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Signature of the examinee/student: [signature]. Date: 14/03/2078

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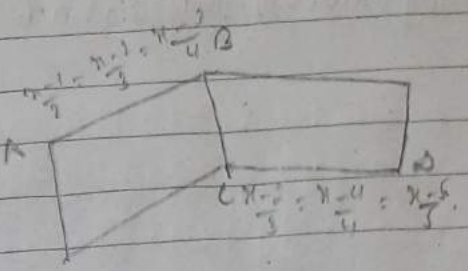
Q.N.1.

A. Ans.

The given eq^n of lines are:



$$\frac{x-1}{2} = \frac{x-2}{3} = \frac{x-3}{4} \quad \ldots\ldots (i)$$

$$\frac{x-2}{3} = \frac{x-4}{4} = \frac{x-5}{5} \quad \ldots\ldots (ii).$$

Let l, m, n be direction cosine of BC.

Since, $BC \perp AB$ then, $2l+3m+4n=0 \ldots\ldots (iii)$

Also, $BC \perp CD$ then, $3l+4m+5n=0 \ldots\ldots (iv)$

Solving (iii) and (iv) by cross method.

$$\frac{l}{15-16} = \frac{m}{-(10-12)} = \frac{n}{8-9}.$$

or, $\frac{l}{-1} = \frac{m}{2} = \frac{n}{-1}$.

or, $\frac{l}{1} = \frac{m}{-2} = \frac{n}{1} = \frac{\sqrt{l^2+m^2+n^2}}{\sqrt{(1)^2+(-2)^2+(1)^2}}$

Taking 1st and last ratio.

$$\frac{l}{1} = \frac{\sqrt{1}}{\sqrt{6}}$$

$$\therefore l = \frac{1}{\sqrt{6}}.$$

and,

$$\frac{m}{-2} = \frac{1}{\sqrt{6}} \qquad \therefore m = \frac{-2}{\sqrt{6}}$$

Also,

$$\frac{n}{1} = \frac{1}{\sqrt{6}}$$

$$\therefore n = \frac{1}{\sqrt{6}}.$$

Now,
Magnitude of short distance (SD) = $\left| l(x_2-x_1) + m(y_2-y_1) + n(z_2-z_1) \right|$

$$= \left| \frac{1}{\sqrt{6}}(2-1) + \left(\frac{-2}{\sqrt{6}}\right)\cdot(4-2) + \frac{1}{\sqrt{6}}(5-3) \right|$$

$$= \left| \frac{1}{\sqrt{6}} - \frac{2}{\sqrt{6}} \times 2 + \frac{2}{\sqrt{6}} \right|$$

$$= \left| \frac{3}{\sqrt{6}} - \frac{4}{\sqrt{6}} \right|$$

$$= \left| \frac{-1}{\sqrt{6}} \right|$$

$$\therefore S.D. = \frac{1}{\sqrt{6}}$$

And, the eq^n of shortest distance is,

$$\begin{vmatrix} x-x_1 & y-y_1 & z-z_1 \\ l_1 & m_1 & n_1 \\ l & m & n \end{vmatrix} = 0 = \begin{vmatrix} x-x_2 & y-y_2 & z-z_2 \\ l_2 & m_2 & n_2 \\ l & m & n \end{vmatrix}$$

i.e.

$$\begin{vmatrix} x-1 & y-2 & z-3 \\ 2 & 3 & 4 \\ \frac{1}{\sqrt{6}} & \frac{-2}{\sqrt{6}} & \frac{1}{\sqrt{6}} \end{vmatrix} = 0 = \begin{vmatrix} x-2 & y-4 & z-5 \\ 3 & 4 & 5 \\ \frac{1}{\sqrt{6}} & -\frac{2}{\sqrt{6}} & \frac{1}{\sqrt{6}} \end{vmatrix}$$

