PRINTABLE VERSION

Practice Test 2

You scored 60 out of 100

Question 1

Your answer is CORRECT.

Give the general solution of the differential equation

$$y'' + 4y = -3\tan(2x)$$

a) $y = C_1 e^{2x} + C_2 e^{-2x} + \frac{3}{4}\cos(2x)\ln(\sec(2x) + \tan(2x))$

b) $y = C_1 \sin(2x) + C_2 \cos(2x) + \frac{3}{4}\sin(2x)\ln(\sec(2x) + \tan(2x))$

c) $y = C_1 \sin(2x) + C_2 \cos(2x) + \frac{3}{4}\sin(2x)\ln(\sec(2x) - \tan(2x))$

d) $y = C_1 e^{2x} + C_2 e^{-2x} + \frac{3}{4}\sin(2x)\ln(\sec(2x) + \tan(2x))$

e) $y = C_1 \sin(2x) + C_2 \cos(2x) + \frac{3}{4}\cos(2x)\ln(\sec(2x) + \tan(2x))$

f) None of the above.

Question 2

Your answer is INCORRECT.

Give the general solution of the differential equation

$$y'' + 4y = -5\cos(6x) + 4\sin(6x)$$

a) $y = C_1 e^{2x} + C_2 e^{-2x} + \frac{5}{32}\cos(6x) + \frac{1}{8}\sin(6x)$

b) $y = C_1 \sin(2x) + C_2 \cos(2x) + \frac{5}{32}\cos(6x) + \frac{1}{8}\sin(6x)$

c) $y = C_1 e^{2x} + C_2 e^{-2x} + \frac{5}{32}\cos(6x) - \frac{1}{8}\sin(6x)$

d) $y = C_1 \sin(2x) + C_2 \cos(2x) - \frac{1}{8}\cos(6x) - \frac{3}{16}x\sin(6x)$

e) $y = C_1 \sin(2x) + C_2 \cos(2x) + \frac{5}{32}\cos(6x) - \frac{1}{8}\sin(6x)$

f) None of the above.

Question 3

Your answer is INCORRECT.

Find the solution of the given initial-value problem.

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

a) $y = \frac{11}{10}\cos(2x) - \frac{13}{40}\sin(2x) + \frac{1}{4}x^2 - \frac{1}{8} + \frac{4}{5}e^x$

b) $y = \frac{13}{40}\cos(2x) + \frac{11}{10}\sin(2x) - \frac{1}{4}x^2 + \frac{1}{8} - \frac{4}{5}e^x$

c) $y = \frac{13}{40}\cos(2x) + \frac{11}{10}\sin(2x) + \frac{1}{4}x^2 - \frac{1}{8} + \frac{4}{5}e^x$

d) $y = \frac{11}{10}\cos(2x) + \frac{13}{40}\sin(2x)$

e) $y = \frac{13}{40}\cos(2x) - \frac{11}{10}\sin(2x)$

f) None of the above.

Question 4

Your answer is CORRECT.

Give the form of a particular solution of the differential equation

$$y'' + 4y' + 4y = e^{4x}\sin(2x) + 3e^{-2x} - 3x$$

a) $z = A e^{4x}\cos(2x) + B e^{4x}\sin(2x) + C x^2 e^{-2x} + E x + F$

b) $z = A e^{4x}\sin(2x) + C x^2 e^{-2x} + E x$

c) $z = A e^{4x}\sin(2x) + C e^{-2x} + E x + F$

d) $z = A e^{4x}\sin(2x) + C e^{-2x} + E x$

e) $z = A e^{4x}\cos(2x) + B e^{4x}\sin(2x) + C x e^{-2x} + E x + F$

f) None of the above.

Question 5

Your answer is CORRECT.

Find the solution of the initial value problem:

$$y''' - y'' + 36y' - 36y = 0$$
$$[y(0) = 0, \; y'(0) = 0, \; y''(0) = -3]$$

a) $y = -\frac{37}{3} e^{x} + \frac{37}{3} \cos(6x) + 74 \sin(6x)$

b) $y = \frac{37}{3} e^{x} + \frac{37}{3} \cos(6x) - 74 \sin(6x)$

c) $y = \frac{3}{37} e^{x} - \frac{3}{37} \cos(6x) + \frac{1}{74} \sin(6x)$

d) $y = -\frac{3}{37} e^{x} - \frac{3}{37} \cos(6x) - \frac{1}{74} \sin(6x)$

e) (selected) $y = -\frac{3}{37} e^{x} + \frac{3}{37} \cos(6x) + \frac{1}{74} \sin(6x)$

f) None of the above.

