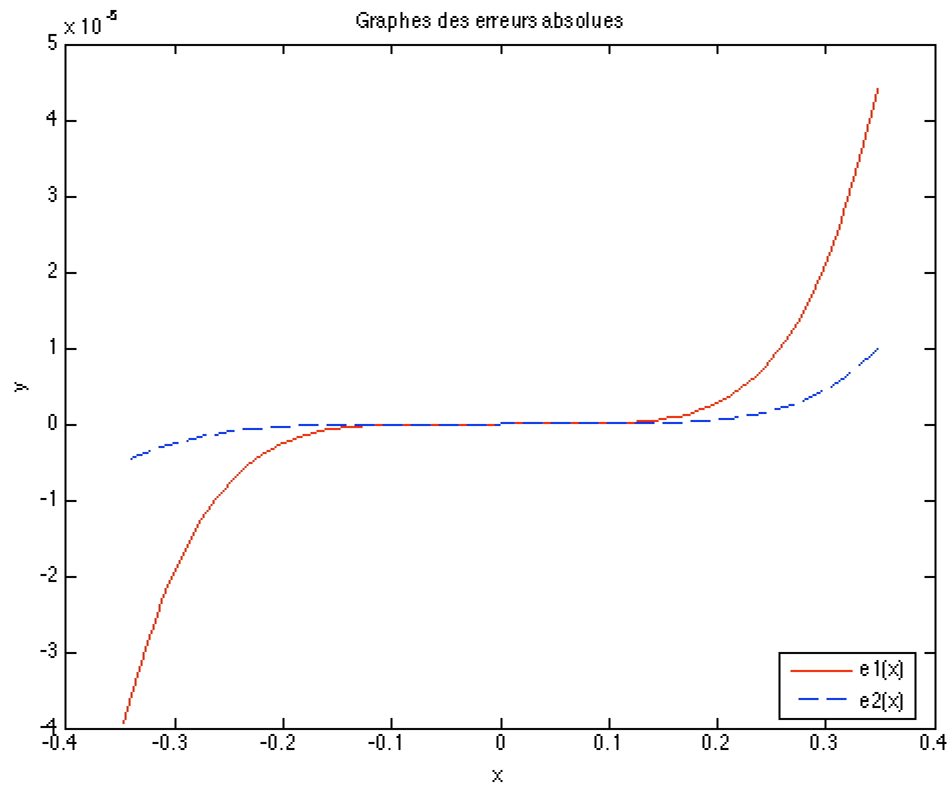
Exercice 1

Question (a)

```
x=linspace(-log(2)/2,log(2)/2,100); %vecteur de 100 abscisses equidistantes
Taylorp4=1+x + x.^2/2 + x.^3/6 + x.^4/24;
AppRat= (x.^2+6*x +12)./(x.^2-6*x+12);
figure(1)
plot(x,exp(x),'-k',x,Taylorp4,'--r',x,AppRat,'.-b')
legend('exp(x)','p4(x)','r(x)','Location','Best')
xlabel('x')
ylabel('y')
title('Graphes de exp(x), p4(x) et r(x)')
% Question (b)
Err1= (exp(x)-Taylorp4);
Err2=  (exp(x)-AppRat);
figure(2)
plot(x,Err1,'.-r')
hold on
plot(x,Err2,'--b')
legend('e1(x)','e2(x)','Location','Best')
xlabel('x')
ylabel('y')
title('Graphes des erreurs absolues')
hold off
```


Graphes de exp(x), p4(x) et r(x)
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
y
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
x
exp(x)
p4(x)
r(x)


x 10^-5
Graphes des erreurs absolues
5
4
3
2
1
0
-1
-2
-3
-4
y
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
x
e1(x)
e2(x)

Question (c)

L'approximation r(x) est plus précise que le polynôme de Taylor de degré 4.

Exercice 2

Question (a)

la fonction racines

```
type racines.m % permet d'inclure le fichier racines.m
```

```
function  R  = racines(a,b,c)
%
% La fonction racines
%
R=zeros(size(2,1));   % initialisation
delta = b^2-4*a*c;   % calcul du discriminant
if((delta>=0) &(a~=0))
    R(1) = (-b +sqrt(delta))/(2*a);
    R(2) = (-b -sqrt(delta))/(2*a);
else                  % racines complexes
    R(1) =NaN;
    R(2) =NaN;
end
```

Question (b)

cas (a)

```
a=1;b=-2;c=1;
R1=racines(a,b,c)
% cas (b)
b=-3;c=2;
R2=racines(a,b,c)
%  cas (c)
a=4;b=0;c=1;
R3=racines(a,b,c)
```

```
R1 =

     1     1


R2 =

     2     1
```

```
R3 =

   NaN    NaN
```

