***Solution Section* 2.5 − Variation of Parameters**

***Exercise***

 is a fundamental set of solutions of .

Find a particular solution of the equation?

***Solution***



 





 





The particular solution:







The general solution:







***Exercise***

Find a particular solution to: 

***Solution***

The homogeneous equation for the differential equation 

 ***Solve for λ***



Therefore; 



|  |  |
| --- | --- |
|  |  |









***Exercise***

Find a particular solution to: 

***Solution***

The homogeneous equation for the differential equation 

 ***Solve for λ***



Therefore; 



































***Exercise***

Find a particular solution to: 

***Solution***

The homogeneous equation for the differential equation: 

 ***Solve for λ***



Therefore; 







|  |  |
| --- | --- |
|  |  |







***Exercise***

Find a particular solution to: 

***Solution***

The homogeneous equation for the differential equation:   




































***Exercise***

Find a particular solution to the given second-order differential equation 

***Solution***







 











 











***Exercise***

Find a particular solution to the given second-order differential equation 

***Solution***







 





 





 



***Exercise***

Find a particular solution to the given second-order differential equation 

***Solution***







 





 







 

***Exercise***

Find a particular solution to the given second-order differential equation 

***Solution***







 





 





 





***Exercise***

Verify that  and are solution to the homogenous equation



***Solution***

The homogeneous equation for the differential equation: 

For 







 is a solution

For 







 is a solution

*Wronskian*: 













Thus, the general solution is: 

***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 

*The homogeneous Eqn*.: 



 



 



 

The ***general*** solution: 

***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 





 







 





 





The ***general*** solution: 

***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 



|  |  |  |
| --- | --- | --- |
|  |  |  |
| **+** |  |  |
| **−** | 1 |  |



 

|  |  |  |
| --- | --- | --- |
|  |  |  |
| **+** |  |  |
| **−** | 1 |  |



 



 



The ***general*** solution: 

***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 





 









 







 











The ***general*** solution: 



***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 

*The homogeneous Eqn*.: 



 





 





 









The ***general*** solution: 

***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 





 



 



 



The ***general*** solution:



***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 





 





 



 

The ***general*** solution:



***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 





 









 





 



The ***general*** solution:



***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 





 





 





 



The ***general*** solution:



***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 





 





 





 

The ***general*** solution:



***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 









 





 









 







The ***general*** solution:



***Exercise***

Find the general solution to the given differential equation. 

***Solution***

*Characteristic Eqn*.: 





 





 







 



The ***general*** solution:



***Exercise***

Find the general solution to the given differential equation. 

***Solution***

*Characteristic Eqn*.: 





 







 





 



The ***general*** solution:



***Exercise***

Find the general solution to the given differential equation. 

***Solution***

*Characteristic Eqn*.: 





 







 





 



The ***general*** solution:



***Exercise***

Find the general solution to the given differential equation. 

***Solution***

*Characteristic Eqn*.: 





 





 





 

The ***general*** solution:





***Exercise***

Find the general solution to the given differential equation. 

***Solution***

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| **+** |  |  |
| **−** | 1 |  |

*Characteristic Eqn*.: 





 

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| **+** |  |  |
| **−** |  |  |
| **+** |  |  |









 





 



The ***general*** solution:



***Exercise***

Find the general solution to the given differential equation. 

***Solution***

*Characteristic Eqn*.: 





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| --- | --- | --- |
|  |  |  |
| **+** |  |  |
| **−** | 1 |  |

 





 





 







***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 





 





 





 







***Exercise***

Find the general solution to the given differential equation. 

***Solution***

*Characteristic Eqn*.: 





 

 

 

 



 





The ***general*** solution: 

***Exercise***

Find the general solution to the given differential equation. 

***Solution***

*Characteristic Eqn*.: 









 







 





 

The ***general*** solution:



***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 

The *homogeneous Eqn*.: 



 





 





 

The ***general*** solution:



***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 

The *homogeneous Eqn*.: 







 





 





 









***Exercise***

Find the general solution to the given differential equation. 

***Solution***

*Characteristic Eqn*.: 

*The homogeneous Eqn*.: 



 









 







 





The ***general*** solution:



***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 

The *homogeneous Eqn*.: 



 





 





The *particular* solution:  

The ***general*** solution:



***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 









 











 







 



The ***general*** solution:



***Exercise***

Find the general solution to the given differential equation. 

