

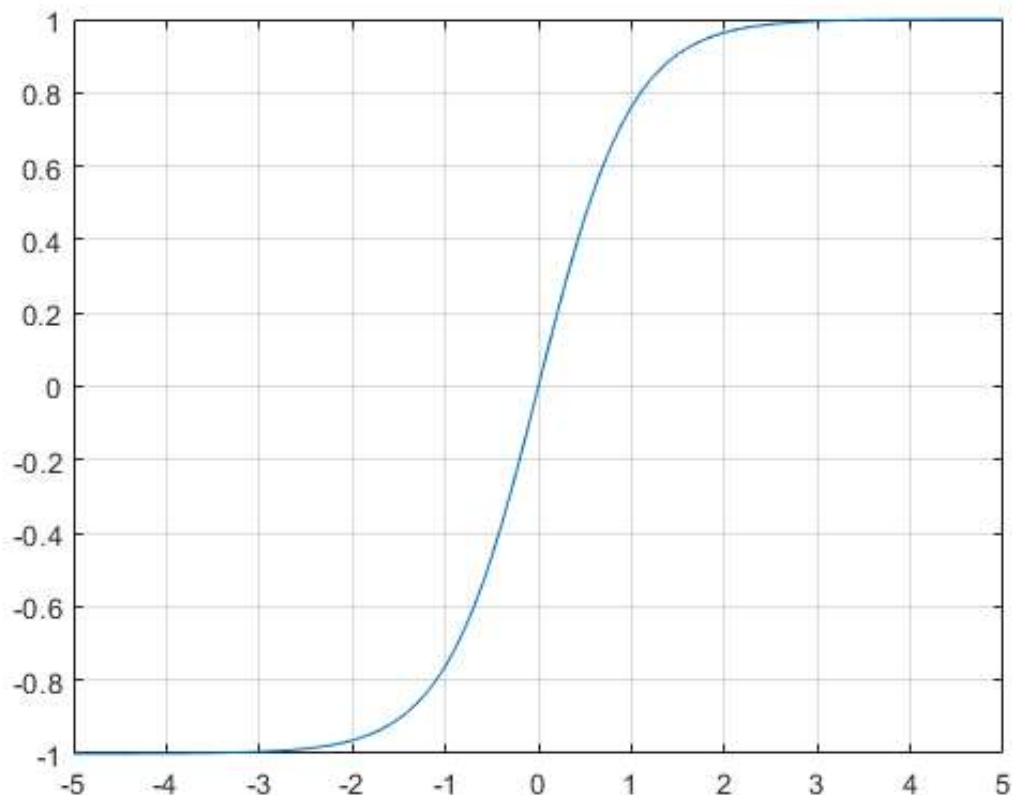
Example#3 : What are the mathematical expressions of the given activation functions? For the Hyperbolic tangent function:

1. What happens when x is +ve large (c const.)?
2. What happens when x is -ve large (c const.)?
3. What happens when $x = 0$?
4. What happens when c is large (>1)?
5. When happens when c is <1 ?

```
% Graph for hyperbolic tangent function
x=-5:0.1:5;
c=1;
Y= (exp(c*x)- exp(-c*x))./(exp(c*x)+ exp(-c*x));
disp(['output Y:' , num2str(Y)]);
```

output Y: -0.99991 -0.99989 -0.99986 -0.99983 -0.9998 -0.99975 -0.9997 .

