ProblemSet1_Integration_Noah_Wach___Selina_Pohl___Anna_Grundel

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[1]:
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'''
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'''

%matplotlib inline
import matplotlib.pyplot as plt
import numpy as np
```

0.1 a) Plot of the Integrand

First we need to plot the integrand for different values of n.

[5]:
```
def func (n,a):
    return x**n/(x+a)

a = 5
n = np.concatenate([np.array([1,5]),np.arange(10,60,10)]) #create an array of␣
 ↪the given n
x = np.linspace(0,1,1000)

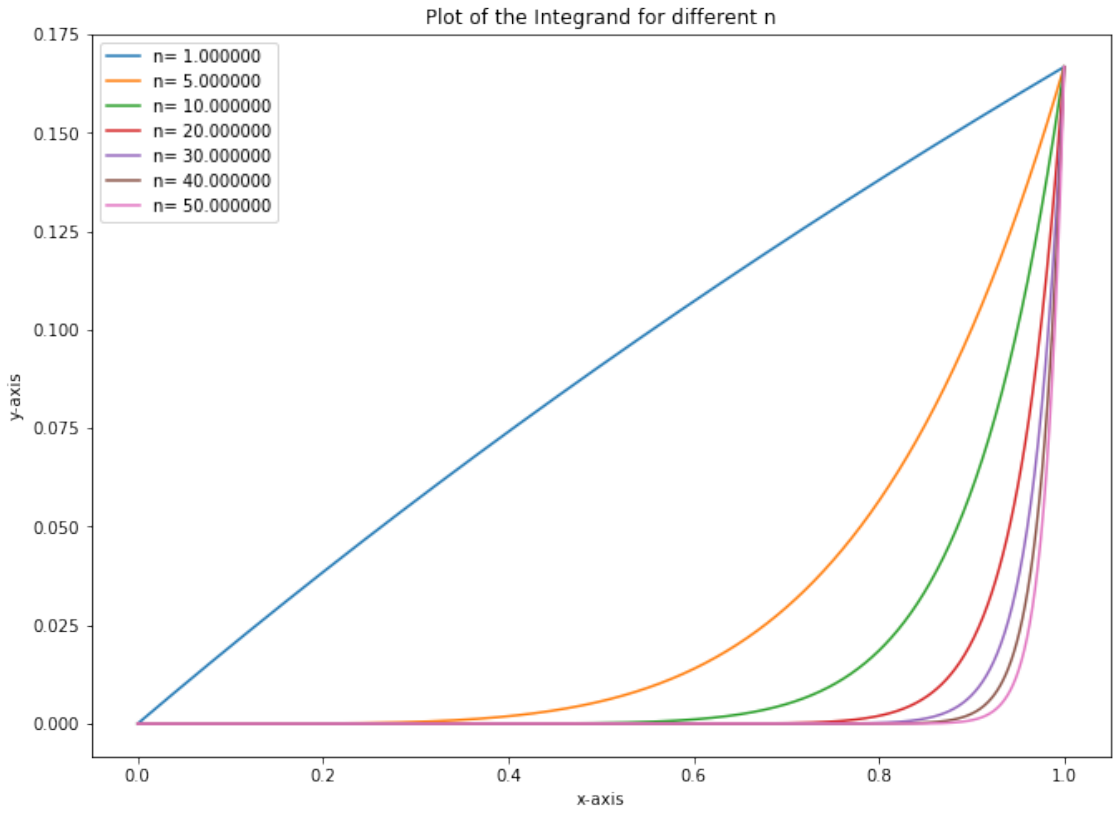
plt.figure(figsize=(11,8))

for i in range(0,len(n)):
    plt.plot(x,func(n[i],a), label='n= %f'%((n[i]))) #plot the function for␣
 ↪different n

plt.legend()

plt.xlabel('x-axis')
plt.ylabel('y-axis')
plt.title('Plot of the Integrand for different n')
```

[5]: Text(0.5, 1.0, 'Plot of the Integrand for different n')



0.2 b) Iteration

We used the given function for y_n to iterate upwards, to iterate downwards, we changed the formula to:

$y_{n-1} = \frac{\frac{1}{n} - y_n}{a}$

[6]:
```
'''
recursive function that calculates the value of y_n1 when called upon integers␣
 ↪n0 and n1 defining the start(n0)
and the end index of the recursion, as well as a number y0 that is the start␣
 ↪value of the integrand at the index n0.
'''
def iteration(a,n0,n1,y0):
    #base case, stops process of continued recursion
    if(n0 == n1):
        return y0
```

```
    #if the starting values of n0<n1, function calls upon itself, starting with␣
↪n = n0 and y0,and
    #iterating forwards till y_n1 is reached
    if(n0<n1):
        return 1/n1-a*iteration(a,n0,n1-1,y0)

    #if the starting values of n0>n1, function calls upon itself,starting with␣
↪n=n0 and
    #iterating backwards till y_n1 is reached
    if(n0> n1):
        return (1/(n1+1)-iteration(a,n0,n1+1,y0))/a
```

0.3 c) Experiment with the Iteration

[7]:
```
#test iteration function as specified on worksheet

print("value for a=5,n0=0,n1=30,y0=ln(1+a/a):\n %f" %(iteration(5,0,30,(np.
↪log((1+5)/5)))))

print("value for a=5,n0=50,n1=30,y0=1:\n %f" %(iteration(5,50,30,1)))
```

```
value for a=5,n0=0,n1=30,y0=ln(1+a/a):
 -36668.803026
value for a=5,n0=50,n1=30,y0=1:
 0.005405
```

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