***Solution***

*Characteristic Eqn*.: 

The *homogeneous Eqn*.: 



 







 







 







***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 









 





 





 



***Exercise***

Find the general solution to the given differential equation. 

***Solution***

*Characteristic Eqn*.: 

The *homogeneous Eqn*.: 







 



 



 



 

 











***Exercise***

Find the general solution to the given differential equation. 

***Solution***

*Characteristic Eqn*.: 

The *homogeneous Eqn*.: 







 







 













 



***Exercise***

Find the general solution to the given differential equation. 

***Solution***











 



 





 



***Exercise***

Find the general solution to the given differential equation. 

***Solution***











 





 





 



***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 









 





 





 











The ***general*** solution:



***Exercise***

Find the general solution to the given differential equation. 

***Solution***











 





 





 



***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 

*The homogeneous Eqn*.: 







 



 











***Exercise***

Find the general solution to the given differential equation. 

***Solution***











 

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| **+** |  |  |
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| **+** |  |  |



 











 







***Exercise***

Find the general solution to the given differential equation. 

***Solution***











 





 







 







***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 

*The homogeneous Eqn*.: 







 



 







 



***Exercise***

Find the general solution to the given differential equation. 

***Solution***

*Characteristic Eqn*.: 

The *homogeneous Eqn*.: 







 









 





 



The ***general*** solution:



***Exercise***

Find the general solution to the given differential equation. 

***Solution***

*Characteristic Eqn*.: 

The *homogeneous Eqn*.: 







 





 





 



***Exercise***

Find the general solution to the given differential equation. 

***Solution***

*Characteristic Eqn*.: 

The *homogeneous Eqn*.: 







 





 





 

The ***general*** solution:



***Exercise***

Find the general solution to the given differential equation. 

***Solution***











 





 





 

The ***general*** solution:



***Exercise***

Find the general solution to the given differential equation. 

***Solution***

*Characteristic Eqn*.: 

The *homogeneous Eqn*.: 









 





 





 



***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 









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| **+** |  |  |

 







 







***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 









 







 



 









 





***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 











 

 

 

 



***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 























 









 







 







 



***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 

 















 





 





 





 





 



***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 





 

The roots are: 





























 

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***Exercise***

Find the general solution by to ***variation of parameters*** with the give n initial conditions.



***Solution***







 





 





 











***Exercise***

Find the general solution by to ***variation of parameters*** with the give n initial conditions.



***Solution***







 







 





 

















***Exercise***

Find the general solution by to ***variation of parameters*** with the give n initial conditions.



***Solution***





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| **+** |  |  |
| **−** |  |  |



 

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| **+** |  |  |
| **−** |  |  |
| **+** |  |  |









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| **+** |  |  |
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| **+** |  |  |
| **−** |  |  |
| **+** |  |  |











 













 



***Exercise***

Find the general solution by to ***variation of parameters*** with the give n initial conditions.



***Solution***











 





 





 















***Exercise***

Find the general solution by to ***variation of parameters*** with the given initial conditions.



***Solution***











 





 





 

















***Exercise***

Find the general solution by to ***variation of parameters*** with the given initial conditions.



***Solution***











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| **+** |  |  |
| **−** |  |  |
| **+** |  |  |

 















 







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| **+** |  |  |
| **−** |  |  |
| **+** |  |  |



























***Exercise***

Find the general solution by to ***variation of parameters*** with the give n initial conditions.



***Solution***











 





 





 























***Exercise***

Find the general solution by to ***variation of parameters*** with the give n initial conditions.



***Solution***











 





 





 





















***Exercise***

Find the general solution by to ***variation of parameters*** with the give n initial conditions.



***Solution***











 





 





 















***Exercise***

Find the general solution by to ***variation of parameters*** with the given initial conditions.



***Solution***





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| **+** |  |  |
| **−** |  |  |









 





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|  |  |  |
| **+** |  |  |
| **−** |  |  |

 





 



















***Exercise***

Find the general solution by to ***variation of parameters*** with the given initial conditions.



***Solution***













 





 





 



















***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 



The roots are: 



















 





 



 











