

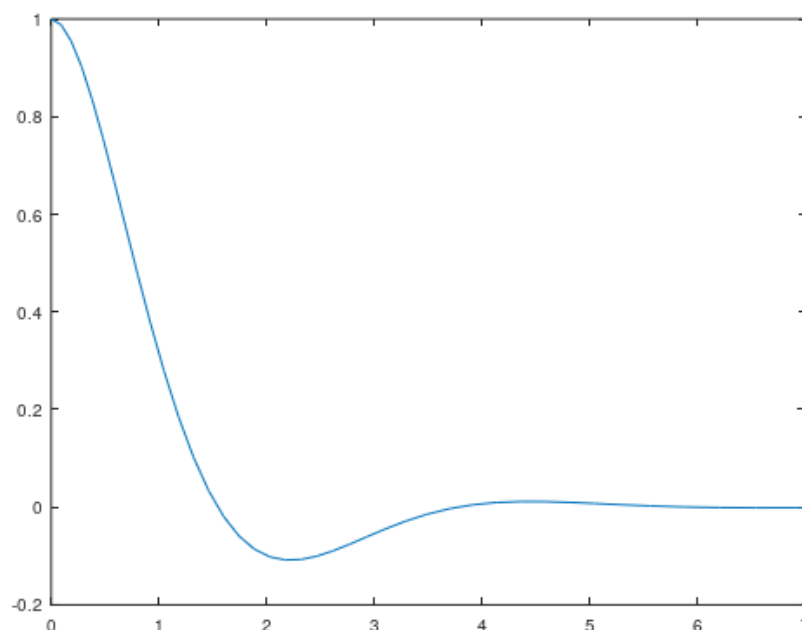
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B9TB1710

First, I define a storing vector to be $p = (v, x)$, where $v = \frac{dx}{dt}$. I create a function $dp = \text{CAPS_06_B9TB1710_assn5}(t, p)$ that will contain derivatives of variables in p . From the formula given in the assignment, $m\ddot{x} + c\dot{x} + kx = 0$, I can find that $\frac{dv}{dt} = \frac{-c\dot{x} - kx}{m}$. Thus, function dp is equal to $\frac{dp}{dt} = \left(\frac{-cp(1) - kp(2)}{m}, p(1) \right)$. I define the values of k and c according to my birthday which is 2nd July.

```
CAPS_06_B9TB1710_assn5.m
1 function dp=CAPS_06_B9TB1710_assn5(t,p); #p=[v,x]
2     c=2;
3     k=3;
4     m=1;
5     dp=[ (-c*p(1)-k*p(2))/m, p(1)];
6 endfunction
7
```

Next, I want to use my function to calculate how v and x change with the time. I use **ode45** package. I call function *CAPS_06_B9TB1710_assn5* saved in the script of the same name. I set the time interval to $[0, 7.0]$ and initial values of variables to $v(0) = 0, x(0) = 1$. My output are time intervals T and values of v and x ($result = [v, x]$) in the given T . I plot $y = x(t)$ according to the results and I get a graph as below.



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>> [T, result]= ode45(@CAPS_06_B9TB1710_assn5,[0,7.0],[0,1])
warning: Option "RelTol" not set, new value 0.000001 is used
warning: called from
ode45 at line 113 column 5
warning: Option "AbsTol" not set, new value 0.000001 is used
warning: called from
ode45 at line 124 column 5
warning: Option "InitialStep" not set, new value 0.700000 is used
warning: called from
ode45 at line 182 column 5
warning: Option "MaxStep" not set, new value 0.700000 is used
warning: called from
ode45 at line 190 column 5
T =

0.00000
0.09104
0.18548
0.28151
0.37958
0.48013
0.58369
0.69094
0.80277
0.92043
1.04589
1.18266
1.32286
1.46189
1.60143
1.74285
1.88735
2.03084
2.17339
2.31681
2.46251
2.61180
2.76608
2.92710

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2.92710
3.09722
3.28012
3.48265
3.70133
3.91793
4.13803
4.36365
4.58571
4.81101
5.04457
5.29167
5.55986
5.86376
6.20315
6.54222
6.89179
7.00000

result =

0.00000 1.00000
-0.24866 0.98831
-0.45695 0.95461
-0.62062 0.90250
-0.74218 0.83532
-0.82425 0.75623
-0.86960 0.66820
-0.88112 0.57402
-0.86181 0.47630
-0.81461 0.37745
-0.74226 0.27959
-0.64675 0.18446
-0.53982 0.10122
-0.43231 0.03366
-0.32876 -0.01936
-0.23254 -0.05893
-0.14623 -0.08613
-0.07413 -0.10178

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-0.82425 0.75623
-0.86960 0.66820
-0.88112 0.57402
-0.86181 0.47630
-0.81461 0.37745
-0.74226 0.27959
-0.64675 0.18446
-0.53982 0.10122
-0.43231 0.03366
-0.32876 -0.01936
-0.23254 -0.05893
-0.14623 -0.08613
-0.07413 -0.10178
-0.01639 -0.10806
0.02812 -0.10707
0.06045 -0.10046
0.08166 -0.08972
0.09292 -0.07613
0.09547 -0.06085
0.09059 -0.04493
0.07960 -0.02930
0.06371 -0.01475
0.04540 -0.00282
0.02851 0.00515
0.01414 0.00978
0.00302 0.01165
-0.00434 0.01144
-0.00859 0.00992
-0.01028 0.00767
-0.00995 0.00514
-0.00816 0.00269
-0.00545 0.00061
-0.00260 -0.00074
-0.00053 -0.00124
0.00068 -0.00119
0.00088 -0.00111

>> plot(T,result(:,2))
>>