PRINTABLE VERSION

Practice Test 2

You scored 30 out of 100

Question 1

Your answer is CORRECT.

Give the general solution of the differential equation

$$y'' + 9y = 4\tan(3x)$$

a) $y = C_1 e^{3x} + C_2 e^{-3x} - \frac{4}{9}\sin(3x)\ln(\sec(3x) + \tan(3x))$

b) $y = C_1 \sin(3x) + C_2 \cos(3x) - \frac{4}{9}\sin(3x)\ln(\sec(3x) - \tan(3x))$

c) $y = C_1 e^{3x} + C_2 e^{-3x} - \frac{4}{9}\cos(3x)\ln(\sec(3x) + \tan(3x))$

d) $y = C_1 \sin(3x) + C_2 \cos(3x) - \frac{4}{9}\cos(3x)\ln(\sec(3x) + \tan(3x))$

e) $y = C_1 \sin(3x) + C_2 \cos(3x) - \frac{4}{9}\sin(3x)\ln(\sec(3x) + \tan(3x))$

f) None of the above.

Question 2

Your answer is CORRECT.

Give the general solution of the differential equation

$$y'' + 9y = 3\cos(4x) - 4\sin(4x)$$

a) $y = C_1 \sin(3x) + C_2 \cos(3x) + \frac{4}{7}\cos(4x) - \frac{4}{7}x\sin(4x)$

b) $y = C_1 e^{3x} + C_2 e^{-3x} - \frac{3}{7}\cos(4x) + \frac{4}{7}\sin(4x)$

c) $y = C_1 e^{3x} + C_2 e^{-3x} - \frac{3}{7}\cos(4x) - \frac{4}{7}\sin(4x)$

d) $y = C_1 \sin(3x) + C_2 \cos(3x) - \frac{3}{7}\cos(4x) + \frac{4}{7}\sin(4x)$

e) $y=C_1\sin(3x)+C_2\cos(3x)-\frac{3}{7}\cos(4x)-\frac{4}{7}\sin(4x)$

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

$$y''+7y'+12y=-4\cos(4x)+2e^{-4x}-4$$

a) $z=A\cos(4x)+B\sin(4x)+Ce^{-4x}+E$

b) $z=A\cos(4x)+Bxe^{-4x}+C$

c) $z=A\cos(4x)+B\sin(4x)+Cxe^{-4x}+E$

d) $z=A\cos(4x)+Be^{-4x}+C$

e) $z=A\cos(4x)+B\sin(4x)+Ce^{-4x}+Ex$

f) None of the above.

Question 5

Your answer is CORRECT.

Find the solution of the initial value problem:

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

a) $y = -e^{x} + \cos(2x) - \frac{1}{2}\sin(2x)$

b) $y = e^{x} + \cos(2x) + \frac{1}{2}\sin(2x)$

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

d) $y = e^{x} - \cos(2x) - 2\sin(2x)$

e) (selected) $y = e^{x} - \cos(2x) - \frac{1}{2}\sin(2x)$

f) None of the above.

Question 6

Your answer is CORRECT.

Find the homogeneous equation with constant coefficients that has the given general solution

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

a) $y''' + 8y' + 4y'' + 16y + 16 = 0$

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

c) (selected) $y^{(4)} + 8y'' + 4y''' + 16y' + 16y = 0$

d) $y^{(4)} + 8y'' - 4y''' - 16y' + 16y = 0$

e) $y^{(4)} - 4y''' + 16y' - 16y = 0$

f) None of the above.

Question 7

Your answer is INCORRECT.

Find the general solution of the nonhomogeneous equation

$$y^{(4)} + 18\ y'' + 81\ y = \cos(3\ x) + 2$$

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

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

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

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

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

f) None of the above.

Question 8

Your answer is INCORRECT.

Give the form of a particular solution of

$$y^{(4)} - 2\ y''' + 5\ y'' - 8\ y' + 4\ y = 3\ e^x + \sin(x) + 1$$

given that $r_1 = 2i$ is a root of the characteristic equation.

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

b) $z = A\ x\ e^x + B\ \cos(x) + C\sin(x) + \mathrm{D}$

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

d) $z = A\ e^x + B\ \cos(x) + C\sin(x) + \mathrm{D}$

e) $z = A\ x^2\ e^x + B\ \cos(x) + C\sin(x) + \mathrm{D}$

f) None of the above.

