In[ ]:=
```
f[x_, y_] := x^2 y / (1 + x^3)
```

In[ ]:=
```
cozER1 = EulerRK1[1., 2., 1., 5]
```

1. Dongu

k1=f[1.,1.]=0.5

{x[1],y[1]}={1.2,1.1}

2. Dongu

k1=f[1.2,1.1]=0.580645

{x[2],y[2]}={1.4,1.21613}

3. Dongu

k1=f[1.4,1.21613]=0.636649

{x[3],y[3]}={1.6,1.34346}

4. Dongu

k1=f[1.6,1.34346]=0.674893

{x[4],y[4]}={1.8,1.47844}

5. Dongu

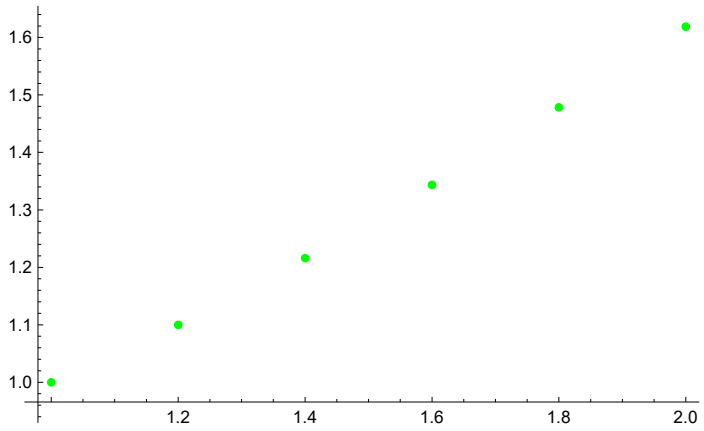
k1=f[1.8,1.47844]=0.701132

{x[5],y[5]}={2.,1.61866}

Out[ ]=
```
{{1., 1.}, {1.2, 1.1}, {1.4, 1.21613}, {1.6, 1.34346}, {1.8, 1.47844}, {2., 1.61866}}
```

In[ ]:=
```
sekER1 = ListPlot[cozER1, PlotStyle → {Green}]
```

Out[ ]=



In[ ]:=
```
cozR = Runge2E[1., 2., 1., 5]
```

1. Dongu

k1=f[1.,1.]=0.5

k2=f[1.13333,1.06667]=0.557915

{x[1],y[1]}={1.2,1.10869}

2. Dongu

k1=f[1.2,1.10869]=0.585231

k2=f[1.33333,1.18672]=0.625961

{x[2],y[2]}={1.4,1.23184}

3. Dongu

k1=f[1.4,1.23184]=0.644875

k2=f[1.53333,1.31783]=0.672819

{x[3],y[3]}={1.6,1.36501}

4. Dongu

k1=f[1.6,1.36501]=0.685719

k2=f[1.73333,1.45644]=0.704897

{x[4],y[4]}={1.8,1.50503}

5. Dongu

k1=f[1.8,1.50503]=0.713744

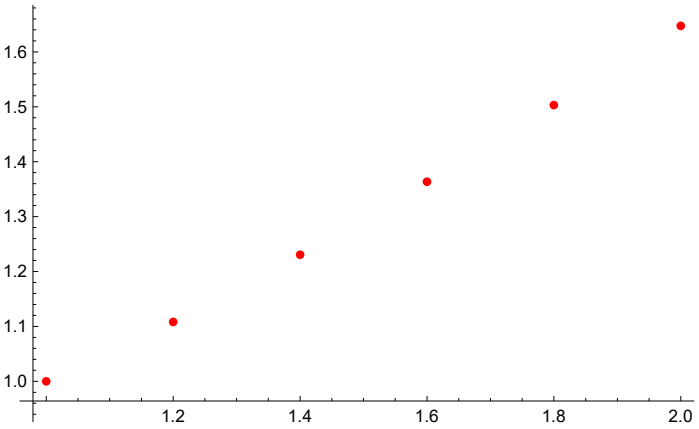
k2=f[1.93333,1.6002]=0.727074

{x[5],y[5]}={2.,1.64978}

Out[•]= {{1., 1.}, {1.2, 1.10869}, {1.4, 1.23184}, {1.6, 1.36501}, {1.8, 1.50503}, {2., 1.64978}}

In[•]:= **sekER2 = ListPlot[cozR, PlotStyle → {Red}]**

Out[•]=

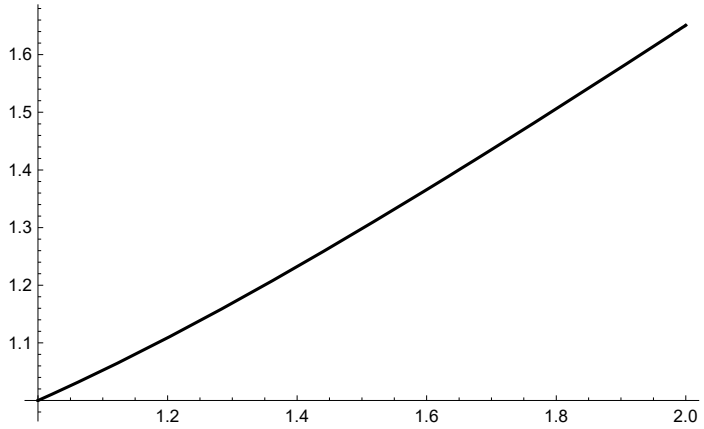


In[•]:= **cozA = DSolve[{D[y[x], x] == f[x, y[x]], y[1] == 1}, y[x], x][[1, 1, 2]]**

