

ELIMINATION OF ARBITRARY CONSTANTS AND FAMILY OF CURVES

**CHAPTER 1**  
**ELIMINATION OF ARBITRARY CONSTANTS**

1.  $x^2 - 2x^2y + c$   
 $2x^2dx - 2x^2dy - 2y(2x)dx + c = 0$   
 $2x^2dx - 4xydx - 4x^2ydy + c = 0$   
 divide by  $2x^2$   
 $dx - 2ydx - 2y^2dy + \frac{c}{x^2} = 0$   
 $\therefore (x - 2y^2)dx - 2y^2dy + \frac{c}{x^2} = 0$  ans.

2.  $y \sin x - xy^2 + c$   
 $y(\cos x dx) + (\sin x dy - xy^2 dy) + c = 0$   
 $y(\cos x dx + \sin x dy - xy^2 dy) + c = 0$   
 ans.

3.  $x^2y + 1 + c$   
 $x^2dy + 2xydx + c = 0 + c$   
 divide by  $dx$   
 $x^2 \frac{dy}{dx} + 2xy + c = 0$   
 substitute  
 $x^2y = 1 + x^2 \frac{dy}{dx} + 2xy$   
 $x^2y dx = dx + x^2 dy + 2xy dx$   
 $dx + x^2 dy + 2xy dx - x^2y dx = 0$   
 $\therefore dx + x^2 dy + xy dx = 0$  ans.

4.  $cy^2 + x^2y$   
 $\frac{x^2y}{y^2} + c$   
 $\frac{x^2(dx + ydy) - (x^2y)dy}{(y^2)^2} = 0$   
 $2xy^2dx + x^2y^2dy - 2xy^2dy - x^2ydy = 0$   
 divide by  $y$   
 $2xydx + x^2ydy - 2xydy - x^2dy = 0$   
 $\therefore 2xydx - x^2dy = 0$  ans.

5.  $x = A \sin(\omega t + \phi)$  ;  $\omega$  &  $\phi$  are parameters not to be elim.  
 $\frac{dx}{dt} = A \omega \cos(\omega t + \phi)$   
 $\frac{d^2x}{dt^2} = -A \omega^2 \sin(\omega t + \phi)$   
 $= -A \omega^2 x$  (wt +  $\phi$ )  
 but  $x = A \sin(\omega t + \phi)$   
 $\frac{d^2x}{dt^2} = -\omega^2 x$   
 $\therefore \frac{d^2x}{dt^2} + \omega^2 x = 0$  ans.

6.  $x = C_1 \cos(\omega t) + C_2 \sin(\omega t)$   
 $\omega$  is a parameter.  
 $\frac{dx}{dt} = -C_1 \omega \sin(\omega t) + C_2 \omega \cos(\omega t)$   
 $\frac{d^2x}{dt^2} = -C_1 \omega^2 \cos(\omega t) - C_2 \omega^2 \sin(\omega t)$   
 $= -\omega^2 (C_1 \cos(\omega t) + C_2 \sin(\omega t))$   
 $= -\omega^2 x$   
 $\therefore \frac{d^2x}{dt^2} + \omega^2 x = 0$  ans.

7.  $y = C_1 e^{2t} + C_2 e^{-2t}$   
 $y' = 2C_1 e^{2t} - 2C_2 e^{-2t}$   
 $\therefore y y' = 2C_1^2 e^{4t} - 2C_2^2 e^{-4t}$  ans.

8.  $y = C_1 e^{\frac{1}{2}t} + C_2 e^{-\frac{1}{2}t}$  ;  $\omega$  is a parameter, to be eliminated.  
 $y' = \frac{1}{2}C_1 e^{\frac{1}{2}t} - \frac{1}{2}C_2 e^{-\frac{1}{2}t}$   
 $\therefore y + 2y' = \frac{1}{2}C_1 e^{\frac{1}{2}t}$  ans.

9.  $y^2 = 4ax$   
 $2y dy = 4a dx$   
 $\therefore 2y = \frac{d(y^2)}{dx}$   
 substitute  
 $y^2 = \left(\frac{d(y^2)}{dx}\right) x$   
 $y^2 dx = x dy^2$   
 $\therefore y^2 dx - x dy^2 = 0$  ans.

10.  $y = Ax^2 + Bx + C$   
 $y' = 2Ax + B$   
 $y'' = 2A$   
 $y'' = 0$  ans.

# Rainville Solution Manual

**Christian Drosten**



## **Rainville Solution Manual:**

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with Differential Equations in Chemical Engineering covers the modelling of rate processes of engineering in terms of differential equations While it includes the purely mathematical aspects of the solution of differential equations the main emphasis is on the derivation and solution of major equations of engineering and applied science Methods of solving differential equations by analytical and numerical means are presented in detail with many solved examples and problems for solution by the reader Emphasis is placed on numerical and computer methods of solution A key chapter in the book is devoted to the principles of mathematical modelling These principles are applied to the equations in important engineering areas The major disciplines covered are thermodynamics diffusion and mass transfer heat transfer fluid dynamics chemical reactions and automatic control These topics are of particular value to chemical engineers but also are of interest to mechanical civil and environmental engineers as well as applied scientists The material is also suitable for undergraduate and beginning graduate students as well as for review by practising engineers *Subject Guide to Books in Print* ,1971

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The book delves into Rainville Solution Manual. Rainville Solution Manual is an essential topic that needs to be grasped by everyone, from students and scholars to the general public. This book will furnish comprehensive and in-depth insights into Rainville Solution Manual, encompassing both the fundamentals and more intricate discussions.

1. The book is structured into several chapters, namely:
  - Chapter 1: Introduction to Rainville Solution Manual
  - Chapter 2: Essential Elements of Rainville Solution Manual
  - Chapter 3: Rainville Solution Manual in Everyday Life
  - Chapter 4: Rainville Solution Manual in Specific Contexts
  - Chapter 5: Conclusion
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