Laplace Transform.

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1. $L[1] = \frac{1}{s}$
2. $L[e^{at}] = \frac{1}{s-a}$
3. $L[t^n] = \frac{n!}{s^{n+1}}$ or $\frac{\Gamma(n+1)}{s^{n+1}}$
4. $L[\sin at] = \frac{a}{s^2+a^2}$
5. $L[\cos at] = \frac{s}{s^2-a^2}$
6. $L[\cosh at] = \frac{s}{s^2-a^2}$
7. $L[\sinh at] = \frac{a}{s^2-a^2}$

$\Rightarrow 2\sin^2\theta = 1 - \cos 2\theta$

$L[t] = \frac{1}{s^2}$

8. $L[F''(t)] = s^2 F(s) - s F(0) - F'(0)$
9. $L[F'''(t)] = s^3 F(s) - s^2 F(0) - sF'(0) - F''(0)$
10. $\cosh at = \frac{e^{at} + e^{-at}}{2}$
11. $\sinh at = \frac{e^{at} - e^{-at}}{2}$

when $t^n F(t)$ condn question then.

$$L[t^n F(t)] = (-1)^n \frac{d^n}{ds^n} F(s)$$

Inverse Laplace transform.

$\sin(A+B) = \sin A \cdot \cos B + \cos A \cdot \sin B$

$\sin(A-B) = \sin A \cdot \cos B - \cos A \cdot \sin B$

$\cos(A+B) = \cos A \cdot \cos B - \sin A \cdot \sin B.$

$\cos(A-B) = \cos A \cdot \cos B + \sin A \cdot \sin B$

$2\sin A \cdot \cos B = \sin(A+B) + \sin(A-B)$

$2\cos A \cdot \sin B = \sin(A+B) - \sin(A-B)$

$2\cos A \cdot \cos B = \cos(A+B) + \cos(A-B)$

$2\sin A \cdot \sin B = \cos(A-B) - \cos(A+B)$

$\cos 2\theta = 2\cos^2\theta - 1 \qquad \cos^2\theta = \frac{1+\cos 2\theta}{2}$

$\cos 2\theta = 1 - 2\sin^2\theta$

$\Rightarrow \sin 3\theta = 3\sin\theta - 4\sin^3\theta.$

$\cos 3\theta = 4\cos^3\theta - 3\cos\theta.$

linear & non repeated

(1) $\frac{x}{(x-a)(x-b)(x-c)} = \frac{A}{x-a} + \frac{B}{x-b} + \frac{C}{x-c}$

(2). linear & repeated.

$\frac{x^2}{(x-a)(x-b)^2} = \frac{A}{x-a} + \frac{B}{x-b} + \frac{C}{(x-b)^2}$

(3) linear & Quadratic.

$\frac{x^2+2}{(x+a)(x^2+Cx+D)} = \frac{A}{x-a} + \frac{Bx+C}{x^2+Cx+D}$

Application of Laplace Transforms

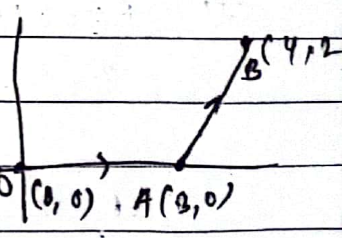
1. $L[0] = 0$
2. $L[y] = y(s)$
3. $L[y'] = sy(s) - y(0)$
4. $L[y''] = s^2 y(s) - sy(0) - y'(0)$
5. $L[y'''] = s^3 y(s) - s^2 y(0) - sy'(0) - y''(0)$
6. $L[y^{iv}]$ or $L[D^4]$

$$= s^4 y(s) - s^3 y(0) - s^2 y'(0) - sy''(0) - y'''(0)$$

*. ~~Gauss~~ ~~eti~~ ⇒ Any integral which is evaluated along the curve is called line Integral

Question

1. Along OA = limit 0 to 3 $y=0$ $dy=0$
2. $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$
3. limit from 3 to 4



Question typ.
Q. ??

$x = a\cos\theta$
$y = a\sin\theta$

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(1). When $\int \vec{F}\cdot d\vec{r}$ $\vec{F}$, $x^2+y^2=a^2$, $z=0$ change into parametri

(A) $e^{ax}\sin bx = \frac{e^{ax}}{a^2+b^2}\left[a\sin bx - b\cos bx\right]$

(B) $e^{ax}\cos bx = \frac{e^{ax}}{a^2+b^2}\left[a\cos bx + b\sin bx\right]$

For Half range fourier series

(1).

$$a_0 = \frac{2}{l}\int_0^l F(x)\,dx$$

$$a_n = \frac{2}{l}\int_0^l F(x)\cos\frac{n\pi x}{l}\,dx$$

$$b_n = \frac{2}{l}\int_0^l F(x)\sin\frac{n\pi x}{l}\,dx.$$

Fourier series expn $f(x)$ interval $(-l, l)$

$$F(x) = \frac{1}{2}a_0 + \sum_{n=1}^{\infty}\left(a_n\cos\frac{n\pi x}{l} + b_n\sin\frac{n\pi x}{l}\right)$$

$$a_0 = \frac{1}{l}\int_{-l}^{l} F(x)\,dx$$

$$a_n = \frac{1}{l}\int_{-l}^{l} F(x)\cos\frac{n\pi x}{l}\,dx$$

$$b_n = \frac{1}{l}\int_{-l}^{l} F(x)\sin\frac{n\pi x}{l}\,dx$$

$\tan(-\theta) = -\tan\theta$

$\sin(-\theta) = -\sin\theta$

$\cos(-\theta) = \cos\theta$

Main formula for fonier series. (Any Question)

