Assignment2

January 27, 2018

EE2703 Applied Programming Lab
Assignment 2
Jan 18, 2018
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0.1 Part 1

The function is defined below:

```
In [1]: # Importing numpy and matplotlib
        %pylab inline

Populating the interactive namespace from numpy and matplotlib


In [2]: # Increase figure and font size
        rcParams['figure.figsize'] = 12,9
        rcParams['font.size'] = 15
        #rcParams['text.usetex'] = True

In [3]: def f(t):
            return 1/(1+t*t)

In [4]: f(arange(10)) # Works with numpy arrays

Out[4]: array([ 1.        ,  0.5       ,  0.2       ,  0.1       ,  0.05882353,
                0.03846154,  0.02702703,  0.02      ,  0.01538462,  0.01219512])
```

0.2 Part 2

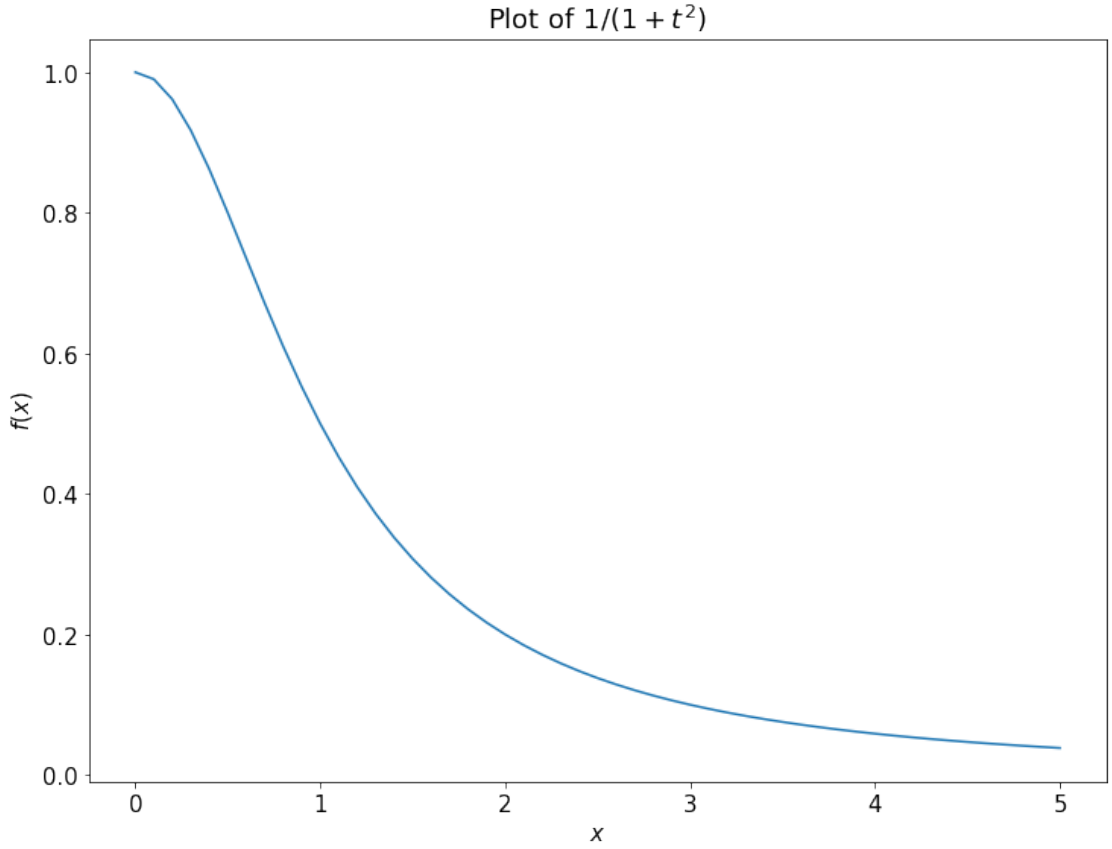
A vector from **start** to **stop** with increments of size **step** is defined below:

```
In [5]: start = 0
        end = 5
        step = 0.1
        x = linspace(start,end,int(1+(end-start)/step))
        x
```

```
Out[5]: array([ 0. ,  0.1,  0.2,  0.3,  0.4,  0.5,  0.6,  0.7,  0.8,  0.9,  1. ,
                1.1,  1.2,  1.3,  1.4,  1.5,  1.6,  1.7,  1.8,  1.9,  2. ,  2.1,
                2.2,  2.3,  2.4,  2.5,  2.6,  2.7,  2.8,  2.9,  3. ,  3.1,  3.2,
                3.3,  3.4,  3.5,  3.6,  3.7,  3.8,  3.9,  4. ,  4.1,  4.2,  4.3,
                4.4,  4.5,  4.6,  4.7,  4.8,  4.9,  5. ])
```

