MTH2210A-RAPPORT DE LABORATOIRE

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Laboratoire 1: MATLAB

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Exercice 1

```
err= [0.5671; 0.4328; 0.4555e-01; 0.3305e-02; 0.2707e-04; 0.1660e-7];
alpha = (1+sqrt(5))/2;
E=  err(1: end-1);
En= err(2: end);

v1 = abs(En./E);
v2 = abs(En./(E.^alpha));
v3 = abs(En./(E.^2));

fprintf( '%s \t %s \t %s \n', 'ratio 1','            ratio 2', '
      ratio 3')
for n = 1: 5
    fprintf ('%16.15e \t %16.15e \t %16.15e \n', v1(n), v2(n), v3(n))
end
```

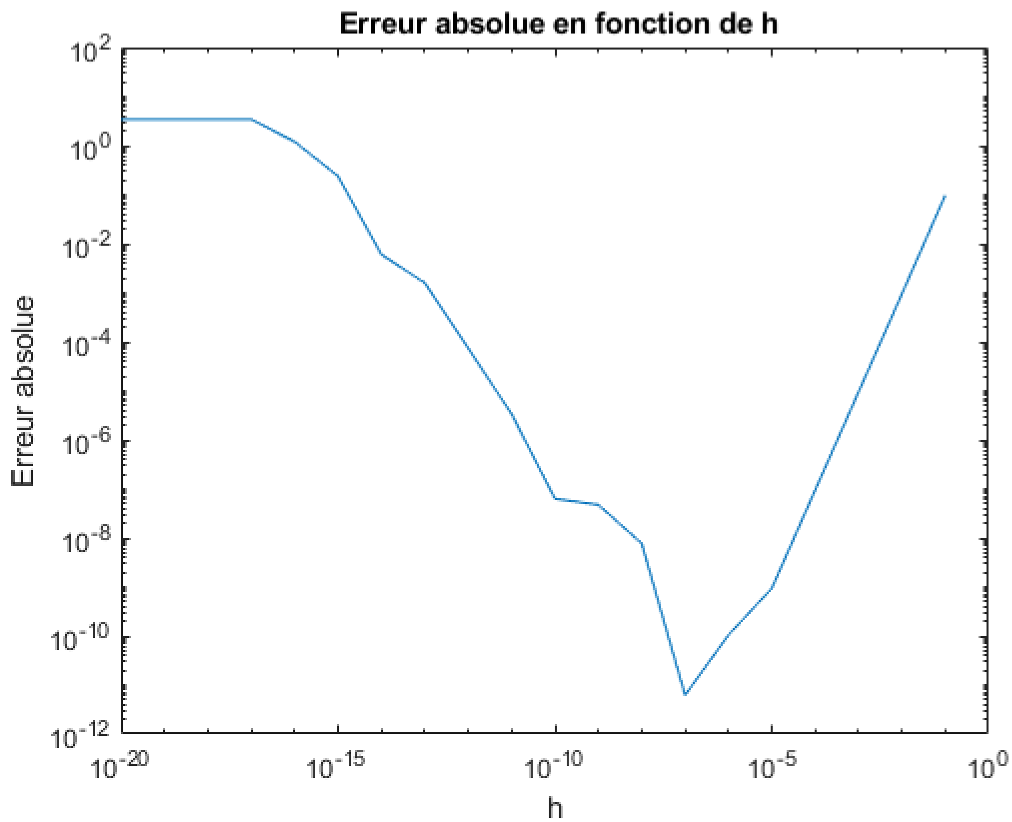
```
ratio 1                ratio 2                 ratio 3
7.631810968083230e-01   1.083613271990273e+00   1.345761059439822e+00
```

```
1.052449168207024e-01   1.765988900133284e-01   2.431721738001442e-01
7.255762897914381e-02   4.895339983934166e-01   1.592922699871434e+00
8.190620272314673e-03   2.796102884759861e-01   2.478251217039236e+00
6.132249722940524e-04   4.078470583206059e-01   2.265330521958080e+01
```