Out[•]= $\frac{\left(1 + x^3\right)^{1/3}}{2^{1/3}}$

In[ ]:=
```
sek = Plot[cozA, {x, 1, 2}, PlotStyle → Black]
```

Out[ ]=



In[ ]:=
```
cozA /. x → 2.
```

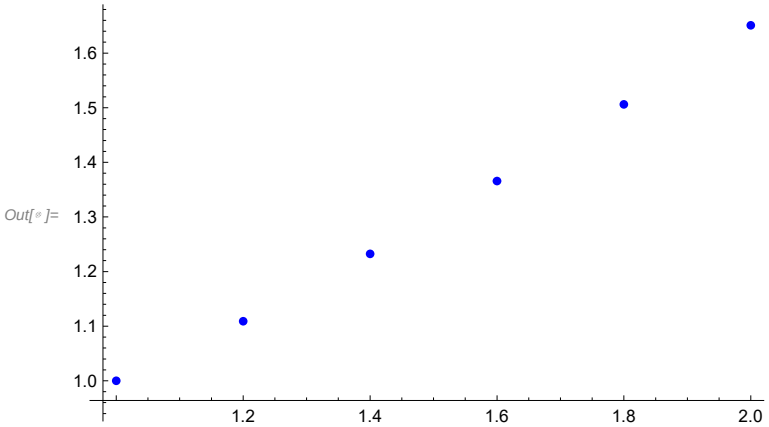
Out[ ]=
```
1.65096
```

In[ ]:=
```
cozER4 = Runge4[1., 2., 1., 5]
```

```
1. Dongu
k1=f(x=1.,y=1.)=0.5
k2=f(x=1.1,y=1.05)=0.545045
k3=f(x=1.1,y=1.0545)=0.547383
k4=f(x=1.2,y=1.10948)=0.585648
{x[1],y[1]}={1.2,1.10902}
2. Dongu
k1=f(x=1.2,y=1.10902)=0.585405
k2=f(x=1.3,y=1.16756)=0.617195
k3=f(x=1.3,y=1.17074)=0.618875
k4=f(x=1.4,y=1.23279)=0.645372
{x[2],y[2]}={1.4,1.23245}
3. Dongu
k1=f(x=1.4,y=1.23245)=0.645191
k2=f(x=1.5,y=1.29697)=0.667011
k3=f(x=1.5,y=1.29915)=0.668134
k4=f(x=1.6,y=1.36607)=0.686254
{x[3],y[3]}={1.6,1.36584}
4. Dongu
k1=f(x=1.6,y=1.36584)=0.686136
k2=f(x=1.7,y=1.43445)=0.701094
k3=f(x=1.7,y=1.43595)=0.701825
k4=f(x=1.8,y=1.5062)=0.7143
{x[4],y[4]}={1.8,1.50605}
5. Dongu
k1=f(x=1.8,y=1.50605)=0.714226
k2=f(x=1.9,y=1.57747)=0.724605
k3=f(x=1.9,y=1.57851)=0.725081
k4=f(x=2.,y=1.65106)=0.733806
{x[5],y[5]}={2.,1.65096}
Out[•]= {{1., 1.}, {1.2, 1.10902}, {1.4, 1.23245}, {1.6, 1.36584}, {1.8, 1.50605}, {2., 1.65096}}
```

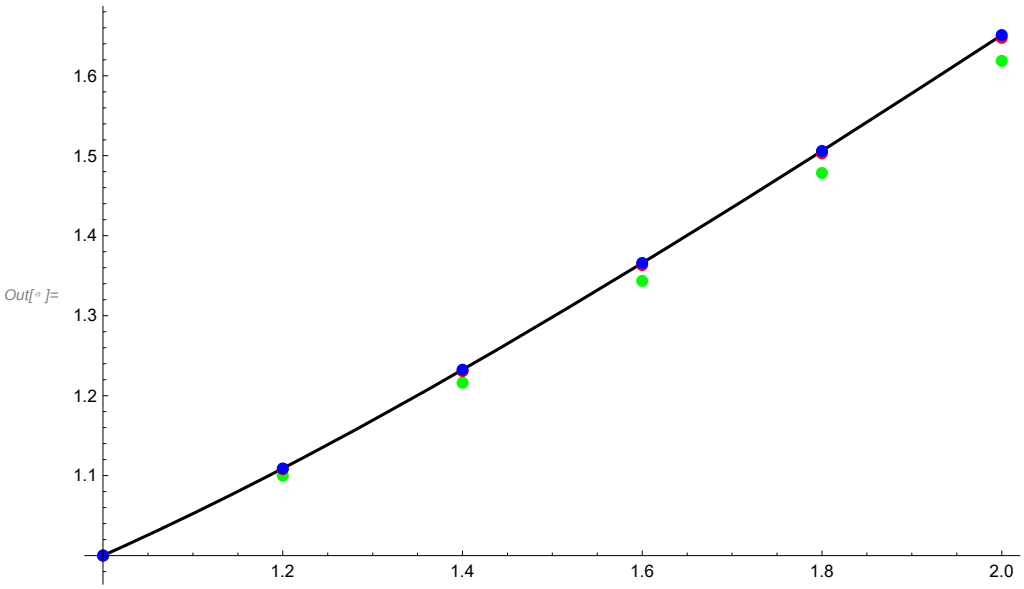
In[ ]:=
```
sekER4 = ListPlot[cozER4, PlotStyle → {Blue}]
```

