

Practical-01 (19-07-2022, Tuesday)

Solution of ODE

Method-I

In[1]= **"Solution of ordinary differential equations"**

DSolve[y''[x] - 4 y[x] == 0, y[x], x]

Out[1]= Solution of ordinary differential equations

Out[2]= $\left\{ \left\{ y[x] \rightarrow e^{2x} C[1] + e^{-2x} C[2] \right\} \right\}$

Method-II

Solution of ordinary differential equations

In[3]= **DSolve[y''[x] - 4 y[x] == 0, y[x], x]**

Out[3]= $\left\{ \left\{ y[x] \rightarrow e^{2x} C[1] + e^{-2x} C[2] \right\} \right\}$

In[4]= **DSolve[2 x y[x] y'[x] - 4 x^2 - 3 y[x]^2 == 0, y[x], x]**

Out[4]= $\left\{ \left\{ y[x] \rightarrow -x \sqrt{-4 + x C[1]} \right\}, \left\{ y[x] \rightarrow x \sqrt{-4 + x C[1]} \right\} \right\}$

System of differential equations

In[5]= **DSolve[{x''[t] - 4 x[t] == 0, y''[t] - 5 y'[t] + 10 == 0, z'[t] == 0}, {x[t], y[t], z[t]}, t]**

Out[5]= $\left\{ \left\{ x[t] \rightarrow e^{2t} C[1] + e^{-2t} C[2], \right. \right.$
 $\left. \left. y[t] \rightarrow 2t + \frac{1}{5} e^{5t} C[3] + C[4], z[t] \rightarrow C[5] \right\} \right\}$

Graph plotting of solutions

In[6]= **soln = DSolve[y'[x] - 2 y[x] + b == 0, y[x], x]**

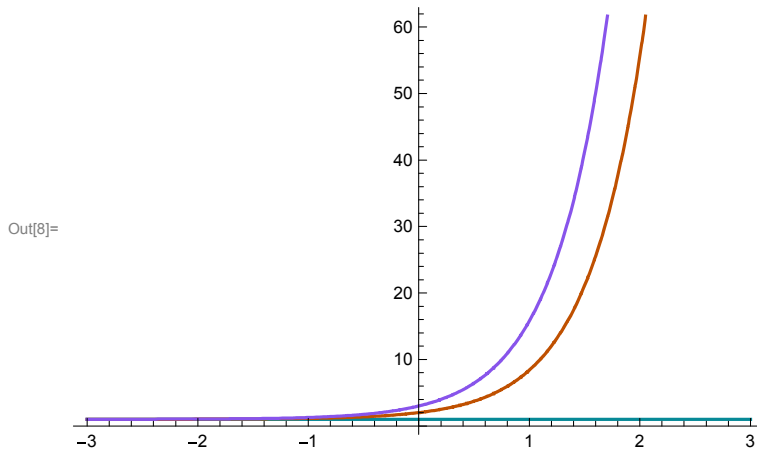
Out[6]= $\left\{ \left\{ y[x] \rightarrow \frac{b}{2} + e^{2x} C[1] \right\} \right\}$

```
In[7]:= eval1 = Evaluate [y[x] /. soln /. {b → 2} /.
      {{C[1] → 0}, {C[1] → 1}, {C[1] → 2}}]
```

```
Out[7]= {{1}, {1 + e2x}, {1 + 2 e2x}}
```

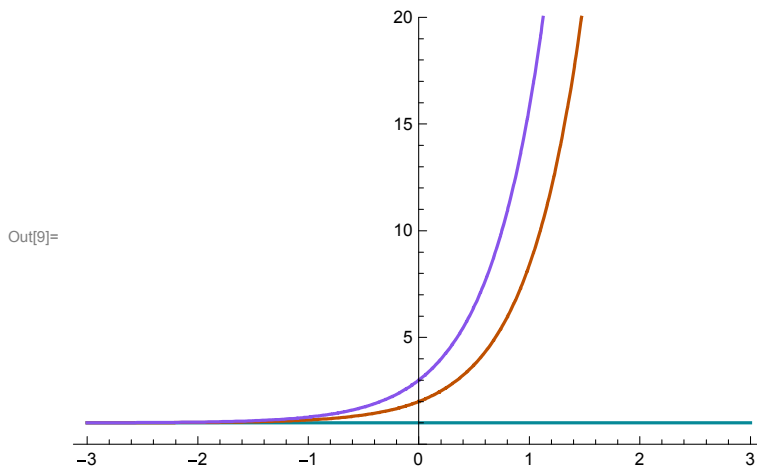
Plot-1

```
In[8]:= Plot [eval1, {x, -3, 3}]
```



