1. The form of a particular solution of \( y'' + 4y = 3 \sec 2x \) is

(a) \( z = A \sec 2x \)
(b) \( z = A \sec 2x + B \cos 2x \)
(c) \( z = A \sec 2x + B \tan 2x \)
(d) \( z = A \sec 2x + B \sec^{-1} 2x \)
(e) None of the above.

2. A particular solution of \( y'' + 9y = 3 \tan 3x \) is

(a) \( z = \frac{1}{3} \cos 3x \ln |\sec 3x + \tan 3x| \)
(b) \( z = -3 \sin 3x \ln |\sec 3x + \tan 3x| \)
(c) \( z = -\frac{1}{3} \cos 3x \ln |\sec 3x + \tan 3x| \)
(d) \( z = \frac{1}{3} \sin 3x \ln |\sec 3x + \tan 3x| \)
(e) None of the above.

3. \( \{y_1(x) = x, \ y_2(x) = x \ln x\} \) is a fundamental set of solutions of the reduced equation of

\[ y'' - \frac{1}{x} y' + \frac{1}{x^2} y = 2 \]

The general solution of the equation is:

(a) \( y = C_1 x + C_2 x \ln x + 2x^2 \)
(b) \( y = C_1 x + C_2 x \ln x - 2x^2 \)
(c) \( y = C_1 x + C_2 x \ln x - x(\ln x) + x^2 \)
(d) \( y = C_1 x + C_2 x \ln x - 2x^2 - x \)
(e) All of the above.

4. A particular solution of \( y'' - 2y' + y = \frac{e^x}{x} \) is:

(a) \( y = -xe^x \ln x \)
(b) \( y = 2x^2 e^x \)
(c) \( y = xe^x \ln x \)
(d) \( y = -xe^x(1 + \ln x) \)
(e) None of the above.
5. The general solution of \( y'' - 2y' - 8y = 15e^{3x} + 2 \) is:

(a) \( y = C_1e^{-4x} + C_2e^{2x} - 3e^{3x} - \frac{1}{4} \)
(b) \( y = C_1e^{4x} + C_2e^{-2x} + 3e^{3x} + 4 \)
(c) \( y = C_1e^{-4x} + C_2e^{2x} + 3e^{3x} + \frac{1}{4} \)
(d) \( y = C_1e^{4x} + C_2e^{-2x} - 3e^{3x} - \frac{1}{4} \)
(e) None of the above.

6. The general solution of \( y'' - y' - 2y = 4 \cos 2x + 2 \sin 2x \) is:

(a) \( y = C_1e^{2x} + C_2e^{-x} - \frac{1}{2} \cos 2x - \frac{1}{2} \sin 2x \)
(b) \( y = C_1e^{-2x} + C_2e^{x} + \frac{1}{4} \cos 2x - \frac{1}{2} \sin 2x \)
(c) \( y = C_1e^{-2x} + C_2e^{x} + \frac{1}{2} \cos 2x + \frac{1}{2} \sin 2x \)
(d) \( y = C_1e^{2x} + C_2e^{-x} + \frac{1}{2} \cos 2x - \frac{1}{2} \sin 2x \)
(e) None of the above.

7. The solution of the initial-value problem

\[ y'' + 4y = 4e^{2x}, \quad y(0) = 1, \quad y'(0) = 3 \]

is:

(a) \( y = \frac{1}{2} \cos 2x + \frac{1}{2} \sin 2x - \frac{1}{2} e^{2x} \)
(b) \( y = \frac{1}{2} \cos 2x - \sin 2x + \frac{1}{2} e^{2x} \)
(c) \( y = \cos 2x + \frac{1}{2} \sin 2x - \frac{1}{2} e^{2x} \)
(d) \( y = \frac{1}{2} \cos 2x + \sin 2x + \frac{1}{2} e^{2x} \)
(e) None of the above.

8. A particular solution \( z \) of \( y'' - 5y' + 6y = 2 \cos 3x + 4e^{3x} \) will have the form

(a) \( z = A \cos 3x + B e^{3x} \)
(b) \( z = A \cos 3x + B \sin 3x + C x e^{3x} \)
(c) \( z = A \cos 3x + B \sin 3x + C e^{3x} \)
(d) \( z = A \sin 3x + B x e^{3x} \)
(e) None of the above.
9. A particular solution $z = z(x)$ of $y'' + y' - 12y = 4e^x \sin 2x + 4xe^3x + 2x$ will have the form

(a) $z = Ae^x \cos 2x + Be^x \sin 2x + (Cx + D)e^3x + Ex$

(b) $z = Ae^x \cos 2x + Be^x \sin 2x + (Cx^2 + Dx)e^3x + Ex + F$

(c) $z = Ae^x \cos 2x + Be^x \sin 2x + (Cx + D)e^3x + Ex + F$

(d) $z = Axe^{2x} \cos x + Bxe^{2x} \sin x + (Cx^2 + Dx)e^3x + Ex$

(e) None of the above.

10. The general solution of $y'' - 5y' = 4e^{5x} + 2x$ will have the form

(a) $y = C_1e^{5x} + C_2 + Axe^{5x} + Bx^2$

(b) $y = C_1e^{5x} + C_2 + Ae^{5x} + Bx + C$

(c) $y = C_1e^{5x} + C_2 + Axe^{5x} + Bx^2 + Cx$

(d) $y = C_1e^{5x} + C_2 + (Ax + B)e^{5x} + Cx + D$

(e) None of the above.

11. A particular solution of $y'' + 4y = 3e^{2x} + 4 \sin 2x + 1$ will have the form

(a) $z = Ae^{2x} + Bx \cos 2x + Cx \sin 2x + D$

(b) $z = Axe^{2x} + Bx \cos 2x + Cx \sin 2x + Dx$

(c) $z = Ae^{2x} + Bx \cos 2x + Cx \sin 2x + Dx$

(d) $z = Ae^{2x} + Bx \sin 2x + C$

(e) None of the above.

12. If $y = y(x)$ is a solution of $y'' + 4y' + 4y = 3$, then $\lim_{x \to \infty} y(x) =$

(a) 0

(b) 4/3

(c) 3/2

(d) 3/4

(e) $\infty$
13. The value of $\alpha$ such that the solution of the initial-value problem
\[ y'' + y = 2e^{-x}, \quad y(0) = 1, \quad y'(0) = \alpha \]
satisfies $\lim_{x \to \infty} y(x) = 0$ is:

(a) 1
(b) −2
(c) −1
(d) 2
(e) None of the above.

14. A particular solution of \[ y'' + 4y' + 4y = \frac{e^{-2x}}{x^2} \] is:

(a) $z = e^{-2x} \ln x$
(b) $z = -e^{-2x} \ln x$
(c) $z = \frac{e^{-2x}}{x}$
(d) $z = -xe^{-2x} \ln x$
(e) None of the above.

15. The general solution of \[ x^2y'' - 3xy' - 12y = 3x \] is:

(a) $y = C_1x^{-2} + C_2x^6 + \frac{x^3}{5}$
(b) $y = C_1x^2 + C_2x^{-6} + \frac{x}{5}$
(c) $y = C_1x^{-2} + C_2x^6 - \frac{x^3}{20}$
(d) $y = C_1x^{-2} + C_2x^6 - \frac{x}{5}$
(e) None of the above.