Exercice 2

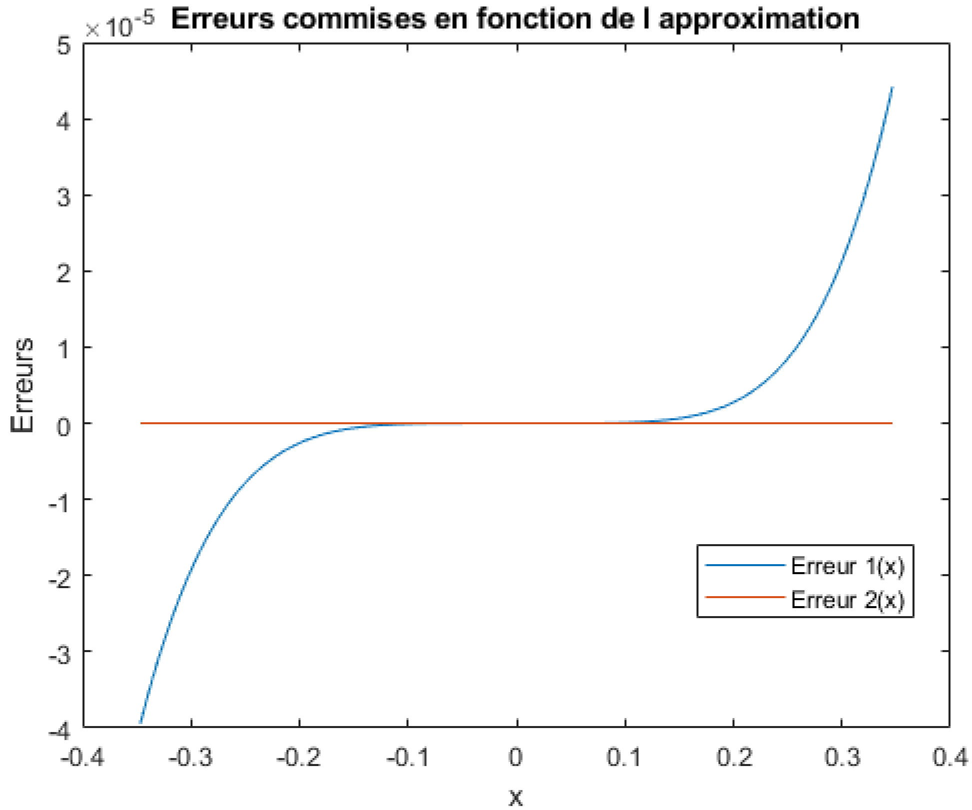
```
n = 1:20;
h= 10.^(-n);

approx= (tan(1+h)- tan(1-h))./(2.*h);
err= abs(approx - sec(1)^2);

 fprintf ( '%s\t %s \t %s \n','h', '      Approximation', '  Erreur
 absolue')
 for i= 1: 20
 fprintf( '%2.0e \t %16.15f \t %16.15f \n',h(i), approx(i), err(i))
 end

 figure(1)
 loglog( h, err);
 xlabel('h')
 ylabel('Erreur absolue')
 title(' Erreur absolue en fonction de h')
```

```
h         Approximation     Erreur absolue
1e-01   3.523007198491566   0.097488377676807
1e-02   3.426464160083409   0.000945339268650
1e-03   3.425528271343459   0.000009450528700
1e-04   3.425518915318726   0.000000094503967
1e-05   3.425518821753571   0.000000000938812
1e-06   3.425518820709961   0.000000000104798
1e-07   3.425518820820983   0.000000000006224
1e-08   3.425518813049422   0.000000007765337
1e-09   3.425518868560573   0.000000047745814
1e-10   3.425518757538271   0.000000063276488
1e-11   3.425515426869196   0.000003393945563
1e-12   3.425593142480921   0.000074321666161
1e-13   3.423927807943983   0.001591012870776
1e-14   3.419486915845482   0.006031904969277
1e-15   3.663735981263016   0.238217160448257
1e-16   2.220446049250313   1.205072771564446
1e-17   0.000000000000000   3.425518820814759
1e-18   0.000000000000000   3.425518820814759
1e-19   0.000000000000000   3.425518820814759
1e-20   0.000000000000000   3.425518820814759
```