The function **f** is plotted using the vector defined above:

```
In [6]: figure()
        title(r"Plot of $1/(1+t^2)$")
        plot(x,f(x))
        xlabel("$x$")
        ylabel("$f(x)$")
        show()
```



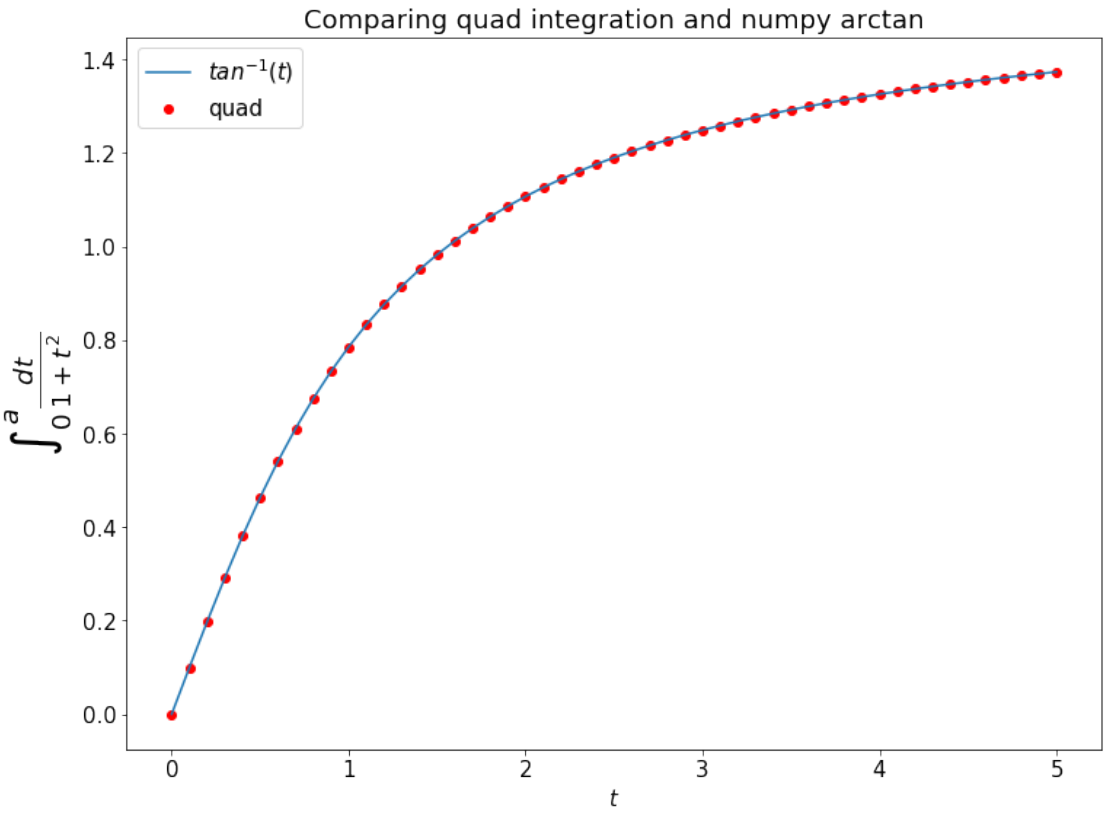

```
In [7]: # Import scipy and quad
        from scipy.integrate import quad

In [8]: integrals = [] # integral values
        errors = [] # errors returned by quad
        # Computation done using a for loop
```