Out[ ]=



In[ ]:=
```
Show[sek, sekER1, sekER2, sekER4]
```

Out[ ]=



In[ ]:=
```
f[x_, y_] := x^2 y + x y
```

In[ ]:=
```
Runge4[1., 2., 1., 10]
```

1. Dongu

k1=f(x=1.,y=1.)=2.

k2=f(x=1.05,y=1.1)=2.36775

k3=f(x=1.05,y=1.11839)=2.40733

k4=f(x=1.1,y=1.24073)=2.86609

{x[1],y[1]}={1.1,1.24027}

2. Dongu

k1=f(x=1.1,y=1.24027)=2.86503

k2=f(x=1.15,y=1.38352)=3.42076

k3=f(x=1.15,y=1.41131)=3.48946

k4=f(x=1.2,y=1.58922)=4.19553

{x[2],y[2]}={1.2,1.58829}

3. Dongu

k1=f(x=1.2,y=1.58829)=4.19308

k2=f(x=1.25,y=1.79794)=5.05671

k3=f(x=1.25,y=1.84112)=5.17816

k4=f(x=1.3,y=2.1061)=6.29725

{x[3],y[3]}={1.3,2.10429}

4. Dongu

k1=f(x=1.3,y=2.10429)=6.29182

k2=f(x=1.35,y=2.41888)=7.6739

k3=f(x=1.35,y=2.48798)=7.89313

k4=f(x=1.4,y=2.8936)=9.7225

{x[4],y[4]}={1.4,2.89009}

5. Dongu

k1=f(x=1.4,y=2.89009)=9.71072

k2=f(x=1.45,y=3.37563)=11.9919

k3=f(x=1.45,y=3.48969)=12.3971

k4=f(x=1.5,y=4.12981)=15.4868

{x[5],y[5]}={1.5,4.12302}

6. Dongu

k1=f(x=1.5,y=4.12302)=15.4613

k2=f(x=1.55,y=4.89609)=19.3518

k3=f(x=1.55,y=5.09061)=20.1206

k4=f(x=1.6,y=6.13509)=25.522

{x[6],y[6]}={1.6,6.12182}

7. Dongu

k1=f(x=1.6,y=6.12182)=25.4668

k2=f(x=1.65,y=7.39516)=32.3354

k3=f(x=1.65,y=7.73859)=33.837

k4=f(x=1.7,y=9.50552)=43.6304

{x[7],y[7]}={1.7,9.47919}

8. Dongu

k1=f(x=1.7,y=9.47919)=43.5095

k2=f(x=1.75,y=11.6547)=56.0881

k3=f(x=1.75,y=12.2836)=59.1148

k4=f(x=1.8,y=15.3907)=77.569

{x[8],y[8]}={1.8,15.3373}

9. Dongu

k1=f(x=1.8,y=15.3373)=77.2998

k2=f(x=1.85,y=19.2022)=101.244

```
k3=f(x=1.85,y=20.3994)=107.556

k4=f(x=1.9,y=26.0929)=143.772

{x[9],y[9]}={1.9,25.9818}

10. Dongu

k1=f(x=1.9,y=25.9818)=143.16

k2=f(x=1.95,y=33.1398)=190.636

k3=f(x=1.95,y=35.5136)=204.292

k4=f(x=2.,y=46.411)=278.466

{x[10],y[10]}={2.,46.1731}
```

Out[ ]= {{1., 1.}, {1.1, 1.24027}, {1.2, 1.58829},
{1.3, 2.10429}, {1.4, 2.89009}, {1.5, 4.12302}, {1.6, 6.12182},
{1.7, 9.47919}, {1.8, 15.3373}, {1.9, 25.9818}, {2., 46.1731}}

In[ ]:=
```
cozA = DSolve[{D[y[x], x] == x^2 y[x] + x y[x], y[1] == 1}, y[x], x][[1, 1, 2]]
```