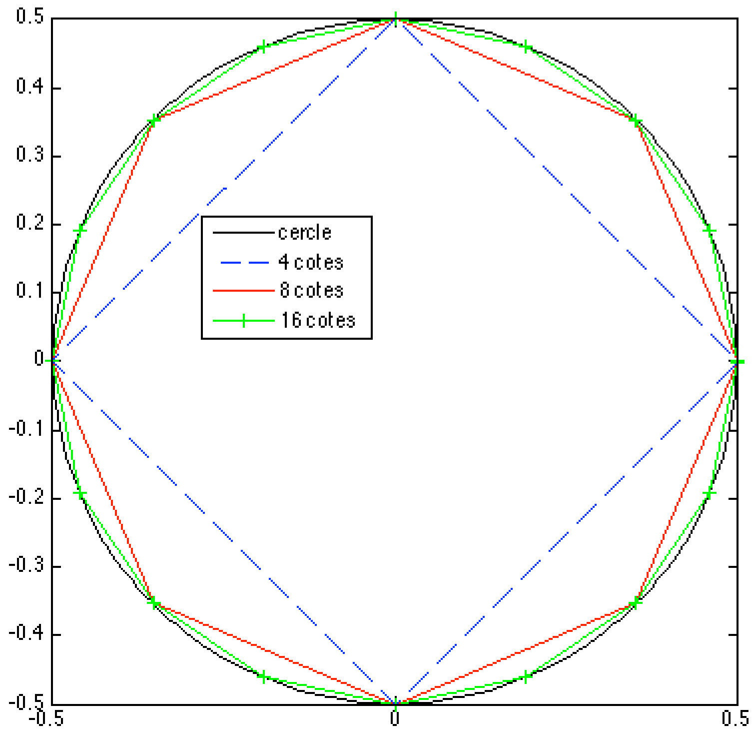
Exercice 3

Question (a)

parametrisation du cercle x= 0.5cos(teta) et y=0.5sin(teta)

```
teta = 0:pi/100:2*pi; % vecteur avec un increment de pi/100
coox = 0.5*cos(teta);
cooy = 0.5*sin(teta);
plot(coox,cooy,'k')
axis('square')
hold on
% graphes des polygones
%symbol=[num2str('--b');num2str('.-r');num2str('-+g')];
symbol=['--b';'.-r';'-+g'];

for i=1:3
    tetap=0:pi/2^i:2*pi;
    cooxp=0.5*cos(tetap);
    cooyp=0.5*sin(tetap);
    plot(cooxp,cooyp,symbol(i,:))
end
legend('cercle','4 cotes','8 cotes','16 cotes','Location','Best')
hold off
```



Question (b)

```
r(3) = 2/(2+sqrt(2));
for n=3:29
    r(n+1) = r(n)/(2+sqrt(4-r(n)));
    p(n+1) = 2^n*sqrt(r(n+1));
end
% sortie formatée
fprintf(' %s \t   %s \t % s\n','n','   p(n)','             erreur absolue')
fprintf('%s\n','-------------------------------------------------------')
for n=4:30
 fprintf('%2d \t %16.15e \t %16.15e \n', n, p(n), abs(p(n)-pi))
end
```

```
 n         p(n)                erreur absolue
-------------------------------------------------------
 4   3.121445152258052e+00   2.014750133174070e-02
 5   3.136548490545939e+00   5.044163043853800e-03
 6   3.140331156954753e+00   1.261496635040160e-03
 7   3.141277250932773e+00   3.154026570202362e-04
 8   3.141513801144301e+00   7.885244549177273e-05
 9   3.141572940367091e+00   1.971322270177822e-05
10   3.141587725277160e+00   4.928312633545318e-06
11   3.141591421511200e+00   1.232078593371710e-06
12   3.141592345570118e+00   3.080196755433917e-07
13   3.141592576584872e+00   7.700492066220477e-08
14   3.141592634338563e+00   1.925123038759580e-08
```

```
15   3.141592648776986e+00   4.812807485876647e-09
16   3.141592652386591e+00   1.203201982491464e-09
17   3.141592653288993e+00   3.008002735782611e-10
18   3.141592653514593e+00   7.520029043917020e-11
19   3.141592653570993e+00   1.880007260979255e-11
20   3.141592653585093e+00   4.699796107843213e-12
21   3.141592653588618e+00   1.175060049263266e-12
22   3.141592653589500e+00   2.935429677108914e-13
23   3.141592653589720e+00   7.283063041541027e-14
24   3.141592653589775e+00   1.776356839400250e-14
25   3.141592653589789e+00   3.996802888650564e-15
26   3.141592653589793e+00   4.440892098500626e-16
27   3.141592653589794e+00   4.440892098500626e-16
28   3.141592653589794e+00   4.440892098500626e-16
29   3.141592653589794e+00   4.440892098500626e-16
30   3.141592653589794e+00   4.440892098500626e-16
```

Calcul du nombre de chiffres significatifs de P(15) et P(24)

```
ErrP15 = abs(p(15)-pi);
ErrP24 = abs(p(24)-pi);
fprintf('%s  %5.4e  %s\n','L''erreur absolue ErrP15=', ErrP15, '< 0.5e-8')
fprintf('%s  %16.15e  %s\n','L''approximation P15=', p(15), ...
    'possede 9 chiffres significatifs.')
fprintf('%s  %5.4e  %s\n','L''erreur absolue Err24=', ErrP24, '< 0.5e-13')
fprintf('%s  %16.15e  %s\n','L''approximation P15=', p(24), ...
    'possede 14 chiffres significatifs.')
```

```
L'erreur absolue ErrP15=  4.8128e-09  < 0.5e-8
L'approximation P15=  3.141592648776986e+00  possede 9 chiffres significatifs.
L'erreur absolue Err24=  1.7764e-14  < 0.5e-13
L'approximation P15=  3.141592653589775e+00  possede 14 chiffres significatifs.
```

Commentaires

La formule de récurrence donne 16 chiffres à partir de n=24. L'approximation de π obtenue correspond à celle de MATLAB à 16 chiffres (15 chiffres après la vigule).