Assignment No.1 2413FEB2T1 : Engineering Mathematics-2
Topic: Differential Equations of First Degree First Order

Problems on Exact Differential Equation

1. Solve $(tany + x)dx + (xsec^2y - 3y)dy = 0$
2. Solve $[1 + log(xy)]dx + (1 + \frac{x}{y})dy = 0$
3. Solve $\frac{dy}{dx} + \frac{ycosx + siny + y}{sinx + xcosy + x} = 0$
4. Solve $[y(1 + \frac{1}{x}) + cosy]dx + (x + logx - xsiny)dy = 0$
5. Solve $\frac{dy}{dx} = \frac{y + 1}{(y + 2)e^y - x}$
6. Solve $\frac{dy}{dx} = \frac{tany - 2xy - y}{x^2 - xtan^2y + sec^2y}$

Problems on Rule 1

If $Mdx + Ndy = 0$ **is given DE and** $\frac{\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}}{N} = f(x)$ **then** $IF = e^{\int f(x)dx}$

1. Solve $(2x\,logx - xy)dy + 2y\,dx = 0$
2. Solve $(xy^2 - e^{\frac{1}{x^3}})dx - x^2y\,dy$
3. Solve $xsinx\,dy + [y(xcosx - sinx) - 2]dx = 0$
4. Solve $(x^3e^x - my^2)\,dx + m\,xy\,dy = 0$

Problems on Rule 2

If $Mdx + Ndy = 0$ **is given DE and** $\frac{\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y}}{M} = f(y)$ **then** $IF = e^{\int f(y)dy}$

1. Solve $(2xy^4e^y + 2xy^3 + y)dx + (x^2y^4e^y - x^2y^2 - 3x)dy = 0$
2. Solve $(\frac{y}{x}secy - tany)dx + (secylogx - x)dy = 0$
3. Solve $(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0$
4. Solve $(2xy^2 - y)dx + xdy = 0$

Problems on Rule 3

If the equation is of the form $f_1(xy)ydx + f_2(xy)xdy = 0$ **and** $Mx - Ny \neq 0$ **then** $\frac{1}{Mx - Ny}$ **is an integrating factor**

1. Solve $y(xy + 2x^2y^2)dx + x(xy - x^2y^2)dy = 0$

2. Solve $y(x^2y^2+2)dx+x(2-2x^2y^2)dy=0$
3. Solve $\frac{dy}{dx}=-\frac{x^2y^3+2y}{2x-2x^3y^2}$
4. Solve $(y-xy^2)dx-(x+x^2y)dy=0$
5. Solve $(y(xy-2x^2y^2)dx+x(xy+x^2y^2)dy=0$

Problems on Rule 4
If the Equation $Mdx+Ndy=0$ **is homogenous and** $Mx+Ny\neq 0$ **then** $\frac{1}{Mx+Ny}$ **is an Integrating Factor**

1. Solve $(x^2+y^2)dx-(x^2+xy)dy=0$
2. Solve $(x^2y-2xy^2)dx-(x^3-3x^2y)dy=0$
3. Solve $(x^2-xy+y^2)dx-xydy=0$
4. Solve $(x^4+y^4)dx-xy^3dy=0$

Problems on Linear Differential Equation

1. Solve $\frac{dy}{dx}+\frac{2x}{x^2+1}y=\frac{4x}{x^2+1}$
2. Solve $sin2x\frac{dy}{dx}=y+tanx$
3. Solve $cosx\frac{dy}{dx}+ysinx=secx$
4. Solve $(1-x^2)\frac{dy}{dx}+2xy=x\sqrt{1-x^2}$
5. Solve $(1+y^2)dx=(e^{tan^{-1}y}-x)dy$

Problems on reducible to Linear Differential Equation

1. Solve $\frac{dy}{dx}+xsin2y=x^3cos^2y$
2. Solve $\frac{dy}{dx}=e^{x-y}(e^x-e^y)$
3. Solve $\frac{dy}{dx}-\frac{tany}{1+x}=(1+x)e^xsecy$
4. Solve $3y^2\frac{dy}{dx}+2y^3x=4x^3e^{x^2}$

Problems on Bernoulliś Linear Differential Equation

1. Solve $x\frac{dy}{dx}+y=x^3y^6$

2. Solve $\frac{dz}{dx} + \frac{z}{x} logz = \frac{z}{x^2}(logz)^2$
3. Solve $\frac{dr}{d\theta} = rtan\theta - \frac{r^2}{cos\theta}$
4. Solve $\frac{dy}{dx} + \frac{2}{x}y = \frac{y^3}{x^3}$
5. Solve $\frac{dy}{dx} = x^3y^3 - xy$
6. Solve $\frac{dx}{dy} = x^3y^3 - xy$