Out[ ]= $e^{-\frac{5}{6}+\frac{x^2}{2}+\frac{x^3}{3}}$

In[ ]:=
```
cozA /. x → 2.
```

Out[ ]= 46.2163

In[ ]:=
```
Exit[]
```

In[ ]:=
```
(* Runge-Kutta dif denk sistemi icin *)
```

In[ ]:=
```
f = {y2 - y1, -6 x + 1 + 6 y1 - y2, y2 y3}
```

Out[ ]= {-y1 + y2, 1 - 6 x + 6 y1 - y2, y2 y3}

In[ ]:=
```
EulerSys[3, 1, 3, {1, 3, 2}, 5]
```

```
1. Dongu
x[0]=1    y[0]={1, 3, 2}
k1=f[1,{1, 3, 2}]={2, -2, 6}
{x[1],y[1]}={1.4`,{1.8, 2.2, 4.4}}
2. Dongu
x[1]=1.4`    y[1]={1.8, 2.2, 4.4}
k1=f[1.4,{1.8, 2.2, 4.4}]={0.4, 1.2, 9.68}
{x[2],y[2]}={1.8`,{1.96, 2.68, 8.272}}
3. Dongu
x[2]=1.8`    y[2]={1.96, 2.68, 8.272}
k1=f[1.8,{1.96, 2.68, 8.272}]={0.72, -0.72, 22.169}
{x[3],y[3]}={2.2`,{2.248, 2.392, 17.1396}}
4. Dongu
x[3]=2.2`    y[3]={2.248, 2.392, 17.1396}
k1=f[2.2,{2.248, 2.392, 17.1396}]={0.144, -1.104, 40.9979}
{x[4],y[4]}={2.6`,{2.3056, 1.9504, 33.5387}}
5. Dongu
x[4]=2.6`    y[4]={2.3056, 1.9504, 33.5387}
k1=f[2.6,{2.3056, 1.9504, 33.5387}]={-0.3552, -2.7168, 65.414}
{x[5],y[5]}={3.`,{2.16352, 0.86368, 59.7043}}
```

Out[ ]= {{1, {1, 3, 2}}, {1.4, {1.8, 2.2, 4.4}},
{1.8, {1.96, 2.68, 8.272}}, {2.2, {2.248, 2.392, 17.1396}},
{2.6, {2.3056, 1.9504, 33.5387}}, {3., {2.16352, 0.86368, 59.7043}}}

In[ ]:= **Runge2ESys[3, 1, 3, {1, 3, 2}, 5]**

```
1. Dongu
x[0]=1   y[0]={1, 3, 2}
k1=f[1,{1, 3, 2}]={2, -2, 6}
k2=f[1.26667,{1.53333, 2.46667, 3.6}]={0.933333, 0.133333, 8.88}
{x[1],y[1]}={1.4`,{1.48, 2.84, 5.264}}
2. Dongu
x[1]=1.4`   y[1]={1.48, 2.84, 5.264}
k1=f[1.4,{1.48, 2.84, 5.264}]={1.36, -1.36, 14.9498}
k2=f[1.66667,{1.84267, 2.47733, 9.2506}]={0.634667, -0.421333, 22.9168}
{x[2],y[2]}={1.8`,{1.8064, 2.5776, 13.634}}
3. Dongu
x[2]=1.8`   y[2]={1.8064, 2.5776, 13.634}
k1=f[1.8,{1.8064, 2.5776, 13.634}]={0.7712, -1.5392, 35.1431}
k2=f[2.06667,{2.01205, 2.16715, 23.0055}]={0.155093, -1.49483, 49.8563}
{x[3],y[3]}={2.2`,{1.93005, 1.97523, 32.1052}}
4. Dongu
x[3]=2.2`   y[3]={1.93005, 1.97523, 32.1052}
k1=f[2.2,{1.93005, 1.97523, 32.1052}]={0.045184, -2.59494, 63.4153}
k2=f[2.46667,{1.9421, 1.28325, 49.016}]={-0.65885, -3.43066, 62.8996}
{x[4],y[4]}={2.6`,{1.73691, 0.686538, 57.3166}}
5. Dongu
x[4]=2.6`   y[4]={1.73691, 0.686538, 57.3166}
k1=f[2.6,{1.73691, 0.686538, 57.3166}]={-1.05037, -4.86507, 39.3501}
k2=f[2.86667,{1.45681, -0.610814, 67.81}]={-2.06763, -6.84832, -41.4193}
{x[5],y[5]}={3.`,{1.01159, -1.85446, 48.8258}}
Out[ ]= {{1, {1, 3, 2}}, {1.4, {1.48, 2.84, 5.264}},
  {1.8, {1.8064, 2.5776, 13.634}}, {2.2, {1.93005, 1.97523, 32.1052}},
  {2.6, {1.73691, 0.686538, 57.3166}}, {3., {1.01159, -1.85446, 48.8258}}}

In[ ]:= f = {y2, y3, -6 x + y1 + 6 y3 - y2}
Out[ ]= {y2, y3, -6 x + y1 - y2 + 6 y3}

In[ ]:= Runge2ESys[3, 0, 1, {3, 2, 1}, 10]
1. Dongu
x[0]=0   y[0]={3, 2, 1}
k1=f[0,{3, 2, 1}]={2, 1, 7}
k2=f[0.0666667,{3.13333, 2.06667, 1.46667}]={2.06667, 1.46667, 9.46667}
{x[1],y[1]}={0.1`,{3.205, 2.135, 1.885}}
2. Dongu
x[1]=0.1`   y[1]={3.205, 2.135, 1.885}
k1=f[0.1,{3.205, 2.135, 1.885}]={2.135, 1.885, 11.78}
```