```
plot(x,Y);
grid on;
```



```
% Graph for Sigmoid function
```

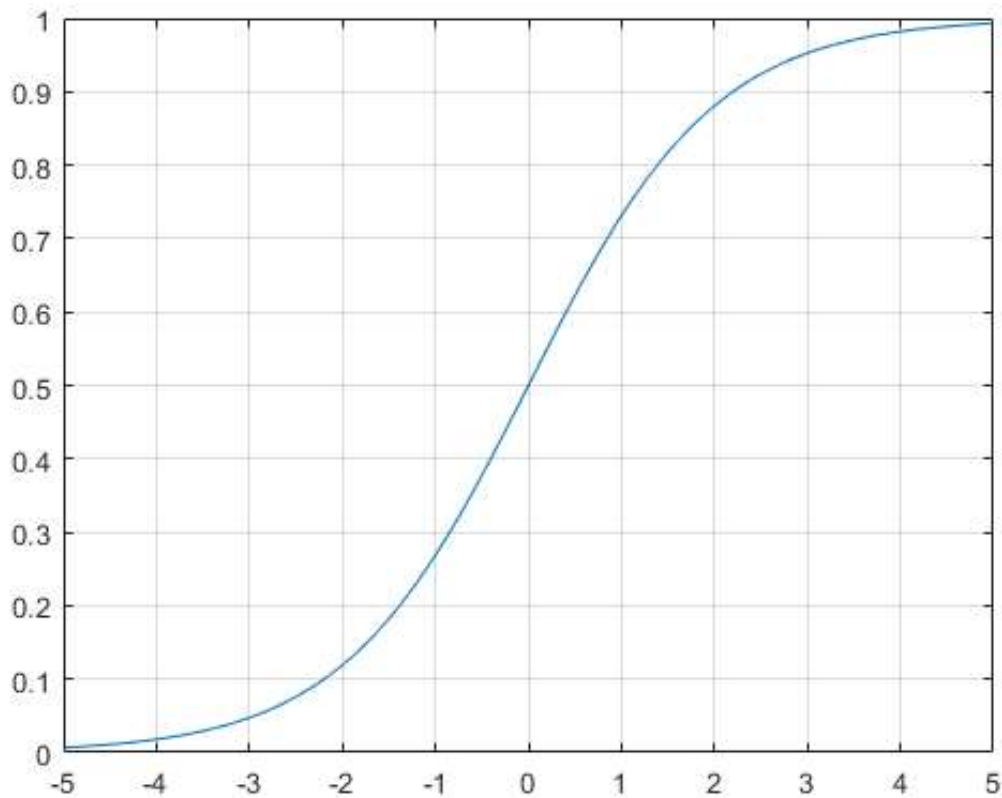
```
x=-5:0.01:5;  
c=1
```

```
c = 1
```

```
Output= 1./(1+ exp( - c*x));  
disp(['output Y1:' , num2str(Output)]);
```

```
output Y1:0.0066929    0.0067597    0.0068271    0.0068953    0.0069641    0.0070336    0.0071038
```

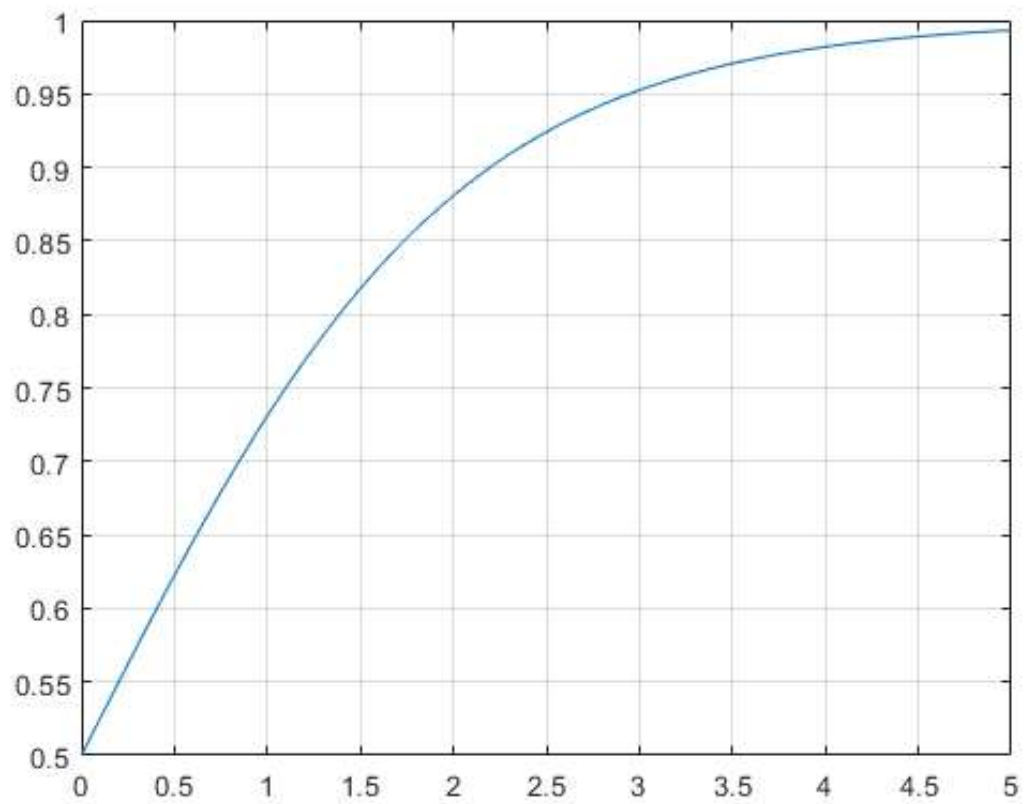
```
plot(x,Output);  
grid on;
```



```
% What happens when x is +ve large (c const.)  