B. Ans.

The equation of sphere through the given circle, $x^2+y^2+z^2=1$ and $2x+4y+5z=6$ be,

$$(x^2+y^2+z^2-1)+k(2x+4y+5z-6)=0.$$

or, $x^2+y^2+z^2+2kx+4ky+5kz-(1+6k)=0 \quad \cdots (i)$

Comparing eq^n (i) with general equation of sphere. i.e. with $x^2+y^2+z^2+2ux+2vy+2wz+d=0$ we get,

$$u=k,\ v=2k\ \&\ w=\frac{5k}{2},\ d=-(1+6k).$$

$\therefore$ Center of eq^n (i) is, $(-u,-v,-w)=(-k,-2k,-5k/2)$.

and,

Radius of (i) is given by:

$$r=\sqrt{u^2+v^2+w^2-d}.$$

$$=\sqrt{k^2+4k^2+\frac{25k^2}{4}+(1+6k)}$$

$$=\sqrt{\frac{4k^2+16k^2+25k^2+4+24k}{4}}$$

$$=\frac{1}{2}\sqrt{45k^2+24k+4}$$

As the sphere (i) touches the plane $z=0$. So, the length of radius of sphere is equal to z-coordinate value.

i.e. $\frac{1}{\cancel{2}}\sqrt{45k^2+24k+4}=\frac{5k}{\cancel{2}}$.

or, $45k^2+24k+4=25k^2$.

or, $20k^2+24k+4=0$

or, $5k^2+6k+1=0$

or, $(5k+1)(k+1)=0$

$\therefore k = -1, -1/5.$

Hence, the eq^n (i) becomes:

$x^2+y^2+z^2-2x-4y-5z+5=0$ and,

$5(x^2+y^2+z^2)-2x-4y-5z+1=0.$

which are required eq^n of sphere.

Q.N.2.

Ans

B. Ans.

Given function:

$$f(x,y) = x^3 + y^3 - 3axy \quad \ldots\ldots (i)$$

Now, Diff. eqⁿ (i) partially we get,

$f_x = 3x^2 - 3ay$. $\qquad f_y = 3y^2 - 3ax$

$f_{xx} = 6x$. $\qquad f_{yy} = 6y$.

$f_{xy} = -3a$.

For stationary point,

$f_x = 0$ $\qquad$ ||ly, $f_y = 0$

i.e. $3x^2 - 3ay = 0$ $\qquad$ i.e. $3y^2 - 3ax = 0$

or, $x^2 - ay = 0 \ldots (ii)$ $\qquad$ or, $y^2 - ax = 0 \ldots (iii)$

Solving (ii) and (iii) we get,

$x = 0, a$ and $y = 0, a$..

At point $(0,0)$ or at $x = 0$ and $y = 0$. the function gives no information.

Also, $f_{xx} \cdot f_{yy} - (f_{xy})$

$\Rightarrow 0 \times 0 - (-3a)^2 = 0$

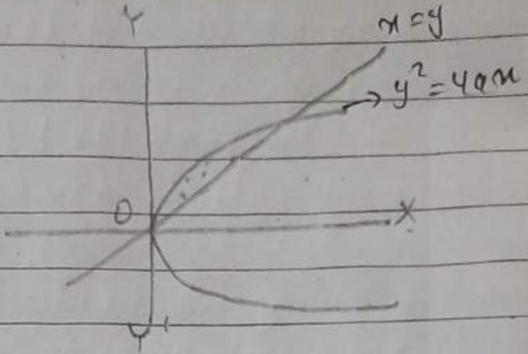
or, $9a^2 = 0$..

$\therefore a = 0$

Q.N.3.

A. Ans.

$$\int_0^{4a}\int_{\frac{y^2}{4a}}^{y} \frac{x^2-y^2}{x^2+y^2}\,.dx.dy.$$



let $I = \int_0^{4a}\int_{\frac{y^2}{4a}}^{y} \frac{x^2-y^2}{x^2+y^2}\,.dx.dy.$

Here, the integrand is first integrated w.r.t. x along the horizontal strip which varies from $x = \frac{y^2}{4a}$ to $x = y$. and w.r.t. y in vertical strip.

