

1. $z_1(x) = 4x^2 + xe^x$, $z_2(x) = xe^x + 2x^2$ are solutions of a second order, linear nonhomogeneous equation $L[y] = f(x)$. $y_1(x) = x^{-3}$ is a solution of the corresponding reduced equation $L[y] = 0$. The general solution of $L[y] = f(x)$ is:

(a) $z = C_1x^{-3} + C_2x^2 + C_3xe^x$

(b) $z = C_1x^{-3} + C_2(x^2 + xe^x)$

(c) $z = C_1x^{-3} + C_2x^2 + xe^x$

(d) $z = C_1x^{-3} + C_2xe^x + 5x^2$

(e) None of the above.

2. $z_1(x) = 5x^2 + 2\sin 2x$, $z_2(x) = 2x^2 + 2\sin 2x$, $z_3(x) = x^3 + 3x^2 + 2\sin 2x$ are solutions of a second order, linear nonhomogeneous equation $L[y] = f(x)$. The general solution of $L[y] = f(x)$ is:

(a) $z = C_1x^2 + C_2x^3 + 2\sin 2x$

(b) $z = C_1(2x^2 + 2\sin 2x) + C_2(x^3 + 2x^2 + 2\sin 2x)$

(c) $z = C_1x^2 + C_2x^3 + C_3\sin 2x$

(d) $z = C_1\sin 2x + C_2x^3 + 2x^2$

(e) None of the above.

3. $\{y_1(x) = x^{-2}, y_2(x) = x^6\}$ is a fundamental set of solutions of the reduced equation of

$$y'' - \frac{3}{x}y' - \frac{12}{x^2}y = 4x^2.$$

A particular solution of the equation is:

(a) $z = \frac{x^4}{5}$

(b) $z = -\frac{x^4}{3}$

(c) $z = \frac{2x^3}{3}$

(d) $z = -\frac{x^4}{6}$

(e) None of the above.

4. $\{y_1(x) = x, y_2(x) = x^4\}$ is a fundamental set of solutions of the reduced equation of

$$y'' - \frac{4}{x}y' + \frac{4}{x^2}y = 3x^2.$$

A particular solution of the equation is:

- (a) $z = -\frac{3}{2}x^4 \ln x$
- (b) $z = x^4 \ln x$
- (c) $z = \frac{2}{3}x^4 \ln x$
- (d) $z = \frac{4}{3}x \ln x^4$
- (e) None of the above.

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

$$y'' + p(x)y' + q(x)y = \frac{2}{x}.$$

The general solution of the equation is:

- (a) $y = C_1x + C_2x \ln x + 2x \ln x$
- (b) $y = C_1x + C_2x \ln x - x^2(\ln x)$
- (c) $y = C_1x + C_2x \ln x + x^2 \ln x - x(\ln x)^2$
- (d) $y = C_1x + C_2x \ln x + x(\ln x)^2$
- (e) All of the above.

6. The reduced equation for $x^2y'' - 4xy' + 6y = 4x^3$ has solutions of the form $y = x^r$. The general solution of the given equation is:

- (a) $y = C_1x + C_2x^2 - \frac{4}{3}x^4$
- (b) $y = C_1x^2 + C_2x^3 + \frac{2}{3}x^5$
- (c) $y = C_1x^3 + C_2x^3 + 4x^3 \ln x$
- (d) $y = C_1x^2 + C_2x^3 - 4x^3 + 4x^3 \ln x$
- (e) None of the above.

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

- (a) $z = -e^{4x} \ln x$

- (b) $z = xe^{4x} \ln x$
- (c) $z = \frac{1}{2}x^2e^{4x}$
- (d) $z = \frac{1}{2}e^{4x} - e^{4x} \ln x$
- (e) None of the above.

8. The general solution of $y'' + 6y' + 9y = \frac{e^{-3x}}{x}$ is:

- (a) $y = C_1e^{-3x} + C_2xe^{-3x} + e^{-3x} \ln x$
- (b) $y = C_1e^{-3x} + C_2xe^{-3x} - 2e^{-3x} \ln x$
- (c) $y = C_1e^{-3x} + C_2xe^{-3x} + xe^{-3x} \ln x$
- (d) $y = C_1e^{3x} + C_2xe^{3x} - \frac{1}{2}xe^{-3x} \ln x$
- (e) None of the above.

9. A particular solution of $y'' + 9y = 3 \sec 3x$ is

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

10. $y_1 = x$ is a solution of the reduced equation of

$$y'' - \frac{3}{x}y' + \frac{3}{x^2}y = 6x^4.$$

The general solution of the equation is:

- (a) $y = C_1x + C_2x^2 - \frac{4}{3}x^4$
- (b) $y = C_1x + C_2x^3 + \frac{2}{5}x^6$
- (c) $y = C_1x + C_2x^{-3} - 2x^6$
- (d) $y = C_1x + C_2x^3 - \frac{2}{5}x^5$
- (e) None of the above.