Question 9

Your answer is CORRECT.

Give the Laplace transform for

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

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

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

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

d) $F(s) = \dfrac{6}{s} - \dfrac{4}{s-3} - \dfrac{2s}{s^2+16}$

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

f) None of the above.

Question 10

Your answer is INCORRECT.

Give the Laplace transform of the solution to

$$\left[y' + 5y = 3e^{4x} - 4\sin(4x), \quad y(0) = -2\right]$$

a) $Y(s) = \dfrac{3}{(s-5)(s-4)} - \dfrac{16}{(s-5)(s^2+16)} - \dfrac{2}{s-5}$

b) $Y(s) = \dfrac{3}{(s+5)(s-4)} - \dfrac{16}{(s+5)(s^2+16)} - \dfrac{2}{s+5}$

c) $Y(s) = \dfrac{3}{(s+5)(s-4)} - \dfrac{16}{(s+5)(s^2+16)} + \dfrac{2}{s+5}$

d) $Y(s) = \dfrac{3}{s-4} - \dfrac{16}{s^2+16} - 2$

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

f) None of the above.

Question 11

Your answer is INCORRECT.

Give the Laplace transform of the solution to

$$\left[y'' + 5y' + 4y = 4e^{-5x}, \quad y(0) = -3, \quad y'(0) = 4\right]$$

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

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

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

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

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

f) None of the above.

Question 12

Your answer is INCORRECT.

Find

$$\mathcal{L}^{-1}\left[-\frac{2}{s} - \frac{3}{s-5}\right]$$

a) $-2 - 3e^{5x}$

b) $-2x - 3e^{5x}$

c) $-2x - 3\cos(5x)$

d) $-2 - 3\cos(5x)$

e) $-2e^{x} - 3\cos(5x)$

f) None of the above.

Question 13

Your answer is INCORRECT.

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

$$\left[y'' + 3y' + 2y = 3e^{-3x}, \quad y(0) = 2, \quad y'(0) = 3\right]$$

a) $y(x) = -6\,e^{-2x} + \frac{9}{2}\,e^{-x} + \frac{3}{2}\,e^{-3x}$

b) $y(x) = -2\,e^{-2x} + \frac{5}{2}\,e^{-x} + \frac{3}{2}\,e^{-3x}$

c) $y(x) = -12\,e^{-2x} + \frac{21}{2}\,e^{-x} + \frac{3}{2}\,e^{-3x}$

d) $y(x) = 10\,e^{-2x} - \frac{19}{2}\,e^{-x} + \frac{3}{2}\,e^{-3x}$

e) $y(x) = -8\,e^{-2x} + \frac{17}{2}\,e^{-x} + \frac{3}{2}\,e^{-3x}$

f) None of the above.

Question 14

Your answer is INCORRECT.

Give the Laplace transform of

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

a) $F(s) = -\frac{1}{s^3} + e^{-3s}\left(-\frac{27}{s^3} + \frac{1}{s^2} - \frac{20}{s}\right)$

b) $F(s) = -\frac{4}{s^3} + e^{-3s}\left(\frac{4}{s^3} + \frac{12}{s^2} + \frac{22}{s}\right)$

c) $F(s) = \frac{1}{s^3} + e^{-3s}\left(\frac{4}{s^3} + \frac{1}{s^2} - \frac{16}{s}\right)$

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

e) $F(s) = \frac{2}{s^3} + e^{-3s}\left(-\frac{1}{s^3} + \frac{2}{s^2} - \frac{10}{s}\right)$

f) None of the above.

Question 15

Your answer is INCORRECT.

Give the inverse Laplace transform of

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

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) $f(x) = 4\,e^{-2\,x} - 2\,u(x-5) + 2\,u(x-5)\,e^{-2\,x+10}$

b) $f(x) = -5\,e^{-2\,x} + 2\,u(x-5) - 2\,u(x-5)\,e^{-2\,x+10}$

c) $f(x) = -2\,e^{-2\,x} + \frac{3}{2}\,u(x-5) - \frac{3}{2}\,u(x-5)\,e^{-2\,x+10}$

d) $f(x) = 5\,e^{-2\,x} - \frac{3}{2}\,u(x-5) + \frac{3}{2}\,u(x-5)\,e^{-2\,x+10}$

e) $f(x) = 5\,e^{-2\,x} + u(x-5) - u(x-5)\,e^{-2\,x+10}$

f) None of the above.

