## ODE of FIRST ORDER

DDE.
which involve only one independent variable
and the differential coefficients with it.
$\frac{d^2y}{dx^2} + 2\left(\frac{dy}{dx}\right)^2 + y = 0$
$\frac{y}{dx} = \frac{x}{dx} \frac{dy}{dx} + \frac{c}{dy} \frac{dx}{dx} = \frac{c}{c}$
$\frac{d^3y}{dx^3} + 2\frac{d^3y}{dx^2} \cdot \frac{dy}{dx} + x^2 \left(\frac{dy}{dx}\right)^3 = 0 - 3$
2 <sup>3</sup> / <sub>2</sub>
(A) Order

It is the order of the highest order derivative accurring in the diff. egn.

e.g. Egns (1) of (4) one of 2nd order

(2) is of 1st order

(3) is of 3nd order.

It is the degree of the highest order

derivative which occurs is the diff egn.

provided the egn has been made free of the

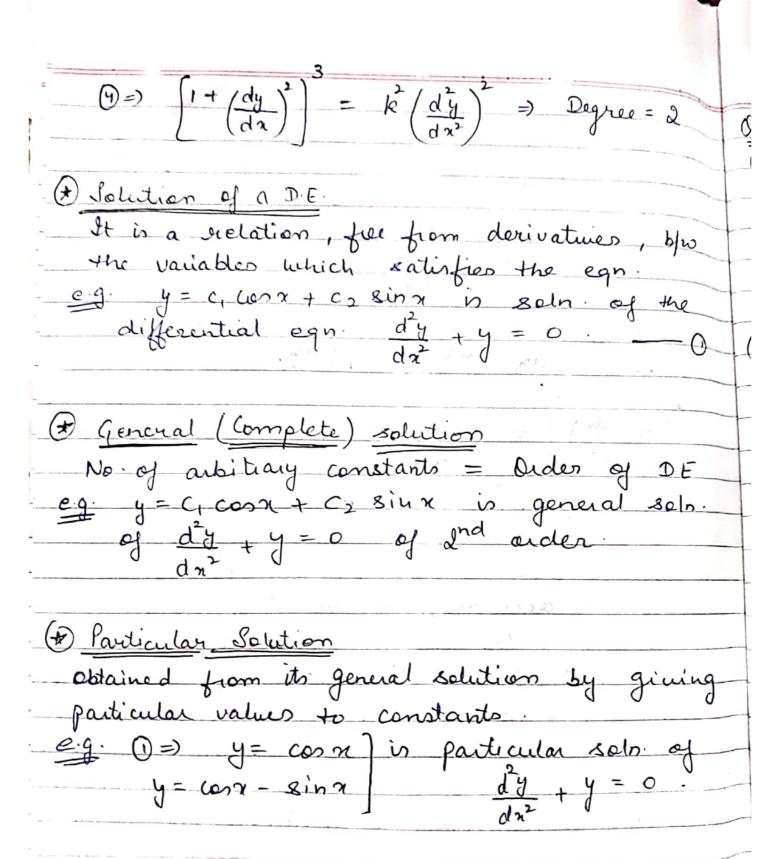
radicals of fractions as far as the

derivatives are concerned.

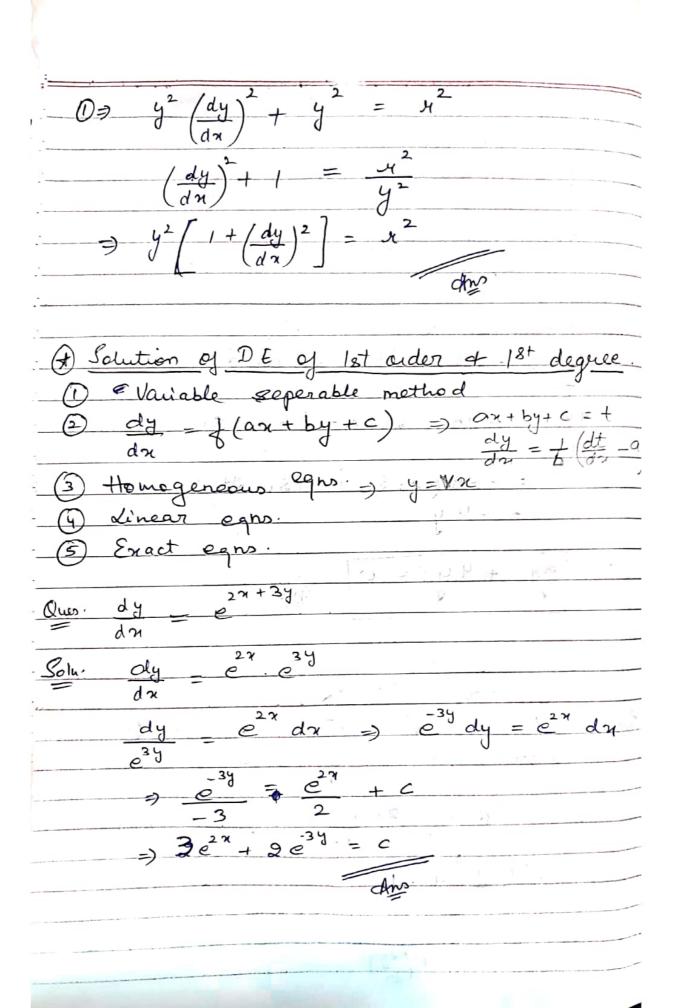
e.g. (1) + (3) are of degree one.