To change it into polar coordinates,
Put $x = r\cos\theta$ and $y = r\sin\theta$.
$\therefore x^2+y^2 = r^2$ and $dy\,dx = r\,dr\,d\theta$ in given integral.
We get, $\theta = \frac{\pi}{4}$ to $\theta = \frac{\pi}{2}$ and $r=0$ to $r = 4a\cot\theta\cdot\operatorname{cosec}\theta$.

Now, our integral becomes:

$$I = \int_{\pi/4}^{\pi/2}\int_0^{4a\cot\theta.\operatorname{cosec}\theta} \frac{r^2\cos^2\theta - r^2\sin^2\theta}{r^2\cos^2\theta + r^2\sin^2\theta}\,.r.dr\,d\theta$$

$$= \int_{\pi/4}^{\pi/2}\int_0^{4a\cot\theta.\operatorname{cosec}\theta} \frac{r^3(\cos^2\theta - \sin^2\theta)}{r^2}\,.dr.d\theta$$

$$= \int_{\pi/4}^{\pi/2}\int_0^{4a\cot\theta.\operatorname{cosec}\theta} r.(\cos^2\theta - \sin^2\theta).dr.d\theta$$

in $\because 4ax = y^2$
or, $4ar\cos\theta = r^2\sin^2\theta$
or, $r^2\sin^2\theta - 4ar\cos\theta = 0$
or, $r[r\sin\theta - 4a\cos\theta] = 0$
$\therefore r = 0$
& $r\sin\theta = 4a\cos\theta$.
$\therefore r = 4a\cot\theta\cdot\operatorname{cosec}\theta$.

$$= \int_{\pi/4}^{\pi/2} \cos 2\theta \left[\frac{r^2}{2}\right]_0^{4a\cot\theta.\operatorname{cosec}\theta} . dr.d\theta.$$

$$= \int_{\pi/4}^{\pi/2} \frac{\cos 2\theta}{2} \left[16a^2.\cot^2\theta.\operatorname{cosec}^2\theta\right].d\theta$$

$$= 8a^2 \int_{\pi/4}^{\pi/2} (\cos^2\theta - \sin^2\theta)\ (\cot^2\theta.\operatorname{cosec}^2\theta).\ d\theta.$$

$$= 8a^2 \int_{\pi/4}^{\pi/2} (\cos^2\theta - \sin^2\theta).\left(\frac{\cos^2\theta}{\sin^4\theta}\right).d\theta$$

$$= 8a^2 \int_{\pi/4}^{\pi/2} \left(\frac{\cos^4\theta}{\sin^4\theta} - \frac{\cos^2\theta.\sin^2\theta}{\sin^4\theta}\right).d\theta$$

$$= 8a^2 \int_{\pi/4}^{\pi/2} (\cot^4\theta - \cot^2\theta).d\theta.$$

$$= 8a^2 \int_{\pi/4}^{\pi/2} \left[\cot^2\theta\,(\operatorname{cosec}^2\theta - 1) - \cot^2\theta\right].d\theta.$$

$$= 8a^2 \int_{\pi/4}^{\pi/2} \left[\cot^2\theta.\operatorname{cosec}^2\theta - 2\cot^2\theta\right].d\theta.$$

$$= 8a^2 \left\{ \left[-\frac{\cot^3\theta}{3}\right]_{\pi/4}^{\pi/2} - \int_{\pi/4}^{\pi/2} 2\cot^2\theta.\ d\theta \right\}$$

$$= 8a^2 \left\{ -\frac{1}{3}\ \left[\cot^3\theta\right]_{\pi/4}^{\pi/2} - 2\int_{\pi/4}^{\pi/2} (\operatorname{cosec}^2\theta - 1).\ d\theta \right\}$$

$$= 8a^2 \left\{ -\frac{1}{3}[0-1] - 2\left[-\cot\theta - \theta\right]_{\pi/4}^{\pi/2} \right\}$$

