Q1 *Does a given differential equation have always a solutionover an interval?*

Q2 *Is it possible for a differential equation tohave more than one dependent variable?*

Q3 *Show that every function of the form* $y = \frac{1}{x} e^{cx}$ *where c is a constant is a solution of the differential equation* $xy' + y - y \ln(xy) = 0$ *for all* $x \neq 0$.

Q4 *How to interpret the differential equation*

$$\frac{dy}{dt} = 0.028y - 10.$$

Q5*Eliminate the constant a from the equation* $(x-a)^2 + y^2 = a^2$

Q6 *Eliminate* α *and* β *from the relation* $x = \beta \cos(\omega t + \alpha)$,*in which* ω *is a parameter (not to be eliminate).*

Q7 *Solve the following differential equations:*

1) $ydx - xdy = xydx.$

2) $(x + y)(dx - dy) = dx + dy.$

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

4) $3e^x \tan ydx + (1 - e^x) \sec^2 ydy = 0.$

Q8 *Suppose that* $\frac{dy}{dx} = g(\frac{y}{x})$*, derive a formula for solving this type of differential equation.*

Q9 *Solve the following differential equations:1)* $xydx + (x^2 + y^2)dy = 0.$

2) $(x^2 + xy + y^2)dx - xydy = 0.$

3) $y' = \frac{x+y}{x-y}.$

4) $\frac{dy}{dx} = \frac{xe^{y/x}+y}{x}.$

5) $(2x \sinh(\frac{y}{x}) + 3y \cosh(\frac{y}{x}))dx - 3x \cosh(\frac{y}{x})dy = 0.$

Q10*Solve the following differential equations:1)* $(y - 2)dx - (x - y - 1)dy = 0.$

2) $(x - 4y - 9)dx + (4x + y - 2)dy = 0.$

3) $(x + y - 1)dx + (2x + 2y + 1)dy = 0.$

Q11*Solve the following differential equations:*

1) $(\cos x \cos y - \cot x)dx - \sin x \sin ydy = 0.$

2) $2xydx + (x^2 + 1)dy = 0$.

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

4) $y' = (xy^2 - 1)/(1 - x^2y)$.

Q12 *Give an example of a differential equation for which adegree is not defined.*

Q13 *Solve the following differential equations (Find the gen-eral solution of the following):*

1) $y\frac{dx}{dy} + 2x = y^3$.

2) $x\frac{dy}{dx} + y = x$.

3) $y' + \tan(x)\, y = \cos^2(x)$, *over the interval* $-\frac{\pi}{2} < x < \frac{\pi}{2}$.

4) $3xy' - y = \ln(x) + 1$, $x > 0$ *satisfying* $y(1) = -2$.

Q 14 *Solve the following differential equations:1)*

$y(6y^2 - x - 1)dx + 2xdy = 0$.

2) $\frac{dy}{dx} + y = (xy)^2$.

3) $xy - \frac{dy}{dx} = y^3e^{-x^3}$.

Q15 *Solve the following differential equations:*

1) $\frac{dy}{dx} = -\frac{x^2+2xy+y^2}{1+(x+y)^2}$.

2) $\frac{dy}{dx} - (3x - 2y)^3 = 0$.