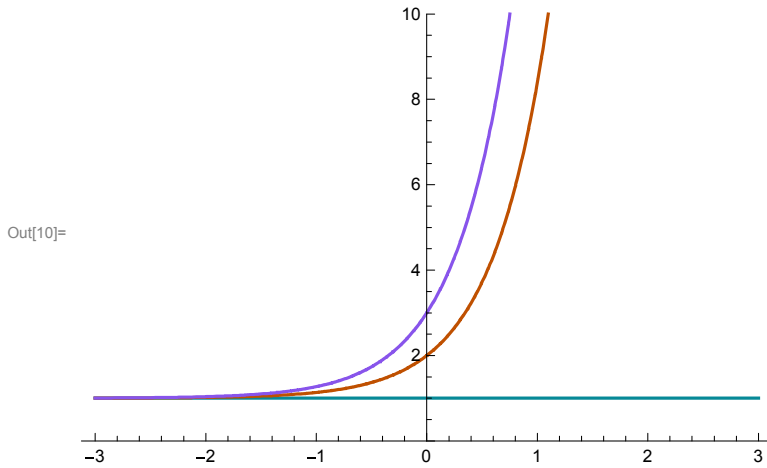
Plot-2

```
In[9]:= Plot [eval1, {x, -3, 3}, PlotRange → {0, 20}]
```



Plot-3

In[10]:= **Plot[eval1, {x, -3, 3}, PlotRange → {0, 10}]**



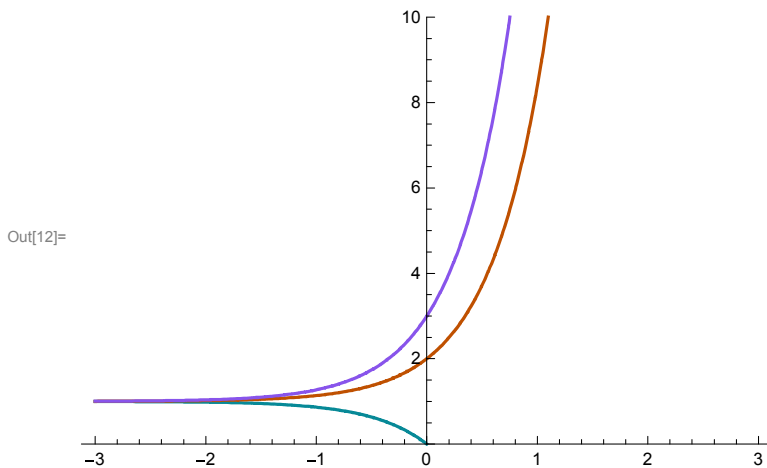
With another set of constant values

In[11]:= **eval2 = Evaluate [y[x] /. soln /. {b → 2} /.
 {{C[1] → -1}, {C[1] → 1}, {C[1] → 2}}]**

Out[11]= **{{1 - e^{2x}}, {1 + e^{2x}}, {1 + 2 e^{2x}}}**

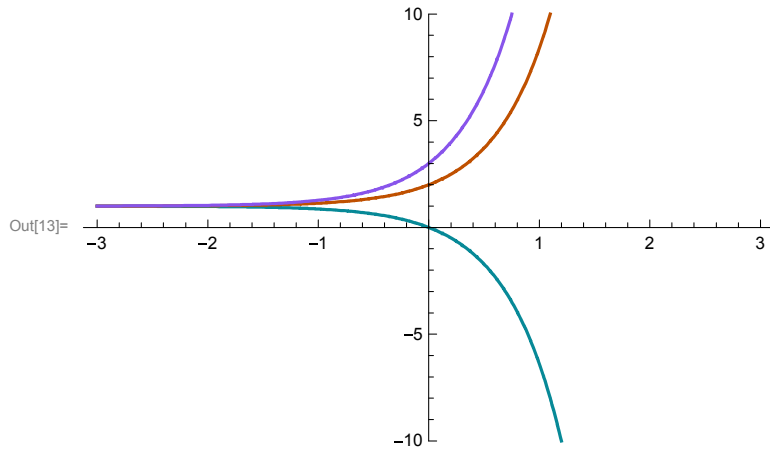
Plot-1

In[12]:= **Plot[eval2, {x, -3, 3}, PlotRange → {0, 10}]**



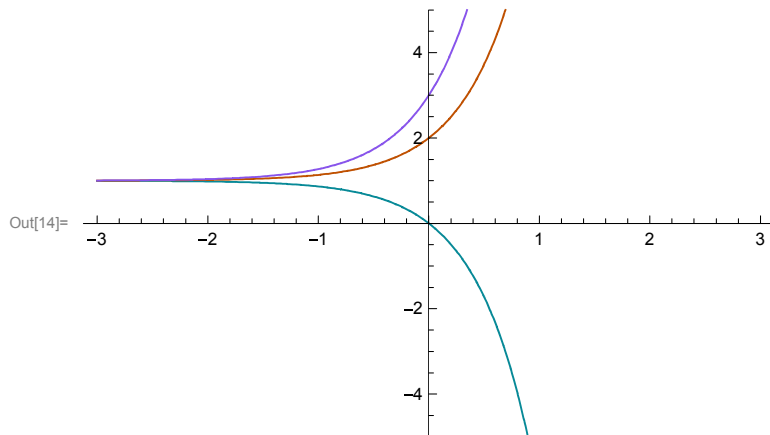
Plot-2

```
In[13]:= Plot[eval2, {x, -3, 3}, PlotRange → {-10, 10}]
```