Question 6

Your answer is INCORRECT.

Find the homogeneous equation with constant coefficients of least order that has the following as a solution

$$y = 2e^{-2x} + 3\sin(2x) + 2x$$

a) $y^{(5)} + 2y^{(4)} + 4y''' + 8y'' = 0$

b) (selected) $y^{(5)} - 2y^{(4)} - 4y''' + 8y'' = 0$

c) $y^{(5)} + 2y^{(4)} - 4y''' - 8y'' = 0$

d) $y^{(5)} + 4y^{(4)} + 8y''' - 4y'' = 0$

e) $y^{(5)} + 8y^{(4)} - 4y''' - 4y'' = 0$

f) None of the above.

Question 7

Your answer is CORRECT.

Find the general solution of the nonhomogeneous equation

$$y^{(4)} + 2\,y'' + y = \cos(2\,x) + 5$$

a) $y = C_1\cos(x) + C_2\sin(x) + C_3\,x\cos(x) + C_4\,x\sin(x) + 5 + \frac{1}{9}\cos(2\,x)$

b) $y = C_1\cos(x) + C_2\,e^{x} + C_3\,x\cos(x) + C_4\,x\sin(x) - 5 - \frac{1}{9}\cos(2\,x)$

c) $y = C_1\cos(x) + C_2\sin(x) + C_3\,e^{x}\cos(x) + C_4\,e^{x}\sin(x) + 5 + \frac{1}{9}\cos(2\,x)$

d) $y = C_1\,e^{x} + C_2\,x\,e^{x} + C_3\cos(x) + C_4\sin(x) + 5 + \frac{1}{9}\sin(2\,x)$

e) $y = C_1\,e^{x} + C_2\,x\,e^{x} + C_3\cos(x) + C_4\sin(x) - 5 - \frac{1}{9}\cos(2\,x)$

f) None of the above.

Question 8

Your answer is INCORRECT.

Give the form of a particular solution of

$$y^{(4)} - 16\,y = 2\,e^{-2\,x} + 3\,e^{3\,x} + \cos(2\,x) + 2$$

a) $z = A\,x\,e^{2\,x} + B\,e^{3\,x} + C\cos(2\,x) + D\sin(2\,x) + E$

b) $z = A\,x\,e^{-2\,x} + B\,e^{3\,x} + C\cos(2\,x) + D\sin(2\,x)$

c) $z = A\,x\,e^{2\,x} + B\,e^{3\,x} + C\,x\cos(2\,x) + D\,x\sin(2\,x) + E$

d) $z = A\,e^{-2\,x} + B\,e^{3\,x} + C\,x\cos(2\,x) + D\,x\sin(2\,x) + E$

e) $z = A\,x\,e^{-2\,x} + B\,e^{3\,x} + C\,x\cos(2\,x) + D\,x\sin(2\,x) + E$

f) None of the above.

Question 9

Your answer is CORRECT.

Give the Laplace transform for

$$f(x) = 2\,x\,e^{-5\,x} + 3\,e^{5\,x}\cos(4\,x)$$

a) $F(s) = \dfrac{2}{s+5} + \dfrac{3\,(s-5)}{(s-5)^2+16}$

b) $F(s) = \dfrac{2}{(s+5)^2} + \dfrac{12}{(s-5)^2+16}$

c) $F(s) = \dfrac{2}{(s+5)^2} + \dfrac{3\,(s-5)}{(s-5)^2+4}$

d) $F(s) = \dfrac{2}{(s+5)^2} + \dfrac{3\,(s-5)}{(s-5)^2+16}$

e) $F(s) = \dfrac{4}{(s+5)^2} + \dfrac{3\,(s-5)}{(s-5)^2+16}$

f) None of the above.

Question 10

Your answer is CORRECT.

Give the Laplace transform of the solution to

$$[y' + 3\,y = 4\cos(3\,x), \quad y(0) = 3]$$

a) $Y(s) = \dfrac{4\,s}{(s^2+9)\,(s+3)} - \dfrac{3}{s+3}$

b) $Y(s) = \dfrac{4\,s}{(s^2+9)\,(s-3)} + \dfrac{3}{s-3}$

c) $Y(s) = \dfrac{4\,s}{(s^2+9)\,(s+3)} + \dfrac{3}{s+3}$

d) $Y(s) = \dfrac{4\,s}{s^2+9} + 3$

e) $Y(s) = \dfrac{4\,s}{s^2+9} - \dfrac{3}{s-3}$

f) None of the above.

