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> #Assignment #3 , MAST 334/ MATH354 , Solutions
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> #Problems 6 and 8 b, page 75
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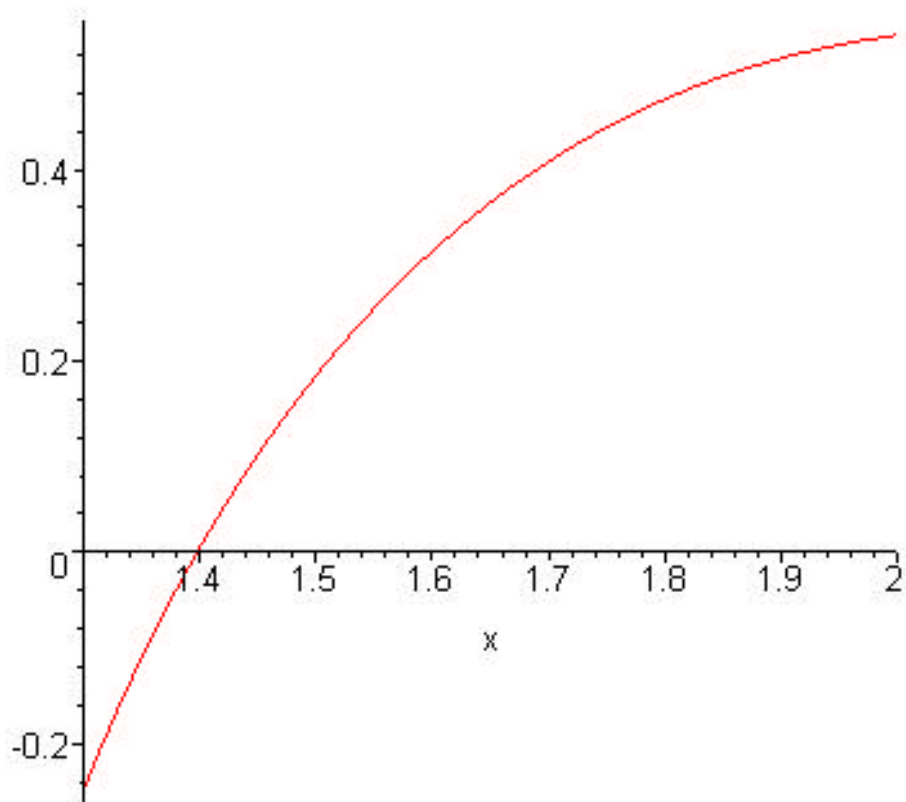
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> f:=x-> ln(x-1)+cos(x-1);# x in [1.3,2]
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ff:=D(f);
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plot(f(x),x=1.3..2);
```

$$f := x \rightarrow \ln(x-1) + \cos(x-1)$$

$$ff := x \rightarrow \frac{1}{x-1} - \sin(x-1)$$



```
> MaxError:=0.00001;
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```
MaxSteps:=30;
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```
#Newton
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print(`Newton Method:`);
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a:=1.5;:Er:=100:
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```
for i from 1 to MaxSteps while (Er >MaxError) and  
(abs(a)<10000) do
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  anew:=evalf(a-f(a)/ff(a));
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```
  Er:=abs(a-anew);
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```
  a:=anew;
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```
  print(a, ` error= `,evalf(Er));
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```
end do;
```

```

#Secant
print(`Secant Method:`);

a1:=1.3;
a2:=1.5;
Er:=100;
for i from 1 to MaxSteps while (abs(Er) >MaxError) and
(abs(a2)<10000) do
  anew:=evalf(a2-f(a2)/((f(a2)-f(a1))/(a2-a1)));
  Er:=a2-anew;
  a1:=a2;
  a2:=anew;
  print(a2, ` error= `,evalf(Er));
end do;
print(`False Position Method:`);
a1:=1.3;
a2:=1.5; # f(a1)*f(a2)<0 #Regula Falsi