x=0:0.01:5;  
output= 1./(1+ exp( - x));  
disp(['output Y2:' , num2str(output)]);
```

```
output Y2:0.5    0.5025    0.505    0.5075    0.51    0.5125    0.515    0.5175
```

```
plot(x,output);  
grid on;
```



% What happens when x is -ve large (c const.)

```
x=-5:0.1:0;
```

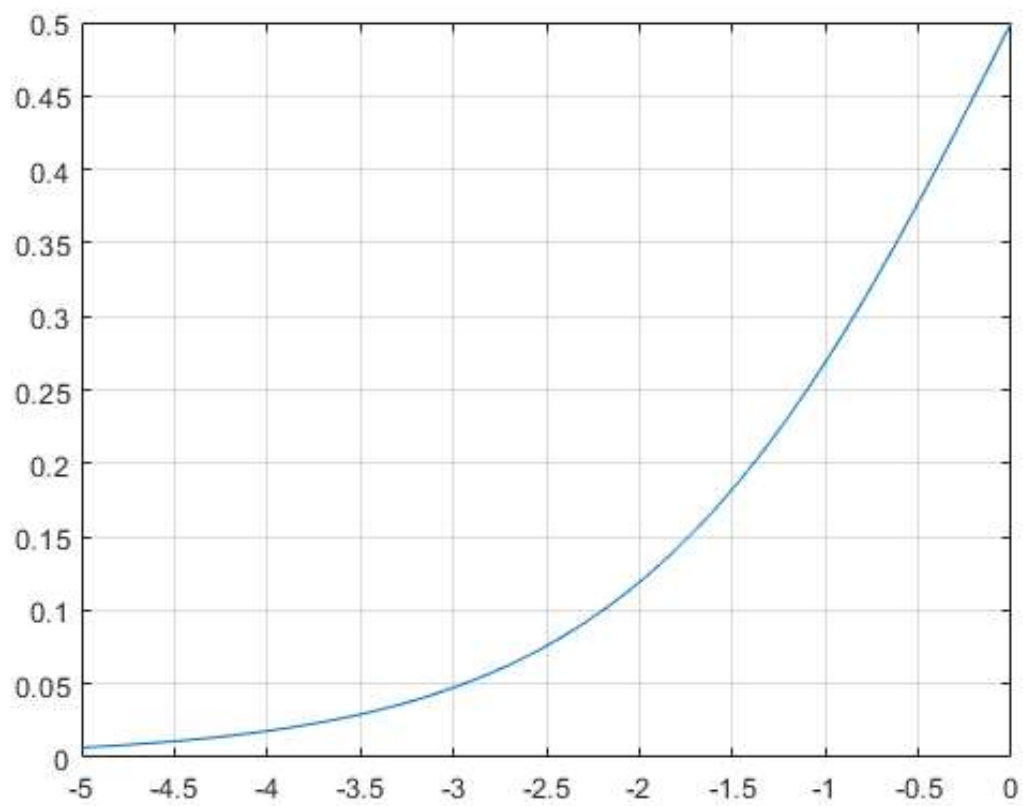
```
Y3= 1./(1+ exp( - x));
```

```
disp(['output Y3:' , num2str(Y3)]);
```

```
output Y3:0.0066929    0.0073915    0.0081626    0.0090133    0.0099518    0.010987    0.012128
```

```
plot(x,Y3);
```

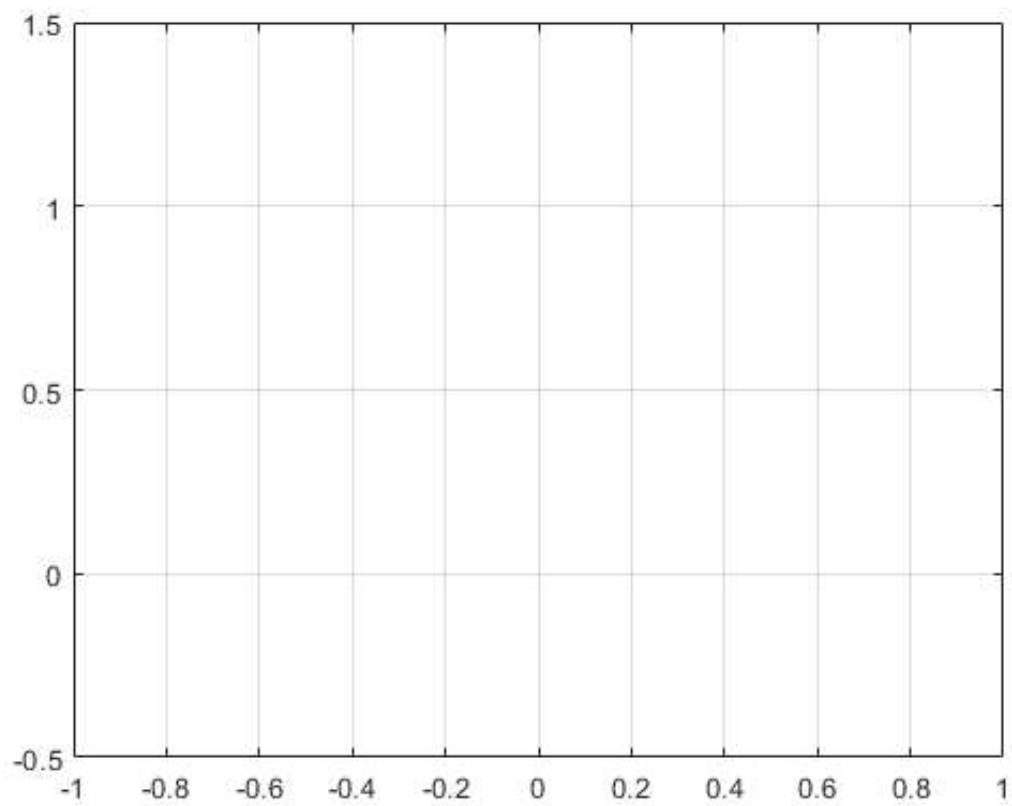
```
grid on;
```



```
% What happens when x = 0  
x=0:0.1:0;  
Y4= 1./(1+ exp( - x));  
disp(['output Y4:' , num2str(Y4)]);
```

output Y4:0.5

```
plot(x,Y4);  
grid on;
```



```
% What happens when c is large (>1)
```

```
x=-5:0.1:5;
```

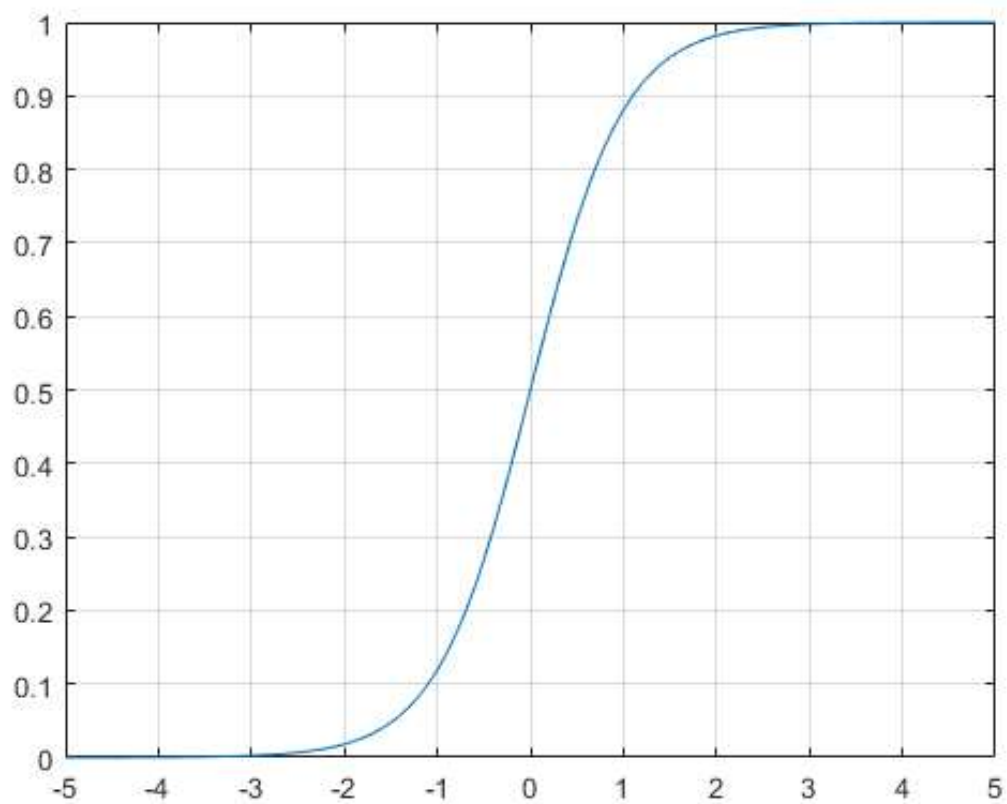
```
c=2
```

```
c = 2
```

```
Y5=1 ./ (1+exp(-c*x));
```

```
disp(['output Y5', num2str(Y5)])
```

```
output Y54.5398e-05  5.5449e-05  6.7724e-05  8.2717e-05  0.00010103  0.00012339  0.00015071  0.00018103  0.00021603  0.00025503  0.00029803  0.00034503  0.00039503  0.00044803  0.00050403  0.00056303  0.00062503  0.00069003  0.00075803  0.00082903  0.00090303  0.00098003  0.00106003  0.00114303  0.00122903  0.00131803  0.00141003  0.00150503  0.00160303  0.00170403  0.00180803  0.00191503  0.00202503  0.00213803  0.00225403  0.00237303  0.00249503  0.00262003  0.00274803  0.00287903  0.00301303  0.00315003  0.00329003  0.00343303  0.00357903  0.00372803  0.00388003  0.00403503  0.00419303  0.00435403  0.00451803  0.00468503  0.00485503  0.00502803  0.00520403  0.00538303  0.00556503  0.00575003  0.00593803  0.00612903  0.00632303  0.00652003  0.00672003  0.00692303  0.00712903  0.00733803  0.00755003  0.00776503  0.00798303  0.00820403  0.00842803  0.00865503  0.00888503  0.00911803  0.00935403  0.00959303  0.00983503  0.01008003  0.01032803  0.01057903  0.01083303  0.01109003  0.01135003  0.01161303  0.01187903  0.01214803  0.01242003  0.01269503  0.01297303  0.01325403  0.01353803  0.01382503  0.01411503  0.01440803  0.01470403  0.01500303  0.01530503  0.01561003  0.01591803  0.01622903  0.01654303  0.01686003  0.01718003  0.01750303  0.01782903  