Question 11

Your answer is INCORRECT.

Give the Laplace transform of the solution to

$$[y'' + 5y' + 4y = 0, \quad y(0) = -3, \quad y'(0) = 4]$$

a) $Y(s) = -\frac{3\,(s+5)}{s^2 + 5s + 4} + \frac{4}{s^2 + 5s + 4}$

b) $Y(s) = -\frac{3\,(s+5)}{s^2 + 5s + 4} - \frac{4}{s^2 + 5s + 4}$

c) $Y(s) = -\frac{11}{s^2 + 5s + 4}$

d) $Y(s) = -\frac{19}{s^2 + 5s + 4}$

e) $Y(s) = -\frac{3\,(s-5)}{s^2 + 5s + 4} - \frac{4}{s^2 + 5s + 4}$

f) None of the above.

Question 12

Your answer is CORRECT.

Find

$$\mathcal{L}^{-1}\left[\frac{-3s - 4}{s^2 + 25}\right]$$

a) $-\frac{3}{5}\cos(5x) - \frac{4}{5}\sin(5x)$

b) $-\frac{4}{5}\cos(5x) - 3\sin(5x)$

c) $-3\cos(5x) - \frac{4}{5}\sin(5x)$

d) $-3\cos(5x) - 4\sin(5x)$

e) $-3e^{5x} - \frac{4}{5}x\,e^{5x}$

f) None of the above.

Question 13

Your answer is INCORRECT.

Use the Laplace transform to solve the initial-value problem:

$$\left[y'' + 5y' + 4y = 5e^{-5x}, \quad y(0) = -5, \quad y'(0) = 5\right]$$

a) $y(x) = \frac{5}{4}e^{-5x} + 5e^{-4x} - \frac{25}{4}e^{-x}$

b) $y(x) = \frac{5}{4}e^{-5x} + \frac{5}{3}e^{-4x} - \frac{95}{12}e^{-x}$

c) $y(x) = \frac{5}{4}e^{-5x} - \frac{5}{3}e^{-4x} - \frac{55}{12}e^{-x}$

d) $y(x) = \frac{5}{4}e^{-5x} + \frac{25}{3}e^{-4x} - \frac{115}{12}e^{-x}$

e) $y(x) = \frac{5}{4}e^{-5x} - 15e^{-4x} + \frac{35}{4}e^{-x}$

f) None of the above.

Question 14

Your answer is CORRECT.

Give the Laplace transform of

$$f(x) = \begin{cases} 4x^2 & 0 \le x \text{ and } x < 3 \\ -4 & 3 \le x \end{cases}$$

a) $F(s) = -\frac{1}{s^3} + e^{-3s}\left(-\frac{3}{s^3} + \frac{1}{s^2} - \frac{16}{s}\right)$

b) $F(s) = \frac{1}{s^3} + e^{-3s}\left(-\frac{2}{s^3} + \frac{1}{s^2} - \frac{4}{s}\right)$

c) $F(s) = -\frac{1}{s^3} + e^{-3s}\left(\frac{9}{s^3} - \frac{1}{s^2} + \frac{8}{s}\right)$

d) $F(s) = \frac{8}{s^3} + e^{-3s}\left(-\frac{8}{s^3} - \frac{24}{s^2} - \frac{40}{s}\right)$

e) $F(s) = \frac{2}{s^3} + e^{-3s}\left(-\frac{24}{s^3} + \frac{2}{s^2} + \frac{18}{s}\right)$

f) None of the above.

Question 15

Your answer is INCORRECT.

Give the inverse Laplace transform of

$$F(s) = -\frac{3}{s} + \frac{e^{-4s}}{s^2} + \frac{3e^{-4s}}{s}$$

as a function of x.

Note: The function u below is the unit step function, which is also known as the *Heaviside* function. YOU MUST BE ABLE TO ALSO WRITE YOUR ANSWER AS A PIECEWISE FUNCTION ON THE EXAM!

a) $f(x) = 4\,u(x-4)\,x - 3 - 4\,u(x-4)$

b) $f(x) = -2\,u(x-4)\,x - 3 - 2\,u(x-4)$

c) $f(x) = 5\,u(x-4)\,x - 3 - u(x-4)$

d) $f(x) = -3\,u(x-4)\,x - 3 - u(x-4)$

e) $f(x) = u(x-4)\,x - 3 - u(x-4)$

f) None of the above.