$$= 8a^2 \left\{ \frac{1}{3} + 2\left[\cot\theta + \theta\right]_{\pi/4}^{\pi/2} \right\}$$

$$= 8a^2 \cdot \left\{ \frac{1}{3} + 2\left[\frac{\pi}{2} - 1 - \frac{\pi}{4}\right] \right\}$$

$$= 8a^2 \left\{ \frac{1}{3} + 2 \times \left(\frac{\pi-4}{4}\right) \right\}$$

$$= 8a^2 \cdot \left\{ \frac{1}{3} + \frac{\pi-4}{2} \right\}$$

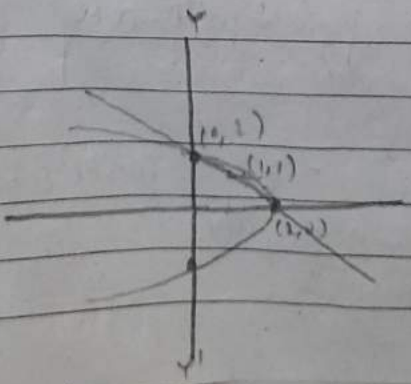
$$= \frac{\cancel{8a^2}}{6} \cancel{(2+3\pi)}$$

B. Ans.

Given eq^n of curves:

$$y = 2 - x \text{ and } y^2 = 2(2-x).$$

Here, $y = 2-x$ is the eq^n of straight line whereas, $y^2 = 4-2x$ is eq^n of parabola having vertex at $(2, 0)$



for $y = 2-x$

x	0	2	1
y	2	0	1

for $y^2 = 4-2x$

x	2	0
y	0	± 2

For point of intersection,

$(2-x)^2 = 4-2x$

or, $\cancel{4} - 4x + x^2 = \cancel{4} - 2x$

or, $x^2 = 2x$

or, $x^2 - 2x = 0$

or, $x(x-2) = 0$

$\therefore x = 0$ or, $x = 2$.

At, $x = 0$, $y = 2$

At $x = 2$, $y = 0$.

Taking horizontal strip.

So, the required Area $= \int_0^2 \int_{2-y}^{4-\frac{y^2}{2}} dx.dy$.

$= \int_0^2 \left[\frac{4-y^2}{2} - (2-y) \right].dy$.

$= \int_0^2 \left[\frac{4-y^2}{2} - 2 + y \right].dy$.

$= \int_0^2 \left[\cancel{2} - \frac{y^2}{2} \cancel{-2} + y \right].dy$

$= \int_0^2 \left[y - \frac{y^2}{2} \right].dy$

$= \int_0^2 \left[\frac{y^2}{2} - \frac{y^3}{6} \right]_0^2$

$$= \left[\frac{(2)^2}{2} - \frac{(2)^3}{6}\right] - 0$$

$$= \frac{4}{2} - \frac{\cancel{8}^{4}}{\cancel{6}_{3}}$$

$$= 2 - \frac{4}{3}$$

$$= \frac{2}{3} \text{ sq. units.}$$

Hence, the area bounded by curve is $\frac{2}{3}$ sq. units.

Q.N.4.

A. Ans.

Linear differential equation of first order is the differential equation which only involves the differential that has order power raised to one. It is usually in form of $\frac{dy}{dx} + Py = Q$.

Example: $\frac{dy}{dx} = \sin x$.

where, P & Q are function of x or constant.

second part:

$$x \log x \cdot \frac{dy}{dx} + y = 2\log x.$$

Dividing both sides by $x.\log x$ we get,

$$\frac{dy}{dx} + \frac{1}{x.\log x} \cdot y = \frac{2\cancel{\log x}}{x.\cancel{\log x}}$$

or, $$\frac{dy}{dx} + \frac{1}{x.\log x} \cdot y = \frac{2}{x} \quad \text{---(i)}$$

Here, eq^n (i) is in the form of, linear differential eq^n.