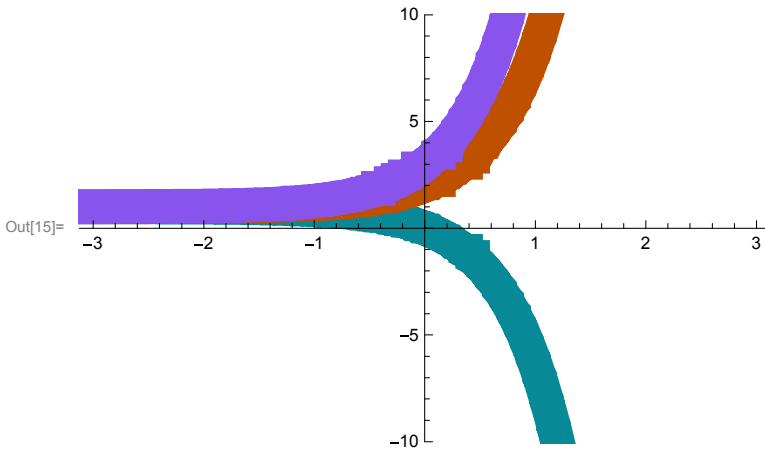
Plot-3

```
In[14]:= Plot[eval2, {x, -3, 3}, PlotRange → {-5, 5},  
PlotStyle → Thickness[0.003]]
```



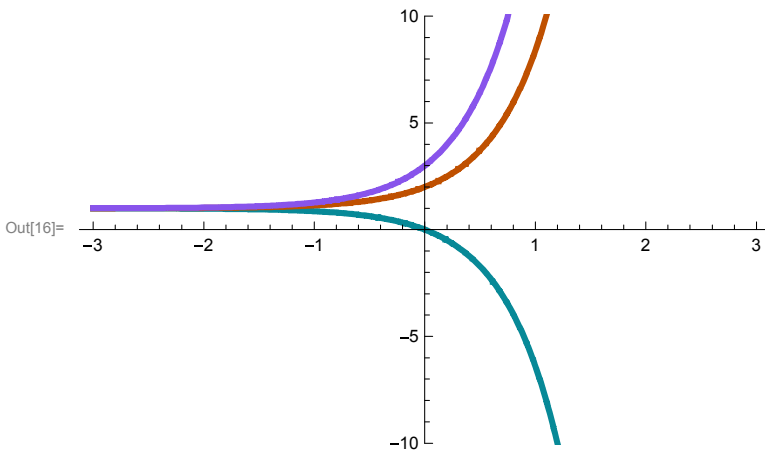
Plot-4

```
In[15]= Plot[eval2, {x, -3, 3}, PlotRange → {-10, 10},  
PlotStyle → Thickness[0.05]]
```



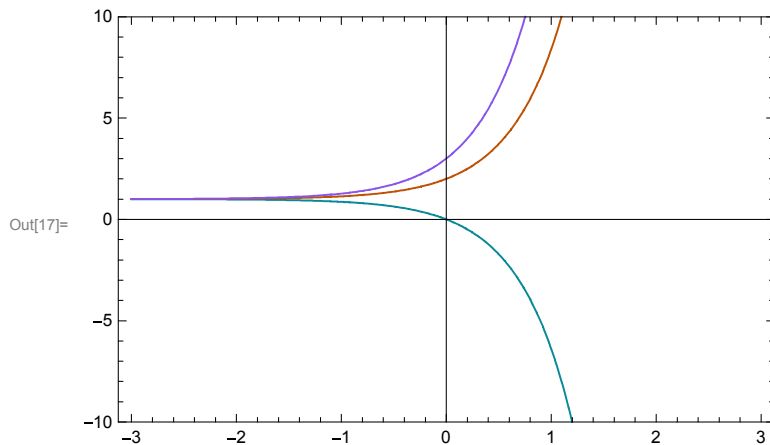
Plot-5

```
In[16]= Plot[eval2, {x, -3, 3}, PlotRange → {-10, 10},  
PlotStyle → Thickness[0.009]]
```



Plot-6

```
In[17]:= Plot[eval2, {x, -3, 3}, PlotRange → {-10, 10},  
PlotStyle → Thickness[0.003], Frame → True]
```



Plot-7

```
In[18]:= Plot[eval2, {x, -3, 3}, PlotRange → {-10, 10},  
PlotStyle → Thickness[0.007],  
Frame → True, FrameTicks → All]
```