Question 16

Your answer is CORRECT.

Use Laplace Transforms to solve the initial value problem

$$[y' + 3y = f(x),\ y(0) = 0]$$

where

$$f(x) = \begin{cases} 2 & 0 \le x \textbf{ and } x < 2 \\ 4 & 2 \le x \end{cases}$$

a) $$y(x) = \begin{cases} -\frac{2}{3}e^{-3x} - \frac{2}{3} & 0 \le x \textbf{ and } x < 2 \\ -\frac{2}{3}e^{-3x} + \frac{4}{3} - 2e^{6-3x} & 2 \le x \end{cases}$$

b) $$y(x) = \begin{cases} \frac{2}{3}e^{-3x} - \frac{2}{3} & 0 \le x \textbf{ and } x < 2 \\ -\frac{2}{3}e^{-3x} + \frac{4}{3} - \frac{2}{3}e^{6-3x} & 2 \le x \end{cases}$$

c) $$y(x) = \begin{cases} \frac{2}{3}e^{-3x} - \frac{2}{3} & 0 \le x \textbf{ and } x < 2 \\ -\frac{2}{3}e^{-3x} + \frac{4}{3} - 2e^{6-3x} & 2 \le x \end{cases}$$

d) ○ $y(x) = \begin{cases} -\frac{2}{3}e^{-3x} + \frac{2}{3} & 0 \le x \text{ and } x < 2 \\ -\frac{2}{3}e^{-3x} - \frac{4}{3} - \frac{2}{3}e^{6-3x} & 2 \le x \end{cases}$

e) ◉ $y(x) = \begin{cases} -\frac{2}{3}e^{-3x} + \frac{2}{3} & 0 \le x \text{ and } x < 2 \\ -\frac{2}{3}e^{-3x} + \frac{4}{3} - \frac{2}{3}e^{6-3x} & 2 \le x \end{cases}$

f) ○ None of the above.

Question 17

Your answer is INCORRECT.

Give the general solution of the differential equation

$$y'' - 10y' + 25y = -2e^{5x} + \frac{e^{5x}}{x^2}$$

a) ○ $y = C_1 e^{5x} + C_2 e^{-5x} - x e^{5x} - x e^{5x} \ln(x)$

b) ○ $y = C_1 e^{-5x} + C_2 x e^{-5x} - x^2 e^{5x} + e^{5x} \ln(x)$

c) ◉ $y = C_1 e^{5x} + C_2 x e^{5x} + x^2 e^{5x} - e^{5x} \ln(x)$

d) ○ $y = C_1 e^{5x} + C_2 x e^{5x} - x^2 e^{5x} + x e^{5x} \ln(x)$

e) ○ $y = C_1 e^{5x} + C_2 x e^{5x} - x^2 e^{5x} + e^{5x} \ln(x)$

f) ○ None of the above.

Question 18

Your answer is CORRECT.

Give the solution set to the system of equations

$$\begin{bmatrix} -2x + 5y - 2z = 1 \\ -2x + 4y - 2z = 1 \\ -x + 2y - z = -1 \end{bmatrix}$$

a) ○ $[x = 3s - 3, y = 4 - s, z = -2s - 3]$

b) $[x = -2, y = 3 + s, z = -2 - 2s]$

c) *The system does not have a solution.*

d) $[x = -3 + 2s, y = -1 - s, z = -3 - s]$

e) $[x = -s + 1, y = 3 + 3s, z = 2 - 2s]$

f) None of the above.

Question 19

Your answer is CORRECT.

For what values of *a* does the system below have nontrivial solutions?

$$\begin{bmatrix} 2x - 2y + 2z = 0 \\ 6x + ay + 6z = 0 \\ -2x - 2y + 3z = 0 \end{bmatrix}$$

a) 3

b) 6

c) -6

d) -3

e) -2

f) None of the above.

Question 20

Your answer is CORRECT.

The matrices A and B are given by

$$A = \begin{bmatrix} 0 & -1 & 2 \\ 1 & 0 & -1 \\ 0 & 1 & -1 \end{bmatrix} \quad B = \begin{bmatrix} 3 & -3 & 2 \\ 0 & 2 & 0 \\ -2 & -1 & -2 \end{bmatrix}$$

and D = AB. Give the value of $d_{2,3}$.

a) 5

b) 7

c) -2

d) 4

e) -5

f) None of the above.