Gautam Buddha University

Engineering Mathematics-III (MA-201)
Second semester (2016-2017)

Tutorial Sheet-2

Differential Equation Reducible to Separable Form, Exact Differential equation.

Q. 1 Solve the following differential equations by first reducing to separable form:

(a) $\cos(x+y)dy = dx$

(b) $\dfrac{dy}{dx} = \cos(x+y) + \sin(x+y)$

(c) $\sin^{-1}(\dfrac{dy}{dx}) = x + y$

(d) $\log(\dfrac{dy}{dx}) = ax + by$

(e) $\dfrac{dy}{dx} = e^{x+y},\ y(1) = 1.$

(f) $\dfrac{dy}{dx} = \sin^2(x - y + 1)$

(g) $x + y\dfrac{dy}{dx} = 2y,$

(h) $\dfrac{x-2y}{2x-y} + \dfrac{dy}{dx} = 0,$

(i) $(x^2 - y^2)dx + 2xydy = 0,$

(j) $(x^2 + y^2)dx + 2xydy = 0,$

(k) $x\dfrac{dy}{dx} + \dfrac{y^2}{x} = x.$

(l) $\dfrac{dy}{dx} = \dfrac{y}{x} + \tan\dfrac{y}{x}$

(m) $\dfrac{dy}{dx} = \dfrac{y - x + 1}{y + x + 5},$

(n) $\dfrac{2x - y + 1}{x + 2y - 3} - \dfrac{dy}{dx} = 0,$

(o) $\dfrac{dy}{dx} = \dfrac{x + y + 4}{x + y - 6},$

Q. 2 Find the equation of the curve that passes through the point $(1, 2)$ and has slope at any point (x, y)

$$\frac{dy}{dx} = -\frac{2xy}{x^2 + 1}$$

Q. 3 Check whether the following differential equations are exact or not if happen to be exact then find their general solution:

(a) $(x + \dfrac{2}{y})dy + ydx = 0$

(b) $(y + y\cos xy)dx + (x + x\cos xy)dy = 0$

(c) $(\sin x \sin y - xe^y)dy = (e^y + \cos x \cos y)dx$

(d) $(2xy^4 + \sin y)dx + (4x^2y^3 + x\cos y)dy = 0$

(e) $2x(1 + \sqrt{x^2 - y})dx = (\sqrt{x^2 - y})dy$

Q. 4 Define an integrating factor. Show that the $M(x, y)dx + N(x, y)dy = 0$ always has an IF $\mu(x, y)$ if it has a general solution. Moreover in this case there are infinitely many IFs.

Q. 5 Under what conditions, the differential equation $(ax + by)dx + (kx + ly)dy$ is exact? Hence solve the exact equation.