Exercice 3

```
x=linspace(-log(2)/2,log(2)/2,129);
p4=1+x + x.^2/2 + x.^3/6 + x.^4/24;
Q= 0.5+0.55553866696900118 8e-1*x.^2+0.495862884905441294e-3*x.^4;
P=0.249999999999999993 + 0.694360001511792852e-2*x.^2
 +0.165203300268279130e-4*x.^4;
r= (Q+x.*P)./(Q-x.*P);
Err1= exp(x) - p4;
Err2= exp(x) - r;
figure(2)
plot(x, Err1)
hold on
plot(x, Err2)
xlabel('x')
ylabel('Erreurs')
title('Erreurs commises en fonction de l approximation')
legend('Erreur 1(x)','Erreur 2(x)','Location','Best')
hold off
```



Commnetaires

Il est possible d'observer sur le graphique que l'approximation p4(x) tend à s'éloigner de la valeur exacte pour des valeurs qui ne sont pas dans le voisinage de x=0. L'approximation r(x) à une allure constante a environ 0. L'approximation avec r(x) permet une erreur plus faible sur un plus grand intervalle.

Exercice 4

```
for n= 1:13
    fact(n)=prod(1:n);
end

m= 1:13;
s= sqrt(2*pi().*m).*(m./exp(1)).^m;

errA= abs(fact-s);
errR= abs(fact-s)./fact;

fprintf( '%s \t %s\t %s\n', ' n','Erreur absolue', '        Erreur
 relative')
for n=1:13
    fprintf( '%2d \t %16.15e \t %16.15e \n', n, errA(n), errR(n))
end
```

n   Erreur absolue   Erreur relative

1	*7.786299110421113e-02*	*7.786299110421113e-02*
2	*8.099564851101770e-02*	*4.049782425550885e-02*
3	*1.637904086541395e-01*	*2.729840144235659e-02*
4	*4.938248671067207e-01*	*2.057603612944670e-02*
5	*1.980832042409972e+00*	*1.650693368674977e-02*
6	*9.921815357815944e+00*	*1.378029910807770e-02*
7	*5.960416838754463e+01*	*1.182622388641759e-02*
8	*4.176045473433333e+02*	*1.035725563847553e-02*
9	*3.343127158052055e+03*	*9.212762230081722e-03*
10	*3.010438125896733e+04*	*8.295960443939411e-03*
11	*3.011749494225532e+05*	*7.545067475913730e-03*
12	*3.314113527225077e+06*	*6.918794273808432e-03*
13	*3.978132480729485e+07*	*6.388500389671871e-03*

Commentaires

Il est possible d'observer que la valeur absolue est croissante en fonction du n, tandis que l'erreur relative diminue. Puisque l'erreur relative tient compte de l'ordre de grandeur de n, on peut conclure que même si l'erreur absolue augmente, son importance diminue avec n.

Exercice 5

```
nbor = (1+sqrt(5))/2;
fib = [0,1];
fib1=0;
fib2=1;
deltaf=1;
i=3;
while deltaf > 0.5e-5

    x= fib2+fib1;
    ratio= x/fib2;
    fib1=fib2;
    fib2=x;
    deltaf = abs (nbor- ratio);
    i=i+1;
end
```