k2=f[0.166667,{3.34733, 2.26067, 2.67033}]={2.26067, 2.67033, 16.1087}

{x[2],y[2]}={0.2`,{3.42793, 2.3824, 3.38765}}

3. Dongu

x[2]=0.2` y[2]={3.42793, 2.3824, 3.38765}

k1=f[0.2,{3.42793, 2.3824, 3.38765}]={2.3824, 3.38765, 20.1714}

k2=f[0.266667,{3.58675, 2.60824, 4.73241}]={2.60824, 4.73241, 27.773}

{x[3],y[3]}={0.30000000000000004`,{3.6831, 2.82202, 5.97491}}

4. Dongu

x[3]=0.30000000000000004` y[3]={3.6831, 2.82202, 5.97491}

k1=f[0.3,{3.6831, 2.82202, 5.97491}]={2.82202, 5.97491, 34.9105}

k2=f[0.366667,{3.87124, 3.22035, 8.30228}]={3.22035, 8.30228, 48.2646}

{x[4],y[4]}={0.4`,{3.99518, 3.59407, 10.4675}}

5. Dongu

x[4]=0.4` y[4]={3.99518, 3.59407, 10.4675}

k1=f[0.4,{3.99518, 3.59407, 10.4675}]={3.59407, 10.4675, 60.8062}

k2=f[0.466667,{4.23478, 4.2919, 14.5213}]={4.2919, 14.5213, 84.2704}

{x[5],y[5]}={0.5`,{4.40692, 4.94485, 18.308}}

6. Dongu

x[5]=0.5` y[5]={4.40692, 4.94485, 18.308}

k1=f[0.5,{4.40692, 4.94485, 18.308}]={4.94485, 18.308, 106.31}

k2=f[0.566667,{4.73658, 6.16538, 25.3953}]={6.16538, 25.3953, 147.543}

{x[6],y[6]}={0.6000000000000001`,{4.99295, 7.30719, 32.0314}}

7. Dongu

x[6]=0.6000000000000001` y[6]={4.99295, 7.30719, 32.0314}

k1=f[0.6,{4.99295, 7.30719, 32.0314}]={7.30719, 32.0314, 186.274}

k2=f[0.666667,{5.48009, 9.44262, 44.4497}]={9.44262, 44.4497, 258.736}

{x[7],y[7]}={0.7000000000000001`,{5.88383, 11.4417, 56.0934}}

8. Dongu

x[7]=0.7000000000000001` y[7]={5.88383, 11.4417, 56.0934}

k1=f[0.7,{5.88383, 11.4417, 56.0934}]={11.4417, 56.0934, 326.803}

k2=f[0.766667,{6.64661, 15.1813, 77.8803}]={15.1813, 77.8803, 454.147}

{x[8],y[8]}={0.8`,{7.30846, 18.6851, 98.3245}}

9. Dongu

x[8]=0.8` y[8]={7.30846, 18.6851, 98.3245}

k1=f[0.8,{7.30846, 18.6851, 98.3245}]={18.6851, 98.3245, 573.771}

k2=f[0.866667,{8.55413, 25.24, 136.576}]={25.24, 136.576, 797.57}

{x[9],y[9]}={0.9`,{9.66859, 31.3864, 172.487}}

10. Dongu

x[9]=0.9` y[9]={9.66859, 31.3864, 172.487}

```
k1=f[0.9,{9.66859, 31.3864, 172.487}]={31.3864, 172.487, 1007.8}

k2=f[0.966667,{11.761, 42.8855, 239.673}]={42.8855, 239.673, 1401.12}

{x[10],y[10]}={1.`,{13.6697, 53.674, 302.765}}
```

Out[ ]= {{0, {3, 2, 1}}, {0.1, {3.205, 2.135, 1.885}}, {0.2, {3.42793, 2.3824, 3.38765}},
{0.3, {3.6831, 2.82202, 5.97491}}, {0.4, {3.99518, 3.59407, 10.4675}},
{0.5, {4.40692, 4.94485, 18.308}}, {0.6, {4.99295, 7.30719, 32.0314}},
{0.7, {5.88383, 11.4417, 56.0934}}, {0.8, {7.30846, 18.6851, 98.3245}},
{0.9, {9.66859, 31.3864, 172.487}}, {1., {13.6697, 53.674, 302.765}}}

In[ ]:=
```
cozA = DSolve[{D[y1[x], x] == y2[x], D[y2[x], x] == -6 x + 1 + 6 y1[x] - y2[x],
    y1[0] == 3, y2[0] == 2}, {y1[x], y2[x]}, x][[1]]
```

Out[ ]= $\left\{y1[x] \to e^{-3x}\left(1 + 2\,e^{5x} + e^{3x}x\right),\ y2[x] \to e^{-3x}\left(-3 + e^{3x} + 4\,e^{5x}\right)\right\}$

