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1. Which of the following sets of functions are linearly independent on $(0, \infty)$?

Select all that apply.

- (a) $\{1, \sin^2 x, \cos^2 x\}$
- (b) $\{1, x + 3, 2x\}$
- (c) $\{\sqrt{x}, x, x^2\}$
- (d) $\{1, \tan^2 x, \sec^2 x\}$
- (e) $\{1/x, x, \ln x\}$

2. One solution of the differential equation $y'' + y' = 0$ is $y = e^{-x}$. A second linearly independent solution is

Select the correct answer.

- (a) $y = c$
- (b) $y = e^x$
- (c) $y = xe^x$
- (d) $y = xe^{-x}$
- (e) $y = e^{-x}$

3. Two linearly independent solutions of the differential equation $y'' - 4y' + 4y = 0$ are

Select the correct answer.

- (a) $y_1 = e^{2x}, y_2 = e^{2x}$
- (b) $y_1 = e^{2x}, y_2 = xe^{2x}$
- (c) $y_1 = e^{2x}, y_2 = e^{-2x}$
- (d) $y_1 = e^{-2x}, y_2 = xe^{-2x}$
- (e) $y_1 = e^{-2x}, y_2 = xe^{2x}$

4. Two linearly independent solutions of the differential equation $y'' - 5y' - 6y = 0$ are

Select the correct answer.

- (a) $y_1 = e^{6x}, y_2 = e^x$
- (b) $y_1 = e^{6x}, y_2 = xe^{-x}$
- (c) $y_1 = e^{6x}, y_2 = e^{-x}$
- (d) $y_1 = e^{-6x}, y_2 = xe^{-x}$
- (e) $y_1 = e^{-6x}, y_2 = e^x$

5. Two linearly independent solutions of the differential equation $y'' - 6y' + 25y = 0$ are
Select the correct answer.

- (a) $y_1 = e^{3x}, y_2 = e^{4x}$
- (b) $y_1 = e^{-3x}, y_2 = e^{-4x}$
- (c) $y_1 = e^{-3x} \cos(4x), y_2 = e^{-3x} \sin(4x)$
- (d) $y_1 = e^{3x} \cos(4x), y_2 = e^{3x} \sin(4x)$
- (e) $y_1 = e^{4x} \cos(3x), y_2 = e^{4x} \sin(3x)$

6. A particular solution of the differential equation $y'' + 3y' + 2y = 4x + 3$ is
Select the correct answer.

- (a) $y_p = 4x + 3$
- (b) $y_p = 2x + 3/2$
- (c) $y_p = 2x - 3/2$
- (d) $y_p = 4x^2 + 3x$
- (e) $y_p = 2x - 3$

7. A particular solution of the differential equation $y'' + 2y' + y = e^x$ is
Select the correct answer.

- (a) $y_p = 4xe^x$
- (b) $y_p = x^2e^x/2$
- (c) $y_p = 2x^2e^x$
- (d) $y_p = e^x/4$
- (e) $y_p = e^x$

8. A particular solution of the differential equation $y'' - 2y' + y = \cos x$ is
Select the correct answer.

- (a) $y_p = \cos x$
- (b) $y_p = \sin x$
- (c) $y_p = \sin x/2$
- (d) $y_p = \cos x/2$
- (e) $y_p = -\sin x/2$

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9. A particular solution of the differential equation $y'' - 2y' + y = e^x$ is
Select the correct answer.

- (a) $y_p = x^2 e^x / 2$
- (b) $y_p = x e^x / 2$
- (c) $y_p = x e^x$
- (d) $y_p = e^x$
- (e) $y_p = e^{-x} / 4$

10. A particular solution of the differential equation $y'' + 3y' - 4y = e^x$ is
Select the correct answer.

- (a) $y_p = x^2 e^x$
- (b) $y_p = x e^x / 5$
- (c) $y_p = x e^x$
- (d) $y_p = e^x$
- (e) $y_p = e^{-x} / 5$

11. Without solving for the undetermined coefficients, the correct form of a particular solution of the differential equation $y'' + 4y = \cos(2x)$ is
Select the correct answer.

- (a) $y_p = A \cos(2x)$
- (b) $y_p = A \cos(2x) + B \sin(2x)$
- (c) $y_p = Ax \cos(2x)$
- (d) $y_p = Ax \cos(2x) + B \sin(2x)$
- (e) $y_p = Ax \cos(2x) + Bx \sin(2x)$

12. Without solving for the undetermined coefficients, the correct form of a particular solution of the differential equation $y'' + 4y' + 5y = e^{-2x} \cos x$ is
Select the correct answer.

- (a) $y_p = A e^{-2x} \cos x$
- (b) $y_p = A e^{-2x} \cos x + B e^{-2x} \sin x$
- (c) $y_p = A e^{-2x} \sin x$
- (d) $y_p = A x e^{-2x} \cos x + B x e^{-2x} \sin x$
- (e) $y_p = A x e^{-2x} \cos x + B e^{-2x} \sin x$

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13. The auxiliary equation for the differential equation $x^2y'' + 3xy' + y = 6$ is
Select the correct answer.

- (a) $m^2 + 3m + 1$
- (b) $m^2 + 3m + 1 = 0$
- (c) $m^2 + 2m + 1 = 0$
- (d) $m^2 + 3m + 1 = 6$
- (e) $m^2 + 2m + 1 = 6$

14. The solution of the differential equation $x^2y'' + 3xy' + y = 0$ is
Select the correct answer.

- (a) $y = c_1x^{-1} + c_2x^{-1} \ln x$
- (b) $y = c_1x^{-1} + c_2x^{-2}$
- (c) $y = c_1x^{(-3+\sqrt{5})/2} + c_2x^{(-3-\sqrt{5})/2}$
- (d) $y = c_1x + c_2x \ln x$
- (e) $y = c_1x + c_2x^2$

15. The solution of the differential equation $x^2y'' - 2xy' + 2y = 0$ is
Select the correct answer.

- (a) $y = c_1x \cos(\ln x) + c_2x \sin(\ln x)$
- (b) $y = c_1x^{1/2} \cos(\sqrt{3} \ln x/2) + c_2x^{1/2} \sin(\sqrt{3} \ln x/2)$
- (c) $y = c_1x^{(1+\sqrt{3})/2} + c_2x^{(1-\sqrt{3})/2}$
- (d) $y = c_1x + c_2x \ln x$
- (e) $y = c_1x + c_2x^2$

16. A solution of the differential equation $y'' = 2x(y')^2$ is
Select the correct answer.

- (a) $y = \ln(c_1 - x^2) + c_2$
- (b) $y = \ln((c_1 - x)/(c_1 + x)) + c_2$
- (c) $y = \ln((c_1 + x)/(c_1 - x)) + c_2$
- (d) $y = \ln(((c_1 + x)/(c_1 - x))^2) + c_2$
- (e) $y = \ln(((c_1 - x)/(c_1 + x))^2) + c_2$