$$\Rightarrow F(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos\left(\frac{2n\pi x}{b-a}\right) + b_n \sin\left(\frac{2n\pi x}{b-a}\right)$$

interval $[\underset{a}{0}, \underset{b}{2}]$

Standard Eulers formula for fonier series

$$\Rightarrow a_0 = \frac{2}{b-a} \int_a^b F(x)\, dx$$

$$a_n = \frac{2}{b-a} \int_a^b F(x) \cos\left(\frac{2n\pi x}{b-a}\right) dx$$

$$b_n = \frac{2}{b-a} \int_a^b F(x) \sin\left(\frac{2n\pi x}{b-a}\right) dx$$

Note: $\sin n\pi = 0$ $\quad$ $\cos n\pi = (-1)^n$

$\sin 2n\pi = 0$ $\quad$ $\cos 2n\pi = 1$

$$\left[\begin{array}{ccc|ccc} 2 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 4 & 0 & 0 & 1 \end{array}\right]$$

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ignored add identity matrix at start like this ↗↗↗

Gauss Jordan Method steps to find inverse:

1. make lower two element C_1 (0) with help of R_1
2. make diagonal middle element 1 and make upper & down element of it to zero (0)
3. Make R_3 last element 1 and make upper 2 element 0 by help of R_3 (recently made 1).

Question Type # Conservative or irrotational type

Step 1. $(\nabla \times F)$ ⟶ Step 2: $\vec{F} = \nabla \phi_{dr}$ dr

Question Type # If $\int \vec{F} \cdot d\vec{r}$ is messed type sol^n then use parametric form

$\therefore x = a\cos\theta$, $y = a\sin\theta$ (maybe ellipse type as well)

Type # If eq^n of line not given use $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$

From given points (0, 0) & (1, 1)

Formula to find area using Greens

$$\text{Area} = \frac{1}{2}\oint x\,dy - y\,dx$$

Dirichlets theorem.

$$V = 8\iiint dx\,dy\,dz$$

Process ⟶ Put $\frac{x^2}{a^2} = u$, $y^2/a^2 = v$, $z^2/a^2 = w$

Matrix. → (+) Gauss jordan method.
(1). Try to make identity matrix.

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Gauss elimination process
(1). Make down didenity in left side.
(2). Then back substitution and get value of x, y, z.

If A given Orthogonal matrix means. $[AA^T = I]$

Find A^{-1}
(1) Find determinant $|D|$
(2) Find cofactors of all & sign ⊕ ⊖ ⊕ ⊖ continously
(3). Arrange cofactors in single matrix.
(4). Find Adjacent (Adj) by transpose of cofactor matrix.
(5). Find $A^{-1} = \frac{1}{|D|}[Adj]$ / $\frac{1}{|D|}[Adjacent]$

For Eigen value & Eigen vector.
(1). $|A - \lambda I| = 0$ subtract by λ to diagonal elements.
(2). $\lambda^3 - P\lambda^2 + Q\lambda - |A| = 0$. — (1) Find value of P by sum of diagnals of element & Q = sum of minors of diagonal of A.
(3) Replace in (1) Find $\lambda = (\quad)$ & Find.
Put λ value in $\begin{bmatrix} \lambda-1 & & \\ & \lambda-2 & \\ & & \lambda-3 \end{bmatrix}$ eqn. & find $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \ \end{bmatrix}$ which is req. eigen vector.

(*) $\int\int \sqrt{a^2 - x^2}\, dx = \frac{x}{2}\sqrt{a^2 - x^2} + \frac{a^2}{2}\sin^{-1} x/a$

$\frac{x^2}{16} + \frac{y^2}{9} = 1$, $\frac{x^2}{4^2} + \frac{y^2}{3^2} = 1$

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Into Parametric eq^n

$x = 4\cos\theta \qquad y = 3\sin\theta$

Green

→ $\oint_C M\,dx + N\,dy = \iint_S \left(\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y}\right) dx\,dy$

→ $\int \vec{F}\cdot d\vec{r} = \iint (\nabla \times F)\cdot\hat{n}\,ds$. [Stroke]

→ $\iint (\vec{F}\cdot\hat{n})\,ds = \iiint (\nabla\cdot\vec{F})\,dx\,dy\,dz$
[Gauss theorem]

To find Area for:

VVI

1. Circle, let $x = a\cos\theta$, $y = a\sin\theta$.
2. Ellipse let $x = a\cos\theta$, $y = b\sin\theta$
3. ~~Hypo~~ Asteroid let $x = a\cos^3\theta$, $y = a\sin^3\theta$
4. Hypercyloid let $x = a\cos^3\theta$, $y = b\sin^3\theta$.

→ $\log\frac{m}{n} = \log m - \log n$.

→ $\log m.n = \log m + \log n$.

(*) Laplace log type Question → $\log\frac{s+a}{s-a}$

noted, Imp.

1. Form $\log c - \log d$ & derivate both side $\frac{d}{ds}$
2. You will get the values as $\frac{d}{ds}$ & log cancels out
3. Inverse (L^{-1}) both side and form formula & change $L^{-1}\left(\frac{d}{ds}(F(s))\right)$ to $-\frac{1}{t}(F(t))$
4. Then solve it.