In[ ]:=
```
cozA /. x → 1.
```

Out[ ]= {y1[1.] → 15.8279, y2[1.] → 30.4069}

In[ ]:=
```
Runge4Sys[3, 0, 1, {3, 2, 1}, 5]
```

```
x={0, 0, 0, 0, 0, 0}    y={{3, 2, 1}, {0, 0, 0}, {0, 0, 0}, {0, 0, 0}, {0, 0, 0}, {0, 0, 0}}
1. Dongu
k1=f[0,{3, 2, 1}]={2, 1, 7}
k2=f[0.1,{3.2, 2.1, 1.7}]={2.1, 1.7, 10.7}
k3=f[0.1,{3.21, 2.17, 2.07}]={2.17, 2.07, 12.86}
k4=f[0.2,{3.434, 2.414, 3.572}]={2.414, 3.572, 21.252}
{x[2],y[2]}={0.2`,{3.4318, 2.40373, 3.5124}}
2. Dongu
k1=f[0.2,{3.4318, 2.40373, 3.5124}]={2.40373, 3.5124, 20.9025}
k2=f[0.3,{3.67217, 2.75497, 5.60265}]={2.75497, 5.60265, 32.7331}
k3=f[0.3,{3.7073, 2.964, 6.78571}]={2.964, 6.78571, 39.6575}
k4=f[0.4,{4.0246, 3.76087, 11.4439}]={3.76087, 11.4439, 66.5272}
{x[3],y[3]}={0.4`,{4.01855, 3.72817, 11.2528}}
3. Dongu
k1=f[0.4,{4.01855, 3.72817, 11.2528}]={3.72817, 11.2528, 65.407}
k2=f[0.5,{4.39137, 4.85344, 17.7935}]={4.85344, 17.7935, 103.299}
k3=f[0.5,{4.5039, 5.50751, 21.5826}]={5.50751, 21.5826, 125.492}
k4=f[0.6,{5.12005, 8.04469, 36.3512}]={8.04469, 36.3512, 211.583}
{x[4],y[4]}={0.6000000000000001`,{5.10171, 7.94004, 35.7385}}
4. Dongu
k1=f[0.6,{5.10171, 7.94004, 35.7385}]={7.94004, 35.7385, 207.992}
k2=f[0.7,{5.89571, 11.5139, 56.5377}]={11.5139, 56.5377, 329.408}
k3=f[0.7,{6.2531, 13.5938, 68.6793}]={13.5938, 68.6793, 400.535}
k4=f[0.8,{7.82047, 21.6759, 115.845}]={21.6759, 115.845, 676.417}
{x[5],y[5]}={0.8`,{7.76276, 21.3406, 113.882}}
5. Dongu
k1=f[0.8,{7.76276, 21.3406, 113.882}]={21.3406, 113.882, 664.912}
k2=f[0.9,{9.89682, 32.7288, 180.373}]={32.7288, 180.373, 1054.01}
k3=f[0.9,{11.0356, 39.3779, 219.282}]={39.3779, 219.282, 1281.95}
k4=f[1.,{15.6383, 65.1971, 370.272}]={65.1971, 370.272, 2166.07}
{x[6],y[6]}={1.`,{15.4545, 64.1228, 363.978}}
```

Out[]= {{0, {3, 2, 1}}, {0.2, {3.4318, 2.40373, 3.5124}},
{0.4, {4.01855, 3.72817, 11.2528}}, {0.6, {5.10171, 7.94004, 35.7385}},
{0.8, {7.76276, 21.3406, 113.882}}, {1., {15.4545, 64.1228, 363.978}}}

```
In[]:= cozA = DSolve[{D[y1[x], x] == y2[x], D[y2[x], x] == -6 x + 1 + 6 y1[x] - y2[x],
    y1[0] == 3, y2[0] == 2}, {y1[x], y2[x]}, x][[1]]
```

Out[]= $\left\{y1[x] \to e^{-3x}\left(1 + 2\,e^{5x} + e^{3x}x\right),\ y2[x] \to e^{-3x}\left(-3 + e^{3x} + 4\,e^{5x}\right)\right\}$

```
In[]:= cozA /. x → 1.
```

Out[]= {y1[1.] → 15.8279, y2[1.] → 30.4069}

In[•]:=
```
f = {y1 - y2, -x + 3 y1 - 2 y2}
```

Out[•]=
$$\{y1 - y2,\ -x + 3\,y1 - 2\,y2\}$$

In[•]:=
```
cozA = DSolve[{D[y1[x], x] == y1[x] - y2[x],
    D[y2[x], x] == -x + 3 y1[x] - 2 y2[x], y1[0] == 3, y2[0] == 2}, {y1[x], y2[x]}, x][[1]]
```

Out[•]=
$$\left\{y1[x] \to \frac{1}{3} e^{-x/2}\left(12 \cos\left[\frac{\sqrt{3}\,x}{2}\right] - 3\,e^{x/2}\cos\left[\frac{\sqrt{3}\,x}{2}\right]^2 + 3\,e^{x/2}\,x\cos\left[\frac{\sqrt{3}\,x}{2}\right]^2 + 4\sqrt{3}\,\sin\left[\frac{\sqrt{3}\,x}{2}\right] - 3\,e^{x/2}\sin\left[\frac{\sqrt{3}\,x}{2}\right]^2 + 3\,e^{x/2}\,x\sin\left[\frac{\sqrt{3}\,x}{2}\right]^2\right),\right.$$
$$\left. y2[x] \to e^{-x/2}\left(4\cos\left[\frac{\sqrt{3}\,x}{2}\right] - 2\,e^{x/2}\cos\left[\frac{\sqrt{3}\,x}{2}\right]^2 + e^{x/2}\,x\cos\left[\frac{\sqrt{3}\,x}{2}\right]^2 + 4\sqrt{3}\,\sin\left[\frac{\sqrt{3}\,x}{2}\right] - 2\,e^{x/2}\sin\left[\frac{\sqrt{3}\,x}{2}\right]^2 + e^{x/2}\,x\sin\left[\frac{\sqrt{3}\,x}{2}\right]^2\right)\right\}$$