Er:=100;
for i from 1 to MaxSteps while (abs(Er) >MaxError) and
(abs(a2)<10000) do
  anew:=evalf(a2-f(a2)/((f(a2)-f(a1))/(a2-a1)));
  Er:=(abs(a2-anew));
  if evalf(f(a2)*f(anew))<0 then a1:=a2 end if;
  a2:=anew;
  #Er:=abs(a2-a1);
  print(a2,a1, ` error= `,evalf(Er));
end do;

```

*MaxError := 0.00001*

*MaxSteps:= 30*

*Newton Method:*

*a := 1.5*

1.378706774 , error= , 0.121293226

1.397135813 , error= , 0.018429039

1.397747837, error= , 0.000612024

1.397748476 error= , 0.639 10<sup>-6</sup>

*Secant Method:*

*a1 := 1.3*

*a2 := 1.5*

1.414824551 , error= , 0.085175449

1.394672598 , error= , 0.020151953

1.397838201 , error= , -0.003165603

1.397748946 , error= , 0.000089255

1.397748476 , error= ,  $0.470 \cdot 10^{-6}$

*False Position Method:*

$a1 := 1.3$

$a2 := 1.5$

1.414824551 , 1.3, error= , 0.085175449

1.400553595 , 1.3, error= , 0.014270956

1.398208326 , 1.3, error= , 0.002345269

1.397823836 , 1.3, error= , 0.000384490

1.397760825, 1.3, error= , 0.000063011

1.397750500, 1.3, error= , 0.000010325

1.397748808, 1.3, error= ,  $0.1692 \cdot 10^{-5}$

> # In the false position method both endpoints of the current interval are printed.

> #Problems 6 and 8 f, page 75

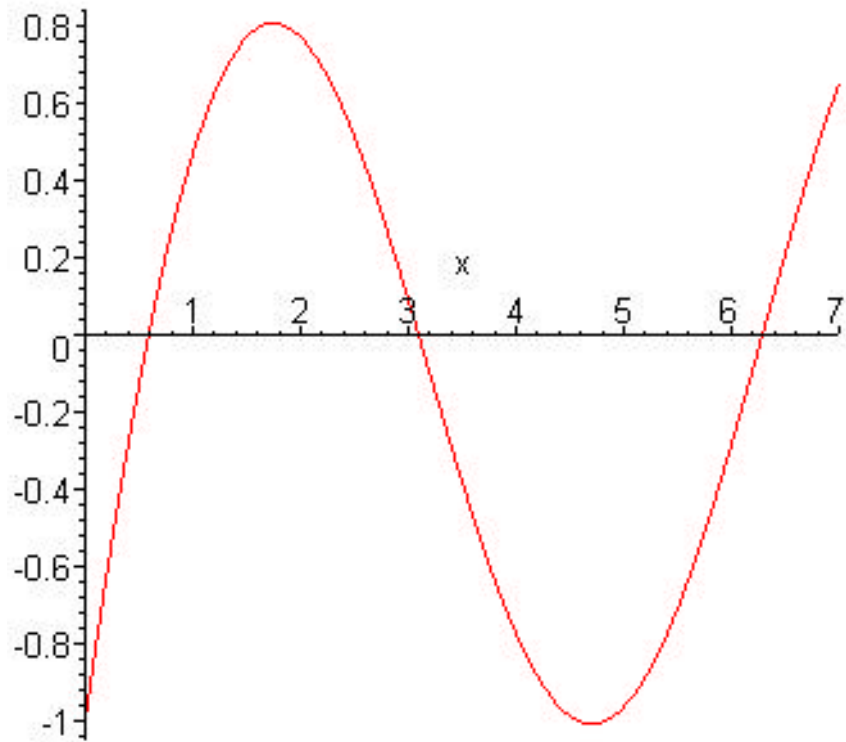
> f:=x-> sin(x)-exp(-x);# x in [0,1] and [3,4] and [6,7]

ff:=D(f);

plot(f(x),x=0..7);

$$f := x \rightarrow \sin(x) - e^{(-x)}$$

$$ff := x \rightarrow \cos(x) + e^{(-x)}$$



```

> # in [0,1]: (only printout)
      MaxError := 0.00001
      MaxSteps:= 30
      Newton Method:
      a := 0.5
0.5856438169, error= , 0.0856438169
0.5885294126 , error= , 0.0028855957
0.5885327440 , error= , 0.33314 10-5
      Secant Method:
      a1 := 0
      a2 := 1
0.6786141007, error= , 0.3213858993
0.5690622514, error= , 0.1095518493
0.5892596136, error= , -0.0201973622
0.5885383580 , error= , 0.0007212556
0.5885327424 , error= , 0.56156 10-5

```

*False Position Method:*

$a1 := 0$

$a2 := 1$

0.6786141007, 0, *error=* , 0.3213858993

0.6056917332, 0, *error=* , 0.0729223675

0.5917072803, 0, *error=* , 0.0139844529

0.5891168394 , 0, *error=* , 0.0025904409

0.5886401051 , 0, *error=* , 0.0004767343

0.5885524741 , 0, *error=* , 0.0000876310

0.5885363697 , 0, *error=* , 0.0000161044

0.5885334103 , 0, *error=* ,  $0.29594 \cdot 10^{-5}$

> # in [3,4]:  
**MaxError:=0.0000001;**  
**MaxSteps:=30;**

*MaxError* :=  $0.1 \cdot 10^{-6}$

*MaxSteps* := 30

*Newton Method:*

$a := 3$

3.097141472, *error=* , 0.097141472

3.096363961, *error=* , 0.000777511

3.096363932, *error=* ,  $0.29 \cdot 10^{-7}$

*Secant Method:*

$a1 := 3$

$a2 := 3.5$

3.096686766 , *error=* , 0.403313234

3.096360541 , *error=* , 0.000326225

3.096363932 , *error=* ,  $-0.3391 \cdot 10^{-5}$

3.096363932, *error=* , 0.

*False Position Method:*

$a1 := 3$

$a2 := 3.5$

3.096686766 , 3, error= , 0.403313234  
3.096361900 , 3.096686766 , error= , 0.000324866  
3.096363932 , 3.096686766 , error= , 0.2032 10<sup>-5</sup>  
3.096363932, 3.096686766, error= , 0.

> # in [6,7]:

*MaxError* := 0.1 10<sup>-6</sup>

*MaxSteps* := 30

*Newton Method:*

*a* := 6.5

6.281598507, error= , 0.218401493

6.285049265 , error= , 0.003450758

6.285049273 , error= , 0.8 10<sup>-8</sup>

*Secant Method:*

*a1* := 6

*a2* := 7

6.300536862, error= , 0.699463138

6.283594754, error= , 0.016942108

6.285049368, error= , -0.001454614

6.285049273, error= , 0.95 10<sup>-7</sup>

*False Position Method:*

*a1* := 6

*a2* := 7

6.300536862 , 6, error= , 0.699463138

6.284858354 , 6.300536862 , error= , 0.015678508

6.285049286, 6.284858354, error= , 0.000190932

6.285049273, 6.285049286, error= , 0.13 10<sup>-7</sup>

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