***Solution Section* 2.4 - Nonhomogeneous Equations; the Method of Undetermined Coefficients**

***Exercise***

Show that the 3 solutions  of the 3rd order equation

 are linearly independent on an open interval . Then find a particular solution that satisfies the initial conditions 

***Solution***







 are linearly independent.







***Exercise***

Find the particular solution for 

***Solution***

 













The particular solution: 

***Exercise***

Find the particular solution for 

***Solution***















Therefore, the particular solution is: 

***Exercise***

Find the particular solution for 

***Solution***















The particular solution: 

***Exercise***

Find the particular solution for the given differential equation 

***Solution***

















The particular solution: 

***Exercise***

Use  to find the particular solution for 

***Solution***

The particular solution: 













 

The particular solution: 

***Exercise***

Use  to find the particular solution for 

***Solution***

The particular solution: 















The particular solution: 

***Exercise***

Find the particular solution for 

***Solution***

The particular solution: 











 

The particular solution: 

***Exercise***

Find the particular solution for 

***Solution***

The particular solution: 









 

The particular solution: 

***Exercise***

Find the particular solution for 

***Solution***

The particular solution: 













 

The particular solution: 

***Exercise***

Find the particular solution for 

***Solution***

 when *y* = 1

The particular solution: 

























The general solution: 

***Exercise***

Find the particular solution for 

***Solution***

The characteristic eq.: 

The particular solution: 











The homogenous solution: 

Because the inhomogeneous part of  is also the solution.

Therefore: 

















***Exercise***

Find the particular solution for 

***Solution***

The particular solution: 



















***Exercise***

Find the particular solution for 

***Solution***

*Characteristic equation*: 

*Homogeneous equation*: 

The particular solution: 



















  



***Exercise***

Use the complex method to find the particular solution for 

***Solution***

The characteristic eq.: 

The homogenous solution: 

The particular solution: 



















This gives the particular solution:







 is a solution of 

 is a solution of 

Therefore;









***Exercise***

Use the complex method to find the particular solution for 

***Solution***

The particular solution: 















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



 Since  in functions of cosine and sine





















***Exercise***

Find the general solution for the given *DE*: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution for the given *DE*: 

***Solution***

The characteristic equation: 















 







***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution for the given *DE*: 

***Solution***

The characteristic equation: 















***Exercise***

Find the general solution for the given *DE*: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution for the given *DE*: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution for the given *DE*: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 











 





***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution for the given *DE*: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution for the given *DE*: 

***Solution***

The characteristic equation: 





















***Exercise***

Find the general solution for the given *DE* 

***Solution***

The characteristic equation: 



The particular equation: 











The particular equation: 

















***Exercise***

Find the general solution for the given *DE*: 

***Solution***

The characteristic equation: 



















 







***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

























***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



























***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 





















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 























***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 













 





***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 





















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 





















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 





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***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 





















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



The particular equation: 









The particular equation: 













***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 













***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



The particular equation: 













***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 











***Exercise***

Find the general solution: 

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The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 















 





***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 























***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution 

***Solution***



















 



***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 













***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 





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***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution 

***Solution***

The characteristic equation: 



The particular equation: 









The particular equation: 















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 























***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 





















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 























***Exercise***

Find the general solution 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution 

***Solution***

The characteristic equation: 

 



















***Exercise***

Find the general solution 

***Solution***

 















 





***Exercise***

Find the general solution 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution 

***Solution***

The characteristic equation: 























***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

















***Exercise***

Find the general solution 

***Solution***

The characteristic equation: 





















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 

 























***Exercise***

Find the general solution for the given differential equation 

***Solution***

The characteristic equation: 



The particular equation: 





















***Exercise***

Find the general solution 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution 

***Solution***

The characteristic equation: 

 





















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 



The particular equation: 















***Exercise***

Find the general solution: 

***Solution***

The characteristic equation: 































***Exercise***

Find the general solution 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution 

***Solution***

The characteristic equation: 



























***Exercise***

Find the general solution 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution 

***Solution***

The characteristic equation: 



















***Exercise***

Find the general solution 

***Solution***



















































 

 







***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 

































***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 





























***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 

























***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 



The particular equation: 





















***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***































***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

































***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

































***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***































***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***



























***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The homogeneous eq.: 

The characteristic eq.: 















The particular solution is: 

The general solution: 













The general solution: 

***Exercise***

Find the solution of the given initial value problem



***Solution***

The characteristic equation: 



























***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 



























***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 































***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 

The homogenous solution: 

The particular solution: 





















This gives the particular solution:







The real part of this solution  is the particular solution of the system.

Thus, the general solution is:



The initial condition: 











The initial condition: 







The general solution: 

***Exercise***

Find the solution of the given initial value problem



***Solution***

The characteristic equation: 





























***Exercise***

Find the solution of the given initial value problem



***Solution***

The characteristic equation: 

























***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***













 

















***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 











 

















***Exercise***

Find the general solution 

***Solution***





















 





***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 

























***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 



























***Exercise***

Find the solution of the given initial value problem



***Solution***

The characteristic equation: 

























***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 

























***Exercise***

Find the general solution 

***Solution***

*Characteristic Eqn*.: 



























The ***general*** solution:



***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 



























***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic *eqn*. : 













The particular solution is: 

The general solution is: 











The general solution is: 

***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The *characteristic* eq.: 

























 **(1)**







 **(2)**

 and 



***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 

























***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***































***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***































***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***













 





















***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 



The particular equation: 















 



***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 





























***Exercise***

Find the solution of the given initial value problem



***Solution***

The characteristic equation: 

























***Exercise***

Find the solution of the given initial value problem



***Solution***

The characteristic equation: 





























***Exercise***

Find the solution of the given initial value problem



***Solution***

The characteristic equation: 



























***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 



























***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 



The particular equation: 















***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 



























***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 



























***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 



























***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 



























***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 



























***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 



























***Exercise***

Find the solution of the given initial value problem



***Solution***

The characteristic equation: 



































***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 



































***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 







































***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 































***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 









































***Exercise***

Find the general solution that satisfy the given initial conditions



***Solution***

The characteristic equation: 













































***Exercise***

If *k* and *b* are positive constants, then find the general solution of 

***Solution***

The characteristic equation: 



If 

