$\therefore P = \frac{1}{x \cdot \log x}$ and, $Q = \frac{2}{x}$.

$\therefore$ I.F. $= e^{+\int P \cdot dx}$

$= e^{\int \frac{1}{x \log x} \cdot dx}$

$= e^{\int \frac{dz}{z}}$

Let $\log x = z$

$\therefore \frac{1}{x} \cdot \frac{dx}{dz} = 1.$

$\therefore \frac{dx}{x} = dz.$

$= e^{\log z}$

$= e^{\log(\log x)}$

$= \log x.$

Multiplying eq^n (i) by I.F. we get,

$$y \times e^{\int P \cdot dx} = \int Q \cdot e^{\int P \cdot dx} \cdot dx + c$$

or, $y \times \log x = \int \frac{2}{x} \times \log x \cdot dx + c.$

or, $y \log x = 2 \cdot \int \frac{\log x}{x} \cdot dx + c$

or, $y \log x = \cancel{2} \cdot \frac{(\log x)^2}{\cancel{2}} + c$

or, $y \log x = 2 \log x + c.$

or $y \overset{\log x}{=} 2 + c'$ where, $c' = \frac{c}{\log x}$

$\therefore y \overset{\log x}{=} 2 + c'$ is required solution.

Q.N. 5.

Ans.

Here, $y'' - 4y = e^{-2x} - 2x. \dots (i)$

~~Taking laplace transform on both~~ sides.

$\cancel{\mathcal{L}y'' - 4\mathcal{L}y = \mathcal{L}e^{-2x}} -$.

Let the solution of eq^n (i) be,

$$y = y_h + y_p.$$

where y_h is the solution of homogenous part.

The homogenous eq^n of (i) is,

$$y'' - 4y = 0 \dots (ii)$$

and, the auxilary eq^n of (ii) is,

$$m^2 - 4 = 0 \Rightarrow m = \pm 2.$$

Here, m has real and distinct value, so solution of (ii) is,

$$y_h(x) = C_1 e^{-2x} + C_2 e^{2x} \dots (iii).$$

Comparing (i) with $y'' + Py' + Qy = R$ we get,

$$R = e^{-2x} - 2x$$

Clearly R has repeated value of e^{-2x}. so lets chose particular sol^n of (i).

$$y_p' = -2C_3 x e^{-2x} + C_3 e^{-2x} + C_4.$$

$$y_p'' = 4C_3 x e^{-2x} - 2C_3 e^{-2x} - 2C_3 e^{-2x}.$$

PAGE NO.:
DATE: / /

B. Ans.

Given differential eqⁿ is,

$y'' = 9y$

or, $y'' - 9y = 0$ ...(i)

Assume the general solution of (i) as,

$y = C_0 + C_1x + C_2x^2 + C_3x^3 + C_4x^4 + \ldots$ (ii)

Diff. (ii) w.r.t. x we get,

$y' = C_1 + 2C_2x + 3C_3x^2 + 4C_4x^3 + 5C_5x^4 + \ldots$

Again, diff. w.r.t. x we get,

$y'' = 2C_2 + 6C_3x + 12C_4x^2 + 20C_5x^3 + \ldots$

Now,

Putting value of y'' and y in given eqⁿ

$(2C_2 + 6C_3x + 12C_4x^2 + 20C_5x^3 + \ldots) - 9(C_0 + C_1x + C_2x^2 + C_3x^3 + C_4x^4 + \ldots) = 0$

or, $(2C_2 - 9C_0) + (6C_3 - 9C_1)x + (12C_4 - 9C_2)x^2 + (20C_5 - 9C_3)x^3 + \ldots$

Equating to zero the coefficient of various powers of x we get,

$2C_2 - 9C_0 = 0 \Rightarrow C_2 = \frac{9}{2}C_0.$

$6C_3 - 9C_1 = 0 \Rightarrow C_3 = \frac{9C_1}{6} = \frac{3C_1}{2}.$

$12C_4 - 9C_2 = 0 \Rightarrow C_4 = \frac{9C_2}{12} = \frac{3C_2}{4} = \frac{3}{4} \times \frac{9}{2}C_0 = \frac{27}{8}C_0$