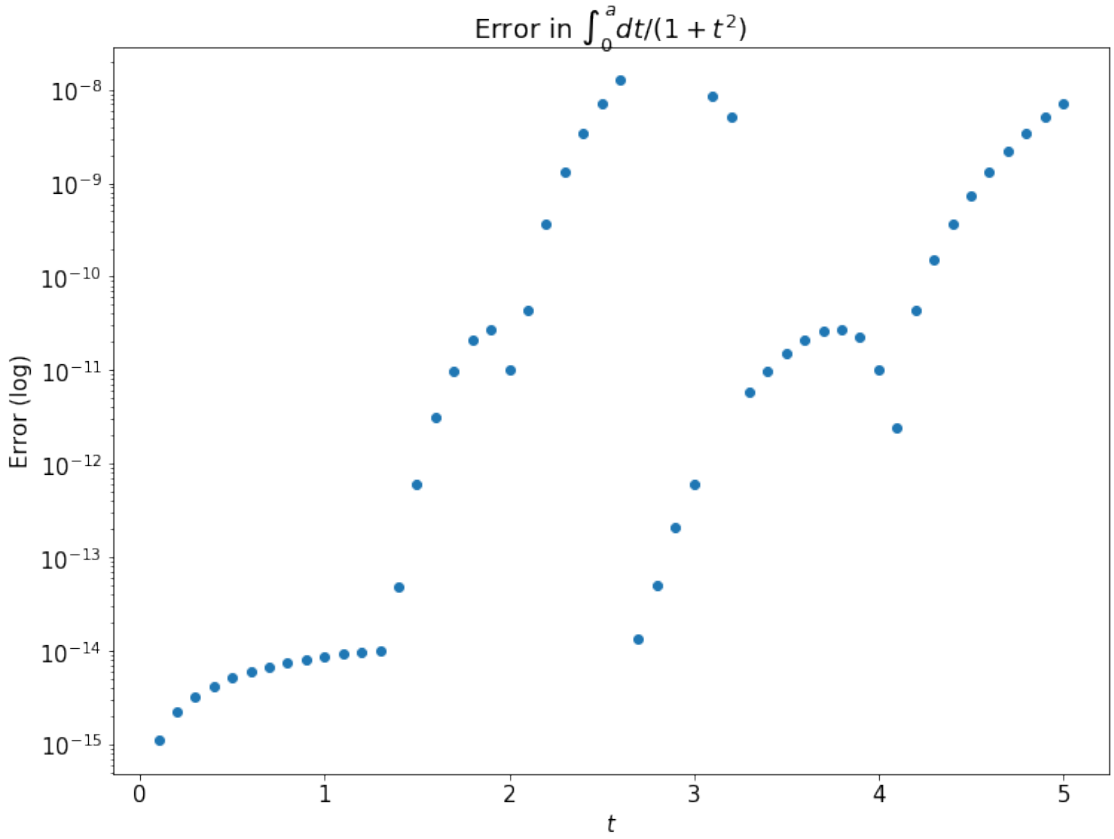
```
    for a in x:
        i,e = quad(f,0,a)
        integrals.append(i)
        errors.append(e)
```

The plot comparing the integral method and the numpy arctan function is shown below:

In [9]:
```
figure()
scatter(x,integrals,color='red')
plot(x,arctan(x))
title("Comparing quad integration and numpy arctan")
ylabel(r"$\int_0^a{\frac{dt}{1+t^2}}$", fontsize = 26)
xlabel(r"$t$")
legend(["$tan^{-1}(t)$","quad"])
show()
```



In [10]:
```
semilogy()
scatter(x,errors)
title(r"Error in $\int_0^a{dt/(1+t^2)}$")
ylabel("Error (log)")
xlabel("$t$")
show()
```


Error in $\int_0^a dt/(1+t^2)$
Error (log)
10^{-8}
10^{-9}
10^{-10}
10^{-11}
10^{-12}
10^{-13}
10^{-14}
10^{-15}
0
1
2
3
4
5
t

In [ ]: