7. By the substitution method a solution of the boundary-value problem of the differential equation

$$y'' + 2y(y')^3 = 0 \quad y(1) = 0,\ y(4) = 3 \qquad \text{satisfies}$$

(a) $y(-2/3) = 1$.

(b) $y(-2/3) = 2$.

(c) $y(-2/3) = -1$.

(d) $y(-2/3) = -2$.

(e) $y(-2/3) = 0$.

8. The function $h(y)$ with $h(0) = 0$ that makes the differential equation

$$[e^{x+y} + h(y)]dx + [e^{x+y} + xye^y]dy = 0 \quad \text{exact must satisfy}$$

(a) $h(1) = -1$.

(b) $h(-1) = -1$.

(c) $h(1) = 1$.

(d) $h(-1) = 1$.

(e) none of the above.

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9. The solution of the boundary-value problem

$$y'' + 4y = 3\sin 2x, \quad y(0) = 1, y(\pi/4) = -1 \qquad \text{satisfies}$$

(a) $y(\pi) = -1 + \sqrt{2}$.

(b) $y(-\pi/4) = 1$.

(c) $y(-\pi/2) = -1 - \pi$.

(d) $y(\pi/2) = -1 - \sqrt{2}$.

(e) none of the above.

10. By using the change of variable $y(x) = x^{-3}u(x)$ the differential equation

$$xy'' + 7y' + xy = 0$$

changes to a

(a) Cauchy-Euler differential equation.

(b) Bessel differential equation with $\nu = 6$.

(c) Bessel differential equation with $\nu = 3$.

(d) Bessel differential equation with $\nu = 7$.

(e) none of the above.

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11. If

$$G(s) = \mathcal{L}\{\int_0^t e^{-\tau} \cos \tau d\tau\},$$

then $G(2)$ is equal to

(a) 3/20.

(b) 3/10.

(c) 7/20.

(d) -1/2.

(e) none of the above.

12. If

$$F(s) = \mathcal{L}\{(t-1)^3 e^t \mathcal{U}(t-1)\},$$

then $F(3)$ is equal to

(a) $3e^{-2}/8$.

(b) $3e^{-3}/8$.

(c) $e^{-3}/3$.

(d) 1/3.

(e) none of the above.

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13. The solution to the initial-value problem

$$ty'' - y' = t^2, \quad y(0) = y'(0) = 0,\ y''(0) = 1 \quad satisfies$$

(a) $y(-2) = -2/3$.

(b) $y(2) = 13/3$.

(c) $y(1) = 7/6$.

(d) $y(-1) = -1/6$.

(e) $y(3) = -27/2$.

14. If the system

$$\begin{aligned} x'(t) - 6x + 3y &= 8e^t \\ y'(t) - 2x - y &= 4e^t \end{aligned}$$

satisfies $x(0) = -1$ and $y(0) = 0$, then

(a) $y(t) = (e^t - e^{4t})/3$.

(b) $x(t) = e^t - 2e^{4t}$.

(c) $x(t) = -e^t$.

(d) $x(t) = -2e^t + e^{4t}$.

(e) none of the above.

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15. The solution of the integro-differential equation

$$f'(t) = \cos t + \int_0^t \cos\tau f(t-\tau)d\tau \quad f(0) = 0$$

satisfies

(a) $f(2) = 3$.

(b) $f(2) = 4$.

(c) $f(2) = 2$.

(d) $f(2) = \pi$.

(e) $f(2) = 5$.

16. The indicial roots of the differential equation

$$x^2y'' - xy' - (x^2 + 5/4)y = 0 \quad \text{are}$$

(a) 5/2, 1/2.

(b) 5/2, 5/2.

(c) 3/2, -1/2.

(d) 3/2, 1/2.

(e) 5/2, -1/2.

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