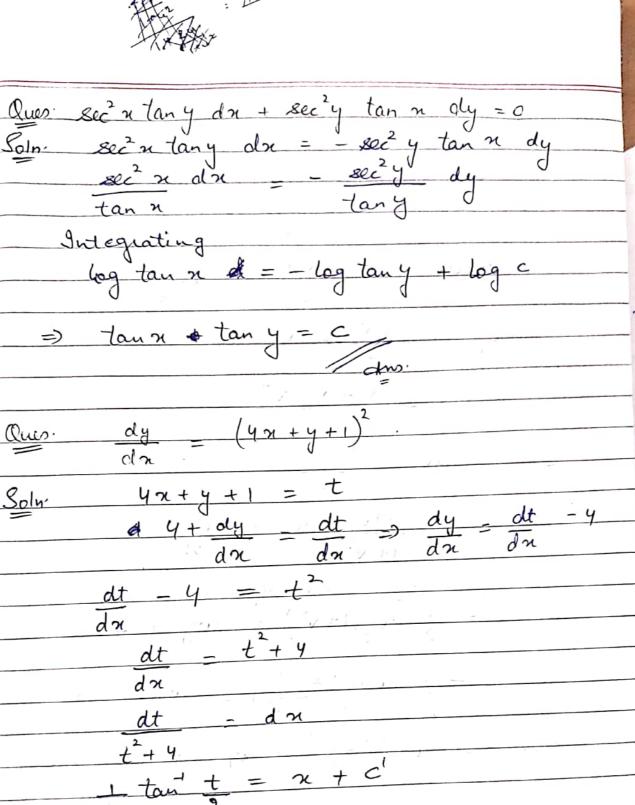
(2) y dy = n (dx) + C = Degree = 2

dn



Obtain the differential egns: = A con 2t + B sin 2t





 $\frac{dt}{t^2 + 4}$   $\frac{1}{2} tan^{\frac{1}{2}} t = x + c^{\frac{1}{2}}$   $\frac{1}{2} tan^{\frac{1}{2}} (4x + 4 + 1) = 2x + c$   $\frac{1}{2} tan^{\frac{1}{2}} (4x + 4 + 1) = 2x + c$ 

=> 4n+y+1 = 2tan (2n+c)

dus.

Ques: (x+y) dx + (y-x) dy = 0.
Soln: dy = x+4
da n-y
Put y= vx = dy = v + x dv
dn dn
(1=) V+2 dV _ 21+V2 _ 1+V
dn n-vn 1-v
x dv 1+V - V
dn 1-V
1+1-1+12
1 - V.
1-V dv = dx
$1+v^2$
dv = 1
1+12 2 1+12 21
Integrating, we get to 1 y - 1 log(1+v²) = log x + C
$\frac{1}{100} \frac{1}{100} \frac{1}$
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
$\frac{\tan^2 4 - \log(1 + 4^2)}{2} = \log x + c$
$\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = \frac{1}{2} = \frac{1}{2} + \frac{1}{2} = \frac{1}{2} = \frac{1}{2} + \frac{1}{2} = \frac{1}$
$\tan^2 \frac{y}{2} - \frac{1}{2} \log (x^2 + y^2) + \log x = \log x + C$
7 2 2
tan = 1 log (x +y) + C
dns:
CH!

(A) Exact Differential Egn.
A D.E. of the form Mdx + Ndy = 0 is s.t.b
exact if it can be obtained directly
by differentiating the egn. u(n,y)=c
which is its perimitive i.e. it
du - Mdx + Ndy
where M and N are Jns. of x 4 y.
Thm: - The necessary and sufficient condition
by the differential egn. Herritage
to be exact is $\partial M = \partial N$ .
Soln Necessay Condition on  No will be exact
The egn. 19an + 1vag
if du = Mdn + Ndy.
D
But $du = \frac{\partial u}{\partial x} dx + \frac{\partial u}{\partial y} dy$
$\frac{1}{2}$
$\frac{\partial u}{\partial x} = \frac{M}{\partial y} = \frac{\partial u}{\partial y} = \frac{\partial u}{\partial y}$
3 AN 24
$\Rightarrow \frac{\partial M}{\partial y} = \frac{\partial u}{\partial y} \Rightarrow \frac{\partial u}{\partial x} = \frac{\partial u}{\partial y} = \frac{\partial u}{\partial x} $
$\frac{1}{2}$
Since du - au andy dy dx
24 2 2
which is the oregot necessary condition.
which or it

Sufficient Condition
$\frac{1}{2y} = \frac{2N}{2x}$
24 24
TP Mdox + Ndy = 0 is exact.
_
det u = Mdn
$det u = \int M dn$ $y constl$
$M = \frac{\partial u}{\partial x} \qquad q \qquad \frac{\partial u}{\partial y \partial x} = \frac{\partial M}{\partial y}$
$=) M = \frac{\partial u}{\partial x} \qquad \frac{\partial u}{\partial y \partial x} = \frac{\partial M}{\partial y}$
Since 24 - 24
Since $\frac{\partial^2 u}{\partial y \partial x} = \frac{\partial^2 u}{\partial x \partial y}$
$\frac{\partial M}{\partial x} = \frac{\partial^2 u}{\partial x^2}$
dy dxdy
<del>-</del>
Abo DM DN
2M - 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
an andy
Integrating with & keeping y constl.
megante just
$N = \partial u + f(y)$
$N = \frac{\partial u}{\partial y} + \frac{1}{2} \left( \frac{u}{2} \right)$
· Mdn + Ndy = du dx + du dy + f(y) dy
$\frac{\partial u}{\partial x} + N dy = \frac{\partial u}{\partial x} dx + \frac{\partial u}{\partial y} dy + \frac{\partial u}{\partial y} dy$
- du +d ft(y) dy
$= d \left[ u + \int f(y) dy \right]$
Line on count dill one
which is an exact diff. egn.  Max + N dy = 0 is exact.  Hence objected:
Here prened.