0.01815803  0.01849003  0.01882503  0.01916303  0.01950403  0.01984803  0.02019503  0.02054503  0.02089803  0.02125403  0.02161303  0.02197503  0.02234003  0.02270803  0.02307903  0.02345303  0.02383003  0.02421003  0.02459303  0.02497903  0.02536803  0.02576003  0.02615503  0.02655303  0.02695403  0.02735803  0.02776503  0.02817503  0.02858803  0.02900303  0.02942103  0.02984203  0.03026603  0.03069303  0.03112303  0.03155603  0.03199203  0.03243103  0.03287303  0.03331803  0.03376603  0.03421703  0.03467103  0.03512803  0.03558803  0.03605103  0.03651703  0.03698603  0.03745803  0.03793303  0.03841103  0.03889203  0.03937603  0.03986303  0.04035303  0.04084603  0.04134203  0.04184103  0.04234303  0.04284803  0.04335603  0.04386703  0.04438103  0.04489803  0.04541803  0.04594103  0.04646703  0.04699603  0.04752803  0.04806303  0.04860103  0.04914203  0.04968603  0.05023303  0.05078303  0.05133603  0.05189203  0.05245103  0.05301303  0.05357803  0.05414603  0.05471703  0.05529103  0.05586803  0.05644803  0.05703103  0.05761703  0.05820603  0.05879803  0.05939303  0.06000003  0.06060903  0.06122103  0.06183603  0.06245403  0.06307503  0.06369903  0.06432603  0.06495603  0.06558903  0.06622503  0.06686403  0.06750603  0.06815103  0.06879903  0.06945003  0.07010403  0.07076103  0.07142103  0.07208403  0.07275003  0.07341903  0.07409103  0.07476603  0.07544403  0.07612503  0.07680903  0.07749603  0.07818603  0.07887903  0.07957503  0.08027403  0.08097603  0.08168103  0.08238903  0.08309903  0.08381203  0.08452803  0.08524703  0.08596903  0.08669403  0.08742103  0.08815103  0.08888403  0.08962003  0.09035903  0.09110103  0.09184603  0.09259403  0.09334503  0.09409903  0.09485603  0.09561603  0.09637903  0.09714503  0.09791403  0.09868603  0.09946103  0.10023903  0.10102003  0.10180403  0.10259103  0.10338103  0.10417403  0.10497003  0.10576903  0.10657103  0.10737603  0.10818403  0.10899503  0.10980903  0.11062603  0.11144603  0.11226903  0.11309503  0.11392403  0.11475603  0.11559103  0.11642903  0.11727003  0.11811403  0.11896103  0.11981103  0.12066403  0.12152003  0.12237903  0.12324103  0.12410603  0.12497403  0.12584503  0.12671903  0.12759603  0.12847603  0.12935903  0.13024503  0.13113403  