In[•]:=
```
Runge4Sys[2, 0, 1, {3, 2}, 5]
```

```
x={0, 0, 0, 0, 0, 0}    y={{3, 2}, {0, 0}, {0, 0}, {0, 0}, {0, 0}, {0, 0}}
1. Dongu
k1=f[0,{3, 2}]={1, 5}
k2=f[0.1,{3.1, 2.5}]={0.6, 4.2}
k3=f[0.1,{3.06, 2.42}]={0.64, 4.24}
k4=f[0.2,{3.128, 2.848}]={0.28, 3.488}
{x[2],y[2]}={0.2`,{3.12533, 2.8456}}
2. Dongu
k1=f[0.2,{3.12533, 2.8456}]={0.279733, 3.4848}
k2=f[0.3,{3.15331, 3.19408}]={-0.0407733, 2.77176}
k3=f[0.3,{3.12126, 3.12278}]={-0.00152, 2.81822}
k4=f[0.4,{3.12503, 3.40924}]={-0.284214, 2.1566}
{x[3],y[3]}={0.4`,{3.12236, 3.40631}}
3. Dongu
k1=f[0.4,{3.12236, 3.40631}]={-0.283947, 2.15447}
k2=f[0.5,{3.09397, 3.62176}]={-0.527789, 1.53839}
k3=f[0.5,{3.06959, 3.56015}]={-0.490565, 1.58845}
k4=f[0.6,{3.02425, 3.724}]={-0.699751, 1.02475}
{x[4],y[4]}={0.6000000000000001`,{3.02168, 3.72074}}
4. Dongu
k1=f[0.6,{3.02168, 3.72074}]={-0.699058, 1.02357}
k2=f[0.7,{2.95178, 3.8231}]={-0.871321, 0.509137}
k3=f[0.7,{2.93455, 3.77166}]={-0.837104, 0.560345}
k4=f[0.8,{2.85426, 3.83281}]={-0.978548, 0.0971681}
{x[5],y[5]}={0.8`,{2.85187, 3.8294}}
5. Dongu
k1=f[0.8,{2.85187, 3.8294}]={-0.97753, 0.0968095}
k2=f[0.9,{2.75412, 3.83908}]={-1.08496, -0.315811}
k3=f[0.9,{2.74337, 3.79782}]={-1.05445, -0.265517}
k4=f[1.,{2.64098, 3.7763}]={-1.13532, -0.629651}
{x[6],y[6]}={1.`,{2.63881, 3.77288}}
```

Out[ ]= {{0, {3, 2}}, {0.2, {3.12533, 2.8456}}, {0.4, {3.12236, 3.40631}},
{0.6, {3.02168, 3.72074}}, {0.8, {2.85187, 3.8294}}, {1., {2.63881, 3.77288}}}

In[ ]:= **cozA /. x → 1.**

Out[ ]= {y1[1.] → 2.6388, y2[1.] → 3.77283}

In[ ]:= **Exit[]**

In[5]:=
```
coz = DSolve[{y'[x] == x^2 / y[x], y[4] == 8}, y[x], x][[1, 1, 2]]
```

DSolve: For some branches of the general solution, the given boundary conditions lead to an empty solution.

Out[5]=
$$\sqrt{\frac{2}{3}}\ \sqrt{32 + x^3}$$

In[6]:=
```
f[x_, y_] := x^2 / y
```

In[7]:=
```
EulerRK1[4., 2., 8., 10]
```

```
1. Dongu
k1=f[4.,8.]=2.
{x[1],y[1]}={3.8,7.6}
2. Dongu
k1=f[3.8,7.6]=1.9
{x[2],y[2]}={3.6,7.22}
3. Dongu
k1=f[3.6,7.22]=1.79501
{x[3],y[3]}={3.4,6.861}
4. Dongu
k1=f[3.4,6.861]=1.68489
{x[4],y[4]}={3.2,6.52402}
5. Dongu
k1=f[3.2,6.52402]=1.56958
{x[5],y[5]}={3.,6.2101}
6. Dongu
k1=f[3.,6.2101]=1.44925
{x[6],y[6]}={2.8,5.92025}
7. Dongu
k1=f[2.8,5.92025]=1.32427
{x[7],y[7]}={2.6,5.6554}
8. Dongu
k1=f[2.6,5.6554]=1.19532
{x[8],y[8]}={2.4,5.41634}
9. Dongu
k1=f[2.4,5.41634]=1.06345
{x[9],y[9]}={2.2,5.20365}
10. Dongu
k1=f[2.2,5.20365]=0.930117
{x[10],y[10]}={2.,5.01762}
```