$20C_5 - 9C_3 = 0 \Rightarrow C_5 = \frac{9C_3}{20} = \frac{9}{20} \times \frac{3}{2}C_1 = \frac{27}{40}C_1$

PAGE NO.
DATE: / /

Putting value in eq^n (ii) we get,

$$y = C_1 + C_1 x + \frac{9}{2} C_0 x^3 + \frac{3}{2} C_1 x^3 + \frac{27}{8} C_0 x^4 + \frac{27}{40} C_1 x^5 + \dots$$

$$\therefore y = C_1 \left(1 + x + \frac{3}{2} x^3 + \frac{25}{40} x^5 + \dots \right) + C_0 \left(\frac{9}{2} x^3 + \frac{27}{8} x^4 + \dots \right)$$

Q.N.6.

A. Ans.

First shifting theorem:

If $\mathcal{L}(f(t)) = F(s)$ then, $\mathcal{L}(e^{at} f(t)) = F(s-a)$.

Proof :

we have : $\mathcal{L}(f(t)) = \int_0^\infty e^{-st} f(t).dt$

$= F(s) \dots$ (i)

Now, $\mathcal{L}(e^{at} \cdot f(t)) = \int_0^\infty e^{-st} e^{at} \cdot f(t).dt$

$= \int_0^\infty e^{-(s-a)t} \cdot f(t).dt$

$= F(s-a)$ for $(s-a) > 0$.

$\therefore \mathcal{L}(e^{at} \cdot f(t)) = F(s-a)$ which proves first shifting theorem.

Second shifting theorem:

If $\mathcal{L}(f(t)) = F(s)$ then, $\mathcal{L}[u(t-a) \cdot f(t-a)] = e^{-as} \cdot F(s)$

PAGE NO.:
DATE: / /

Proof :

By definition of laplace transform, $\mathcal{L}(f(t)) = \int_0^\infty e^{-st} f(t).dt$

$= F(s).$

Now,

$$\mathcal{L}[u(t-a).f(t-a)] = \int_0^\infty e^{-st}.u(t-a).f(t-a).dt.$$

$$= \int_0^a e^{-st}.0.f(t-a)\,dt + \int_a^\infty e^{-st}.1.f(t-a).dt$$

$$= \int_a^\infty e^{-st}.f(t-a).dt.$$

Put $(t-a) = z.$

$\therefore 1-0 = \frac{dz}{dt}.$

$\therefore dz = dt.$

When $t = a$ then $z = 0$

When $t = \infty$ then $z = \infty.$

$$= \int_0^\infty e^{-s(z+a)}.f(z).dz.$$

$$= \int_0^\infty e^{-sz-as}.f(z).dz.$$

$$= e^{-as}\int_0^\infty e^{-sz}.f(z).dz.$$

$$= e^{-as}.F(s).$$

which proves the second shifting theorem.

PAGE NO.:

DATE: / /

B. Ans.

Here, $y'' + 4y' + 4y = e^{-t}$.

Taking Laplace transform on both sides,

$$\mathcal{L}(y'' + 4y' + 4y) = \mathcal{L}\, e^{-t}.$$

or, $\mathcal{L}y'' + 4\mathcal{L}y' + 4\mathcal{L}y = \frac{1}{s+1}$.

or, $[s^2\mathcal{L}y - s.y(0) - y'(0)] + 4[s.\mathcal{L}(y) - y(0)] + 4\mathcal{L}y = \frac{1}{s+1}$.

or, $[s^2\mathcal{L}(y) - s\times 0 - 0] + 4[s.\mathcal{L}(y) - 0] + 4.\mathcal{L}(y) = \frac{1}{s+1}$

or, $s^2\mathcal{L}(y) + 4s\mathcal{L}(y) + 4.\mathcal{L}(y) = \frac{1}{s+1}$.