0.13202603  0.13292103  0.13381903  0.13472003  0.13562403  0.13653103  0.13744103  0.13835403  0.13927003  0.14018903  0.14111103  0.14203603  0.14296403  0.14389503  0.14482903  0.14576603  0.14670603  0.14764903  0.14859503  0.14954403  0.15049603  0.15145103  0.15240903  0.15337003  0.15433403  0.15530103  0.15627103  0.15724403  0.15822003  0.15919903  0.16018103  0.16116603  0.16215403  0.16314503  0.16413903  0.16513603  0.16613603  0.16713903  0.16814503  0.16915403  0.17016603  0.17118103  0.17219903  0.17322003  0.17424403  0.17527103  0.17630103  0.17733403  0.17837003  0.17940903  0.18045103  0.18149603  0.18254403  0.18359503  0.18464903  0.18570603  0.18676603  0.18782903  0.18889503  0.18996403  0.19103603  0.19211103  0.19318903  0.19427003  0.19535403  0.19644103  0.19753103  0.19862403  0.19972003  0.20081903  0.20192103  0.20302603  0.20413403  0.20524503  0.20635903  0.20747603  0.20859603  0.20971903  0.21084503  0.21197403  0.21310603  0.21424103  0.21537903  0.21652003  0.21766403  0.21881103  0.21996103  0.22111403  0.22227003  0.22342903  0.22459103  0.22575603  0.22692403  0.22809503  0.22926903  0.23044603  0.23162603  0.23280903  0.23399503  0.23518403  0.23637603  0.23757103  0.23876903  0.23997003  0.24117403  0.24238103  0.24359103  0.24480403  0.24602003  0.24723903  0.24846103  0.24968603  0.25091403  0.25214503  0.25337903  0.25461603  0.25585603  0.25709903  0.25834503  0.25959403  0.26084603  0.26210103  0.26335903  0.26462003  0.26588403  0.26715103  0.26842103  0.26969403  0.27097003  0.27224903  0.27353103  0.27481603  0.27610403  0.27739503  0.27868903  0.27998603  0.28128603  0.28258903  0.28389503  0.28520403  0.28651603  0.28783103  0.28914903  0.29047003  0.29179403  0.29312103  0.29445103  0.29578403  0.29712003  0.29845903  0.29980103  0.30114603  0.30249403  0.30384503  0.30519903  0.30655603  0.30791603  0.30927903  0.31064503  0.31201403  0.31338603  0.31476103  0.31613903  0.31752003  0.31890403  0.32029103  0.32168103  0.32307403  0.32447003  0.32586903  0.32727103  0.32867603  0.33008403  0.33149503  0.33290903  0.33432603  0.33574603  0.33716903  0.33859503  0.34002403  0.34145603  0.34289103  0.34432903  0.34577003  0.34721403  0.34866103  