The general solution of the differential equation $y'' + 9y' = 0$ is :

A. $y(t) = c_1 \cos 3t + c_2 \sin 3t$

B. $y(t) = c_1 + c_2 e^{-9t}$

C. $y(t) = c_1 \cos 4t + c_2 \sin 4t$

D. $y(t) = c_1 + c_2 e^{-16t}$

E. None

If we write $y(x) = \sum_{n=0}^{\infty} a_n (n+3)x^n$ as a series that start at $n = 2$ it will be equivalent to :

A. $\sum_{n=2}^{\infty} a_{n+2}(n+5)x^{n+2}$

B. $\sum_{n=2}^{\infty} a_{n-2}(n+1)x^{n-2}$

C. $\sum_{n=2}^{\infty} a_{n-2}(n+3)x^{n-2}$

D. $\sum_{n=2}^{\infty} a_{n+2}(n+2)x^{n+2}$

E. None

The homogeneous equation with constant coefficients that has the general solution :
$y = c_1 e^{-3x} + c_2 \cos 2x + c_3 \sin 2x + c_4$ is:

A. $y^{(4)} + 3y''' + 4y'' + 12y' = 0$

B. $y^{(4)} + y''' + 4y'' + 4y' = 0$

C. $y^{(4)} + 2y''' + 9y'' + 18y' = 0$

D. $y^{(4)} + y''' + 9y'' + 9y' = 0$

E. None

The general solution for the differential equation :
$y''' + 4y'' - 3y' - 18y = 0$, **Given that** $r = 2$ **is a root of the characteristic equation:**

A. $y = c_1e^{3x} + c_2e^{-2x} + c_3xe^{-2x}$
B. $y = c_1e^{2x} + c_2e^{-3x} + c_3xe^{-3x}$
C. $y = c_1e^{-2x} + c_2e^{3x} + c_3xe^{3x}$
D. $y = c_1e^{-3x} + c_2e^{2x} + c_3xe^{2x}$
E. None

The homogeneous equation with constant coefficients that has the general solution :
$y = c_1 e^{-x} + c_2 \cos 2x + c_3 \sin 2x + c_4$ is:

A. $y^{(4)} + y''' + 9y'' + 9y' = 0$

B. $y^{(4)} + 3y''' + 4y'' + 12y' = 0$

C. $y^{(4)} + 2y''' + 9y'' + 18y' = 0$

D. $y^{(4)} + y''' + 4y'' + 4y' = 0$

E. None

If we write $y(x) = \sum_{n=0}^{\infty} a_n(n+5)x^n$ as a series that start at $n = 2$ it will be equivalent to :

A. $\sum_{n=2}^{\infty} a_{n+2}(n+5)x^{n+2}$

B. $\sum_{n=2}^{\infty} a_{n-2}(n+1)x^{n-2}$

C. $\sum_{n=2}^{\infty} a_{n-2}(n+3)x^{n-2}$

D. $\sum_{n=2}^{\infty} a_{n+2}(n+2)x^{n+2}$

E. None

The general solution for the differential equation :
$y''' + 4y'' - 3y' - 18y = 0$, Given that $r = 2$ is a root of the characteristic equation:

A. $y = c_1e^{3x} + c_2e^{-2x} + c_3xe^{-2x}$
B. $y = c_1e^{2x} + c_2e^{-3x} + c_3xe^{-3x}$
C. $y = c_1e^{-2x} + c_2e^{3x} + c_3xe^{3x}$
D. $y = c_1e^{-3x} + c_2e^{2x} + c_3xe^{2x}$
E. None

The indicial equation of $(x+1)y'' + x(x-1)y' + y = 0$ at $x = -1$ is:

A. $r^2 + 2r = 0$

B. $r^2 + r = 0$

C. $r^2 - 2r = 0$

D. $r^2 - r = 0$

E. None

Consider the non homogenous differential equation $y'' - 4y' = 5 + 5xe^{-4x} + \cos 5x$, then a suitable form of the particular solution can be written as $Y(x) =$

A. $Ax + (Bx + C)e^{4x} + D\cos 5x + E\sin 5x$

B. $A + (Bx + C)e^{-4x} + D\cos 5x + E\sin 5x$

C. $Ax + (Bx + C)e^{-4x} + D\cos 5x + E\sin 5x$

D. $Ax + x(Bx + C)e^{-4x} + Dx\cos 5x + Ex\sin 5x$

E. None

The regular singular points of the differential equation

$(x+1)(x-3)y'' + (x-3)y' + e^x y = 0$ are $x =$

A. $-1, 3$

B. 1

C. $1, -3$

D. -3

E. None

If we write $y(x) = \sum_{n=0}^{\infty} a_n(n+3)x^n$ as a series that start at $n = 2$ it will be equivalent to :

A. $\sum_{n=2}^{\infty} a_{n+2}(n+5)x^{n+2}$

B. $\sum_{n=2}^{\infty} a_{n-2}(n+1)x^{n-2}$

C. $\sum_{n=2}^{\infty} a_{n-2}(n+3)x^{n-2}$

D. $\sum_{n=2}^{\infty} a_{n+2}(n+2)x^{n+2}$

E. None

Let $y_1 = 2\sin^2 x$ and $y_2 = 1 - \cos^2 x$ be two solutions of a second order differential equation. Choose the correct statement, where W is the Wronskian

A. $W[y_1, y_2] \neq 0$, therefore y_1 and y_2 are linearly dependent.
B. $W[y_1, y_2] = 0$, therefore y_1 and y_2 are linearly independent.
C. $W[y_1, y_2] \neq 0$, therefore y_1 and y_2 are linearly independent.
D. $W[y_1, y_2] = 0$, therefore y_1 and y_2 are linearly dependent.
E. None

The indicial equation of $(x+1)y'' + x(x-1)y' + y = 0$ at $x = -1$ is:

A. $r^2 + 2r = 0$

B. $r^2 + r = 0$

C. $r^2 - 2r = 0$

D. $r^2 - r = 0$

E. None

If $Y(x) = 5x^4$ is a particular solution for $x^2y'' + 2y' = h(x)$ then $h(x) =$

A. $80x^4$

B. $140x^4$

C. $4x^5$

D. $70x^4$

E. None

If we substitute $y(x) = \sum_{n=0}^{\infty} a_n x^n$ into the differential equation $xy'' + 2y = 0$, we get for $n \geq 1$

A. $(n)(n+1)a_{n+1} - 2a_n = 0$

B. $(n)(n-1)a_{n+2} - 2a_n = 0$

C. $(n)(n+1)a_{n+1} + 2a_n = 0$

D. $(n)(n-1)a_{n+2} + 2a_n = 0$

E. None