Out[7]=
```
{{4., 8.}, {3.8, 7.6}, {3.6, 7.22}, {3.4, 6.861}, {3.2, 6.52402}, {3., 6.2101},
 {2.8, 5.92025}, {2.6, 5.6554}, {2.4, 5.41634}, {2.2, 5.20365}, {2., 5.01762}}
```

In[8]:=
```
coz /. x → 2.
```

Out[8]=
```
5.16398
```

In[9]:=
```
EulerRK1[4., 10., 8., 30]
```

```
1. Dongu
k1=f[4.,8.]=2.
{x[1],y[1]}={4.2,8.4}
2. Dongu
k1=f[4.2,8.4]=2.1
{x[2],y[2]}={4.4,8.82}
3. Dongu
k1=f[4.4,8.82]=2.19501
{x[3],y[3]}={4.6,9.259}
4. Dongu
k1=f[4.6,9.259]=2.28534
{x[4],y[4]}={4.8,9.71607}
5. Dongu
k1=f[4.8,9.71607]=2.37133
{x[5],y[5]}={5.,10.1903}
6. Dongu
k1=f[5.,10.1903]=2.4533
{x[6],y[6]}={5.2,10.681}
7. Dongu
k1=f[5.2,10.681]=2.5316
{x[7],y[7]}={5.4,11.1873}
8. Dongu
k1=f[5.4,11.1873]=2.60652
{x[8],y[8]}={5.6,11.7086}
9. Dongu
k1=f[5.6,11.7086]=2.67837
{x[9],y[9]}={5.8,12.2443}
10. Dongu
k1=f[5.8,12.2443]=2.7474
{x[10],y[10]}={6.,12.7938}
11. Dongu
k1=f[6.,12.7938]=2.81387
{x[11],y[11]}={6.2,13.3565}
12. Dongu
k1=f[6.2,13.3565]=2.87799
```

{x[12],y[12]}={6.4,13.9321}

13. Dongu

k1=f[6.4,13.9321]=2.93996

{x[13],y[13]}={6.6,14.5201}

14. Dongu

k1=f[6.6,14.5201]=2.99997

{x[14],y[14]}={6.8,15.1201}

15. Dongu

k1=f[6.8,15.1201]=3.05817

{x[15],y[15]}={7.,15.7318}

16. Dongu

k1=f[7.,15.7318]=3.11472

{x[16],y[16]}={7.2,16.3547}

17. Dongu

k1=f[7.2,16.3547]=3.16973

{x[17],y[17]}={7.4,16.9887}

18. Dongu

k1=f[7.4,16.9887]=3.22333

{x[18],y[18]}={7.6,17.6333}

19. Dongu

k1=f[7.6,17.6333]=3.27562

{x[19],y[19]}={7.8,18.2884}

20. Dongu

k1=f[7.8,18.2884]=3.32669

{x[20],y[20]}={8.,18.9538}

21. Dongu

k1=f[8.,18.9538]=3.37663

{x[21],y[21]}={8.2,19.6291}

22. Dongu

k1=f[8.2,19.6291]=3.42552

{x[22],y[22]}={8.4,20.3142}

23. Dongu

k1=f[8.4,20.3142]=3.47343

{x[23],y[23]}={8.6,21.0089}

24. Dongu

k1=f[8.6,21.0089]=3.52041

{x[24],y[24]}={8.8,21.713}

25. Dongu

k1=f[8.8,21.713]=3.56653

```
{x[25],y[25]}={9.,22.4263}
26. Dongu
k1=f[9.,22.4263]=3.61183
{x[26],y[26]}={9.2,23.1487}
27. Dongu
k1=f[9.2,23.1487]=3.65637
{x[27],y[27]}={9.4,23.8799}
28. Dongu
k1=f[9.4,23.8799]=3.70018
{x[28],y[28]}={9.6,24.62}
29. Dongu
k1=f[9.6,24.62]=3.7433
{x[29],y[29]}={9.8,25.3686}
30. Dongu
k1=f[9.8,25.3686]=3.78578
{x[30],y[30]}={10.,26.1258}
```

Out[9]= {{4., 8.}, {4.2, 8.4}, {4.4, 8.82}, {4.6, 9.259}, {4.8, 9.71607}, {5., 10.1903}, {5.2, 10.681}, {5.4, 11.1873}, {5.6, 11.7086}, {5.8, 12.2443}, {6., 12.7938}, {6.2, 13.3565}, {6.4, 13.9321}, {6.6, 14.5201}, {6.8, 15.1201}, {7., 15.7318}, {7.2, 16.3547}, {7.4, 16.9887}, {7.6, 17.6333}, {7.8, 18.2884}, {8., 18.9538}, {8.2, 19.6291}, {8.4, 20.3142}, {8.6, 21.0089}, {8.8, 21.713}, {9., 22.4263}, {9.2, 23.1487}, {9.4, 23.8799}, {9.6, 24.62}, {9.8, 25.3686}, {10., 26.1258}}

In[10]:= **coz /. x → 10.**

Out[10]= 26.2298