0.35011103  0.35156403  0.35302003  0.35447903  0.35594103  0.35740603  0.35887403  0.36034503  0.36181903  0.36329603  0.36477603  0.36625903  0.36774503  0.36923403  0.37072603  0.37222103  0.37371903  0.37522003  0.37672403  0.37823103  0.37974103  0.38125403  0.38277003  0.38428903  0.38581103  0.38733603  0.38886403  0.39039503  0.39192903  0.39346603  0.39500603  0.39654903  0.39809503  0.39964403  0.40119603  0.40275103  0.40430903  0.40587003  0.40743403  0.40899903  0.41056703  0.41213803  0.41371203  0.41528903  0.41686903  0.41845203  0.42003803  0.42162703  0.42321903  0.42481403  0.42641203  0.42801303  0.42961703  0.43122403  0.43283403  0.43444703  0.43606303  0.43768203  0.43930403  0.44092903  0.44255703  0.44418803  0.44582203  0.44745903  0.44909903  0.45074203  0.45238803  0.45403703  0.45568903  0.45734403  0.45899903  0.46065703  0.46231803  0.46398203  0.46564903  0.46731903  0.46899203  0.47066803  0.47234703  0.47402903  0.47571403  0.47740203  0.47909303  0.48078703  0.48248403  0.48418403  0.48588703  0.48759303  0.48930203  0.49101403  0.49272903  0.49444703  0.49616803  0.49789203  0.49961903  0.50134903  0.50308203  0.50481803  0.50655703  0.50829903  0.51004403  0.51179203  0.51354303  0.51529603  0.51705203  0.51881103  0.52057303  0.52233803  0.52410603  0.52587703  0.52765103  0.52942803  0.53120803  0.53299103  0.53477703  0.53656603  0.53835803  0.54015303  0.54195103  0.54375203  0.54555603  0.54736303  0.54917303  0.55098603  0.55280203  0.55462103  0.55644303  0.55826803  0.56009603  0.56192703  0.56376103  0.56559803  0.56743803  0.56928103  0.57112703  0.57297603  0.57482803  0.57668303  0.57854103  0.58040203  0.58226603  0.58413303  0.58600303  0.58787603  0.58975203  0.59163103  0.59351303  0.59539803  0.59728603  0.59917703  0.60107103  0.60296803  0.60486803  0.60677103  0.60867703  0.61058603  0.61249803  0.61441303  0.61633103  0.61825203  0.62017603  0.62210303  0.62403303  0.62596603  0.62790203  0.62984103  0.63178303  0.63372803  0.63567603  0.63762703  0.63958103  0.64153803  0.64349803  0.64546103  0.64742703  0.64939603  0.65136803  0.65334303  0.65532103  0.65730203  0.65928603  0.66127303  0.66326303  0.66525603  0.66725203  0.66925103  