Exercice 6

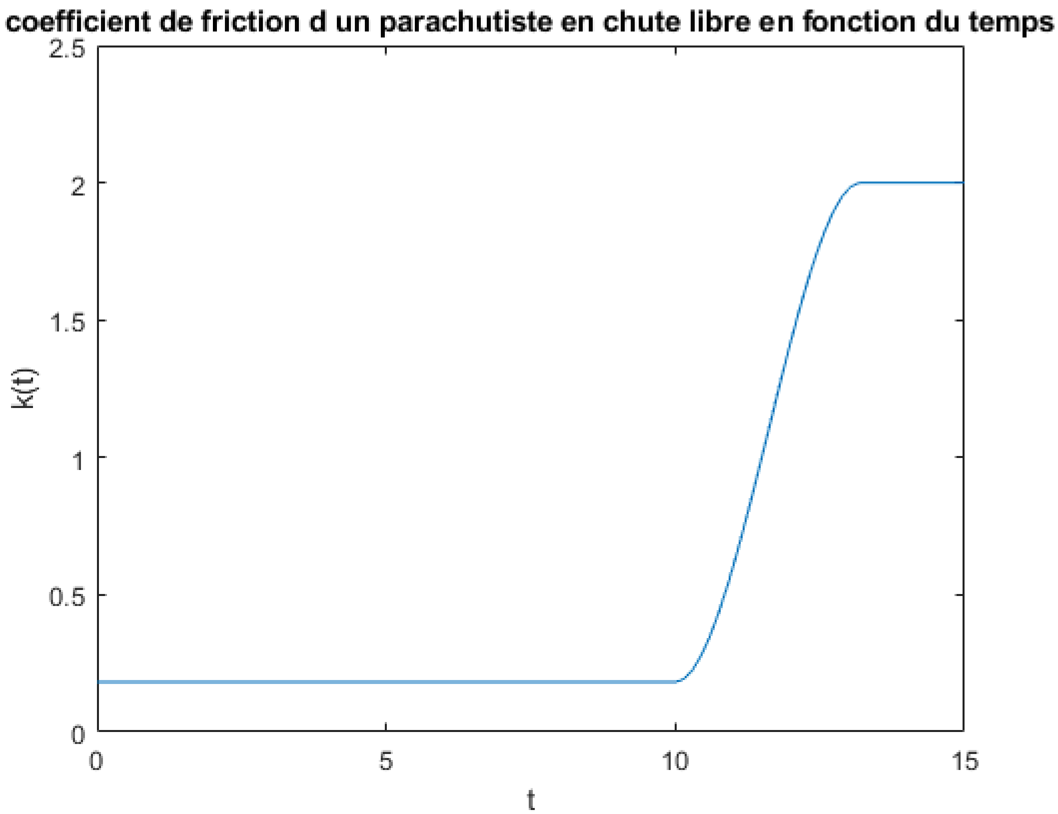
Question (a)

```
t= linspace(0,15);
```

Question (b)

```
figure(3);
plot( t, Function(t))
xlabel('t')
ylabel('k(t)')
```

```
ylim([0,2.5])
title('coefficient de friction d un parachutiste en chute libre en
 fonction du temps')
```



Exercice 7

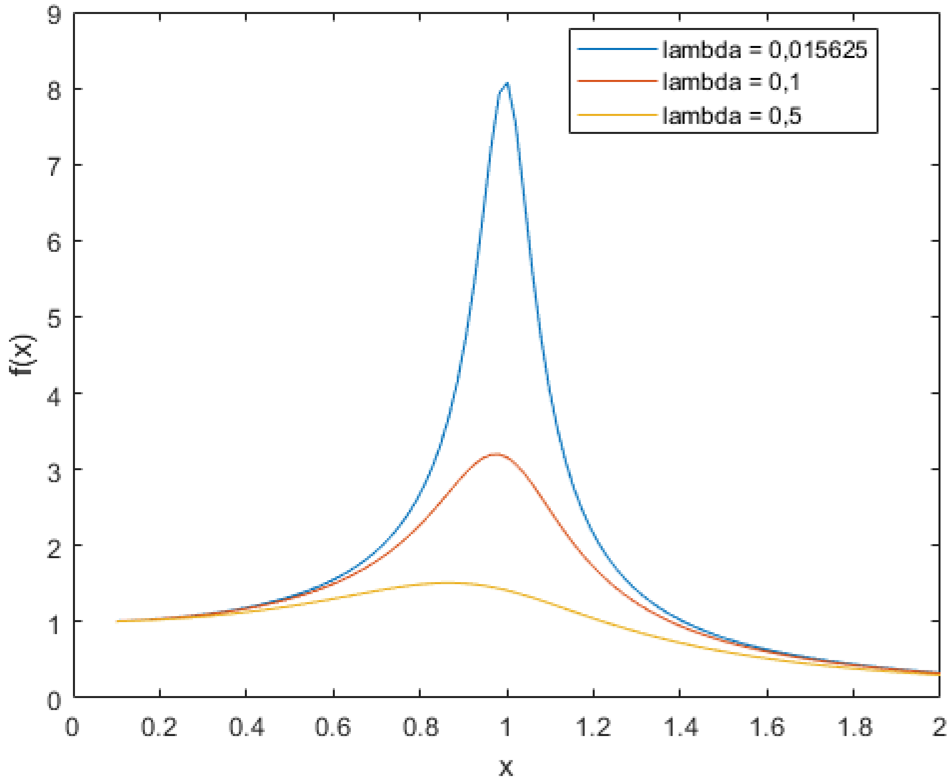
Question (a)

```
x = linspace(0.1,2);
global lambda
```

