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## TOPIC 8 DIFFERENTIAL EQUATIONS SCHEMATIC DIAGRAM

|  | (ii).General and particular <br> solutions of a differential <br> equation | $* *$ | Ex. 2,3 pg384 |
| :---: | :---: | :---: | :--- |
|  | (iii).Formation of differential <br> equation whose general <br> solution is given | $*$ | Q. 7,8,10 pg 391 |
| (iv).Solution of differential <br> equation by the method of <br> separation of variables | $*$ | Q.4,6,10 pg 396 |  |
| (vi).Homogeneous differential <br> equation of first order and <br> first degree | $* *$ | Q. 3,6,12 pg 406 |  |
| (vii)Solution of differential <br> equation of the type <br> dy/dx +py=q where p and q <br> are functions of x <br> And solution of differential <br> equation of the type <br> dx/dy+px=q where p and q <br> are functions of y | $* * *$ | Q.4,5,10,14 pg 413,414 |  |

## SOME IMPORTANT RESULTS/CONCEPTS

** Order of Differential Equation: Order of the heighest order derivative of the given differential equation is called the order of the differential equation.
** Degree of the Differential Equation:Heighest power of the heighest order derivative when powers of all the derivatives are of the given differential equation is called the degree of the differential equatin
** Homogeneou s Differential Equation : $\frac{d y}{d x}=\frac{f_{1}(x, y)}{f_{2}(x, y)}$, where $f_{1}(x, y) \& f_{2}(x, y)$ be the homogeneou s function of same degree.
** Linear Differential Equation :
i. $\frac{d y}{d x}+p y=q$, where $p \& q$ be thefunction of $x$ or constant.

Solution of theequation is : y. $\mathrm{e}^{\int \mathrm{pdx}}=\int \mathrm{e}^{\int \mathrm{pdx}} \cdot \mathrm{qdx}$, where $\mathrm{e}^{\int \mathrm{pdx}}$ is Integrating Factor (I.F.)
ii. $\frac{d x}{d y}+p x=q$, where $p \& q$ be the function of $y$ or constant.

Solution of theequation is: $\mathrm{x} . \mathrm{e}^{\int \mathrm{pdy}}=\int \mathrm{e}^{\int \text { pdy }} . q$ dy , where $\mathrm{e}^{\int \mathrm{pdy}}$ is Integrating Factor (I.F.)

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## ASSIGNMENTS

## 1. Order and degree of a differential equation <br> LEVEL I

1. Write the order and degree of the following differential equations
(i) $\left(\frac{d^{2} y}{d x^{2}}\right)^{2}+\left(\frac{d y}{d x}\right)^{3}+2 y=0$

## 2. General and particular solutions of a differential equation

## LEVEL I

1. Show that $y=e^{-x}+a x+b$ is the solution of $e^{x} \frac{d^{2} y}{d x^{2}}=1$

## 3. Formation of differential equation

## LEVEL II

1. Obtain the differential equation by eliminating $a$ and $b$ from the equation $y=e^{x}(a \cos x+b \sin x)$

## LEVEL III

1. Find the differential equation of the family of circles $(x-a)^{2}-(y-b)^{2}=r^{2}$
2. Obtain the differential equation representing the family of parabola having vertex at the origin and axis along the positive direction of x -axis

## 4. Solution of differential equation by the method of separation of variables

## LEVEL II

1. Solve $\frac{d y}{d x}=1+x+y+x y$
2. Solve $\frac{d y}{d x}=e^{-y} \cos x$ given that $\mathrm{y}(0)=0$.
3. Solve $\left(1+x^{2}\right) \frac{d y}{d x}-x=\tan ^{-1} x$
5.Homogeneous differential equation of first order and first degree

## LEVEL II

1. Solve $\left(x^{2}+x y\right) d y=\left(x^{2}+y^{2}\right) d x$

## LEVEL III

Show that the given differential equation is homogenous and solve it.

$$
\text { 1. }(x-y) \frac{d y}{d x}=x+2 y
$$

$$
\text { 2. } y d x+x \log \left(\frac{y}{x}\right) d y-2 x d y=0
$$

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3.Solve $x d y-y d x=\sqrt{x^{2}-y^{2}} d x$
4.Solve $x^{2} y d x-\left(x^{3}+y^{3}\right) d y=0$
5.Solve $x d y-y d x=\sqrt{\left(x^{2}+y^{2}\right)} d x$ CBSE2011 6.Solve $\quad\left(\mathrm{y}+3 \mathrm{x}^{2}\right) \frac{d x}{d y}=\mathrm{x}$
7. Solve $x d y+\left(y-x^{3}\right) d x=0$ CBSE2011 8.Solve $x d y+\left(y+2 x^{2}\right) d x=0$

## 6. Linear Differential Equations

## LEVEL I

1.Find the integrating factor of the differential $x \frac{d y}{d x}-y=2 x^{2}$

## LEVEL II

1. Solve $\frac{d y}{d x}+2 y \tan x=\sin x$
2. Solve $(1+x) \frac{d y}{d x}-y=e^{3 x}(x+1)^{2}$
3. Solve $x \frac{d y}{d x}+y=x \log x$

## LEVEL III

1. Solve $\frac{d y}{d x}=\cos (x+y)$
2. Solve $x^{2} \frac{d y}{d x}=y(x+y)$
2.Solve $y e^{y} d x=\left(y^{3}+2 x^{y}\right) d y$
3. Solve $\frac{d y}{d x}+\frac{4 x}{x^{2}+1} y=-\frac{1}{\left(x^{2}+1\right)^{3}}$
4. Solve the differential equation $\left(x+2 y^{2}\right) \frac{d y}{d x}=y$;given that when $\mathrm{x}=2, \mathrm{y}=1$

## Questions for self evaluation

1. Write the order and degree of the differential equation $\left(\frac{d^{3} y}{d y^{3}}\right)^{2}+\frac{d^{2} y}{d x^{2}}+\sin \left(\frac{d y}{d x}\right)=0$
2. Form the differential equation representing the family of ellipses having foci on x -axis and centre at origin .
3. Solve the differential equation : $\left(\tan ^{-1} y-x\right) d y=\left(1+y^{2}\right) d x$, given that $y=0$ when $x=0$.
4. Solve the differential equation : $x d y-y d x=\sqrt{x^{2}+y^{2}} d x$
5. Solve the differential equation: $x \log x \frac{d y}{d x}+y=\frac{2}{x} \log x$.
6. Solve the differential equation $: x^{2} d y+\left(y^{2}+x y\right) d x=0, \quad y(1)=1$
7. Show that the differential equation $2 y . e^{\frac{x}{y}} d x+\left(y-2 x e^{\frac{x}{y}}\right) d y=0$ is homogeneous andfind its particular solution given that $\mathrm{y}(0)=1$.
8. Find the particular solution of differential equation

$$
\frac{d y}{d x}+y \cot x=2 x+x^{2} \cot x, \text { given that } y\left(\frac{\pi}{2}\right)=0
$$