0.67125303  0.67325803  0.67526603  0.67727703  0.67929103  0.68130803  0.68332803  0.68535103  0.68737703  0.68940603  0.69143803  0.69347303  0.69551103  0.69755203  0.69959603  0.70164303  0.70369303  0.70574603  0.70780203  0.70986103  0.71192303  0.71398803  0.71605603  0.71812703  0.72020103  0.72227803  0.72435803  0.72644103  0.72852703  0.73061603  0.73270803  0.73480303  0.73690103  0.73899903  0.74109903  0.74320103  0.74530603  0.74741403  0.74952503  0.75163903  0.75375603  0.75587603  0.75799903  0.76012503  0.76225403  0.76438603  0.76652103  0.76865903  0.77080003  0.77294403  0.77509103  0.77724103  0.77939403  0.78155003  0.78370903  0.78587103  0.78803603  0.79020403  0.79237503  0.79454903  0.79672603  0.79890603  0.80108903  0.80327503  0.80546403  0.80765603  0.80985103  0.81204903  0.81425003  0.81645403  0.81866103  0.82087103  0.82308403  0.82529903  0.82751703  0.82973803  0.83196203  0.83418903  0.83641903  0.83865203  0.84088803  0.84312703  0.84536903  0.84761403  0.84986203  0.85211303  0.85436703  0.85662403  0.85888403  0.86114703  0.86341303  0.86568203  0.86795403  0.87022903  0.87250703  0.87478803  0.87707203  0.87935903  0.88164903  0.88394203  0.88623803  0.88853703  0.89083903  0.89314403  0.89545203  0.89776303  0.90007703  0.90239403  0.90471403  0.90703703  0.90936303  0.91169203  0.91402403  0.91635903  0.91869703  0.92103803  0.92338203  0.92572903  0.92807903  0.93043203  0.93278803  0.93514703  0.93750903  0.93987403  0.94224203  0.94461303  0.94698703  0.94936403  0.95174403  0.95412703  0.95651303  0.95890203  0.96129403  0.96368903  0.96608703  0.96848803  0.97089203  0.97329903  0.97570903  0.97812203  0.98053803  0.98295703  0.98537903  0.98780403  0.99023203  0.99266303  0.99509703  0.99753403  1.00000003  1.00246903  1.00494103  1.00741603  1.00989403  1.01237503  1.01485903  1.01734603  1.01983603  1.02232903  1.02482503  1.02732403  1.02982603  1.03233103  1.03483903  1.03735003  1.03986403  1.04238103  1.04489903  1.04742003  1.04994403  1.05247103  1.05500103  1.05753403  1.06007003  1.06260903  1.06515103  1.06769603  1.07024403  1.07279503  1.07534903  1.07790603  1.08046603  1.08302903  1.08559503  1.08816403  1.09073603  