or, $\mathcal{L}(y)[s^2 + 4s + 4] = \frac{1}{s+1}$.

or, $\mathcal{L}(y) = \frac{1}{(s+1)(s^2+4s+4)}$

$$= \frac{1}{(s+1)(s+2)^2}$$

Let $\mathcal{L}(y) = \frac{1}{(s+1)(s+2)^2} = \frac{A}{(s+1)} + \frac{B}{(s+2)} + \frac{C}{(s+2)^2}$ ...... (i).

$$\therefore 1 = A(s+2)^2 + (s+1)(s+2)B + (s+1).C.$$

Put $s = -2$, $1 = -C$ $\therefore C = -1$.

Put $s = -1$, $1 = A$. $\therefore A = 1$

Saroj Dahal - 191725

PAGE NO.
DATE: /

On Equating coefficients we get,

$$1 = 4A + 2B + C$$

or, $1 = 4 + 2B - 1$

or, $2 = 4 + 2B$

or, $-2 = 2B$

$\therefore B = -1.$

Now, substituting value of A, B and C in eqⁿ (i) we get.

$$\mathcal{L}(y) = \frac{1}{s+1} - \frac{1}{s+2} - \frac{1}{(s+2)^2}$$

or, $y = \mathcal{L}^{-1}\left(\frac{1}{s+1}\right) - \mathcal{L}^{-1}\left(\frac{1}{s+2}\right) - \mathcal{L}^{-1}\left(\frac{1}{(s+2)^2}\right).$

$$= e^{-t} - e^{-2t} - \cancel{1}.t.e^{-2t}$$

$$\therefore y = e^{-t} - e^{-2t}(1-t)$$

Q.N. 7.

A. Ans.

Given: $(1+x)y\,dx + (1+y)x\,dy = 0.$

PAGE NO:
DATE: / /

7. B. Ans.

To find $\mathcal{L}(t \cdot e^t)$.

since, $\mathcal{L}(t \cdot f(t)) = (-1) \cdot \frac{d}{ds} \cdot F(s)$

$= (-1) \cdot \frac{d}{ds} \cdot \mathcal{L}(f(t))$.

$= (-1) \cdot \frac{d}{ds} \cdot \mathcal{L}(e^t)$.

$= (-1) \cdot \frac{d}{ds} \left(\frac{1}{s-a}\right)$.

$= (-1) \cdot \log(s-a)$.

$\therefore \mathcal{L}(t \cdot e^t) = -\log(s-a)$

7. C. Ans.

We have: $f = ax^2 + 2hxy + by^2 = u$ ...(i).

According to euler theorem,

$x \cdot \frac{\partial u}{\partial x} + y \cdot \frac{\partial u}{\partial y} = nu$, where n is degree of homogenous eq^n

then,

Diff. (i) partially, w.r.t. x

$\frac{\partial u}{\partial x} = 2ax + 2hy$.

lly, w.r.t. y.

$\frac{\partial u}{\partial y} = 2hx + 2by$.

Now,

$$x \cdot \frac{\partial u}{\partial x} + y \cdot \frac{\partial u}{\partial y}$$

$= x(2ax + 2hy) + y(2hx + 2by)$

$= 2ax^2 + 2hxy + 2hxy + 2by^2.$

$= 2(ax^2 + 2hxy + by^2)$

$= 2u.$

Hence, Euler formula is verified.

7.D. Ans.

Since the required plane is parallel to $3x - 4y + 5z = 0$.
so our required eq^n is,

$3x - 4y + 5z + K = 0 \ldots\ldots (i)$

Also, eq^n (i) passes through $(1, 1, 1)$ so,

$3 \times 1 - 4 \times 1 + 5 \times 1 + k = 0$

or, $4 + K = 0$

$\therefore K = -4.$

Hence, the eq^n of required plane is, $3x - 4y + 5z - 4 = 0.$