Question (b)

```
figure(4);
lambda = 0.01525;
plot(x, function2(x))
hold on
lambda = 0.1;
plot(x, function2(x))
hold on
lambda = 0.5;
plot(x, function2(x))
hold off
xlabel('x')
```

```
ylabel('f(x)')
legend('lambda = 0,015625','lambda = 0,1','lambda =
 0,5','Location','Best')
```



Question 8

```
pn = 2*sqrt(2);
fprintf( '%s \t %s \t %s \n', 'n','              pn', '          erreur
 absolue')
for n = 3:30

    p = (2.^(n-1).*sqrt(2.*(1-sqrt(1-(pn./(2.^(n-1))).^2))));
    pn = p;
    e = abs(pi()- pn);
    fprintf ('%2d \t %16.15e \t %16.15e \n', n, pn, e)
end
```

```
n               pn            erreur absolue
 3   3.061467458920719e+00   8.012519466907442e-02
 4   3.121445152258053e+00   2.014750133174026e-02
 5   3.136548490545941e+00   5.044163043852468e-03
 6   3.140331156954739e+00   1.261496635053927e-03
 7   3.141277250932757e+00   3.154026570362234e-04
 8   3.141513801144145e+00   7.885244564764804e-05
 9   3.141572940367883e+00   1.971322191041125e-05
10   3.141587725279961e+00   4.928309832230582e-06
```

11	*3.141591421504635e+00*	*1.232085157898410e-06*
12	*3.141592345611077e+00*	*3.079787163073888e-07*
13	*3.141592576545004e+00*	*7.704478877101906e-08*
14	*3.141592633463248e+00*	*2.012654487515420e-08*
15	*3.141592654807589e+00*	*1.217796086194767e-09*
16	*3.141592645321215e+00*	*8.268577822434509e-09*
17	*3.141592607375720e+00*	*4.621407345695161e-08*
18	*3.141592910939673e+00*	*2.573498796287765e-07*
19	*3.141594125195191e+00*	*1.471605397984632e-06*
20	*3.141596553704820e+00*	*3.900115026489459e-06*
21	*3.141596553704820e+00*	*3.900115026489459e-06*
22	*3.141674265021758e+00*	*8.161143196439014e-05*
23	*3.141829681889202e+00*	*2.370282994084150e-04*
24	*3.142451272494134e+00*	*8.586189043406911e-04*
25	*3.142451272494134e+00*	*8.586189043406911e-04*
26	*3.162277660168380e+00*	*2.068500657858641e-02*
27	*3.162277660168380e+00*	*2.068500657858641e-02*
28	*3.464101615137754e+00*	*3.225089615479613e-01*
29	*4.000000000000000e+00*	*8.584073464102069e-01*
30	*0.000000000000000e+00*	*3.141592653589793e+00*

Commentaires

À partir de n= 17, l'erreur absolue augmente ce qui ne devrait pas être le cas puisque, plus le nombre de côté augmente, plus on devrait être proche du périmètre d'un cercle.

pour p15: 1.21178...e-09 < 0.5e-8, donc le nombre de chiffres significatifs est 9.

Pour p24: 8.586189...e-04 < 0.5e-2, donc le nombre de chiffres significatifs est 3.

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