Question 16

Your answer is INCORRECT.

Use Laplace Transforms to solve the initial value problem

$$[y' - 4\,y = f(x),\ y(0) = 0]$$

where

$$f(x) = \begin{cases} 3 & 0 \le x \textbf{ and } x < 4 \\ 4 & 4 \le x \end{cases}$$

a) $y(x) = \begin{cases} \frac{3}{4}\,e^{4\,x} - \frac{3}{4} & 0 \le x \textbf{ and } x < 4 \\ \frac{3}{4}\,e^{4\,x} + 1 + \frac{1}{4}\,e^{-16+4\,x} & 4 \le x \end{cases}$

b) $y(x) = \begin{cases} -\frac{3}{4}\,e^{4\,x} + \frac{3}{4} & 0 \le x \textbf{ and } x < 4 \\ \frac{3}{4}\,e^{4\,x} - 1 + \frac{7}{4}\,e^{-16+4\,x} & 4 \le x \end{cases}$

c) $y(x) = \begin{cases} \frac{3}{4}\,e^{4\,x} + \frac{3}{4} & 0 \le x \textbf{ and } x < 4 \\ \frac{3}{4}\,e^{4\,x} - 1 + \frac{7}{4}\,e^{-16+4\,x} & 4 \le x \end{cases}$

d) $y(x) = \begin{cases} \frac{3}{4}e^{4x} - \frac{3}{4} & 0 \le x \text{ and } x < 4 \\ \frac{3}{4}e^{4x} - 1 + \frac{1}{4}e^{-16+4x} & 4 \le x \end{cases}$

e) $y(x) = \begin{cases} -\frac{3}{4}e^{4x} + \frac{3}{4} & 0 \le x \text{ and } x < 4 \\ \frac{3}{4}e^{4x} - 1 + \frac{1}{4}e^{-16+4x} & 4 \le x \end{cases}$

f) None of the above.

Question 17

Your answer is INCORRECT.

Give the general solution of the differential equation

$$y'' - 6y' + 9y = -5e^{3x} + \frac{e^{3x}}{x^2}$$

a) $y = C_1 e^{3x} + C_2 x e^{3x} - \frac{5}{2}x^2 e^{3x} + x e^{3x}\ln(x)$

b) $y = C_1 e^{3x} + C_2 x e^{3x} + \frac{5}{2}x^2 e^{3x} - e^{3x}\ln(x)$

c) $y = C_1 e^{3x} + C_2 e^{-3x} - \frac{5}{2}x e^{3x} - x e^{3x}\ln(x)$

d) $y = C_1 e^{3x} + C_2 x e^{3x} - \frac{5}{2}x^2 e^{3x} - e^{3x}\ln(x)$

e) $y = C_1 e^{-3x} + C_2 x e^{-3x} - \frac{5}{2}x^2 e^{3x} + e^{3x}\ln(x)$

f) None of the above.

Question 18

Your answer is INCORRECT.

Give the solution set to the system of equations

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

a) $\left[x=\frac{1}{2}-\frac{13}{2}s,\ y=-\frac{1}{2}-\frac{7}{2}s,\ z=-\frac{7}{2}-\frac{1}{2}s\right]$

b) $\left[x=\frac{3}{2}-\frac{11}{2}s,\ y=\frac{3}{2}-\frac{7}{2}s,\ z=-\frac{9}{2}-\frac{1}{2}s\right]$

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

d) $\left[x=-\frac{1}{2}-\frac{13}{2}s,\ y=-\frac{1}{2}-\frac{1}{2}s,\ z=-\frac{7}{2}-\frac{11}{2}s\right]$

e) $\left[x=-\frac{7}{2}-\frac{1}{2}s,\ y=\frac{5}{2}+\frac{3}{2}s,\ z=-\frac{7}{2}-\frac{1}{2}s\right]$

f) None of the above.

Question 19

Your answer is INCORRECT.

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

$$\begin{bmatrix} 3x+4y+2z=0 \\ -6x+ay-4z=0 \\ -4x+3y+4z=0 \end{bmatrix}$$

a) 8

b) 4

c) -8

d) -2

e) 2

f) None of the above.

Question 20

Your answer is INCORRECT.

The matrices A and B are given by

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

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

a) ◉ 21

b) ○ 9

c) ○ 18

d) ○ 12

e) ○ 19

f) ○ None of the above.