1.09331103  1.09588903  1.09847003  1.10105403  1.10364103  1.10623103  1.10882403  1.11142003  1.11401903  1.11662103  1.11922603  1.12183403  1.12444503  1.12705903  1.12967603  1.13229603  1.13491903  1.13754503  1.14017403  1.14280603  1.14544103  1.14807903  1.15072003  1.15336403  1.15601103  1.15866103  1.16131403  1.16397003  1.16662903  1.16929103  1.17195603  1.17462403  1.17729503  1.18000003  1.18270903  1.18542103  1.18813603  1.19085403  1.19357503  1.19629903  1.19902603  1.20175603  1.20448903  1.20722503  1.20996403  1.21270603  1.21545103  1.21819903  1.22095003  1.22370403  1.22646103  1.22922103  1.23198403  1.23475003  1.23751903  1.24029103  1.24306603  1.24584403  1.24862503  1.25140903  1.25419603  1.25698603  1.25977903  1.26257503  1.26537403  1.26817603  1.27098103  1.27378903  1.27659903  1.27941203  1.28222803  1.28504703  1.28786903  1.29069403  1.29352203  1.29635303  1.29918703  1.30202403  1.30486403  1.30770703  1.31055303  1.31340203  1.31625403  1.31910903  1.32196703  1.32482803  1.32769203  1.33055903  1.33342903  1.33630203  1.33917803  1.34205703  1.34493903  1.34782403  1.35071203  1.35360303  1.35649703  1.35939403  1.36229403  1.36519703  1.36810303  1.37101203  1.37392403  1.37683903  1.37975703  1.38267803  1.38560203  1.38852903  1.39145903  1.39439203  1.39732803  1.40026703  1.40320903  1.40615403  1.40910203  1.41205303  1.41500703  1.41796403  1.42092403  1.42388703  1.42685303  1.42982203  1.43279403  1.43576903  1.43874703  1.44172803  1.44471203  1.44769903  1.45068903  1.45368203  1.45667803  1.45967703  1.46267903  1.46568403  1.46869203  1.47170303  1.47471703  1.47773403  1.48075403  1.48377703  1.48680303  1.48983203  1.49286403  1.49589903  1.49893703  1.50197803  1.50502203  1.50806903  1.51111903  1.51417203  1.51722803  1.52028703  1.52334903  1.5264140
```



% What happens when c is large (<1)

```
x=-5:0.1:5;
```

```
c=0;
```

```
Y6=1 ./ (1+exp(-c*x))
```

```
Y6 = 1×101
```

```
0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000
```

```
disp(['output Y6',num2str(Y6)]);
```

```
output Y60.5
```

```
0.5
```

```
0.5
```

```
0.5
```

```
0.5
```

```
0.5
```

```
0.5
```

```
0.5
```

```
plot(x,Y6)
```

```
grid on;
```

