

ELIMINATION OF ARBITRARY CONSTANTS AND FAMILY OF CURVES

CHAPTER 1
ELIMINATION OF ARBITRARY CONSTANTS

1. $x^2 - 2x^2y + c$
 $2x^2y - 2x^2y - 2y(2x^2y) = c$
 $2x^2y - 4x^2y - 4xy^2 = 2x^2y + c$
 divide by $2x$
 $x - 2y^2x - 2y = 0$
 $\therefore (x - 2y^2)x - 2y = 0$ ans.

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

3. $x^2y + 1 + c$
 $x^2y + 2xy dx = 0 + c dx$
 divide by dx
 $\frac{d^2y}{dx^2} + 2xy = c$

substitute
 $x^2y = 1 + x^2 \frac{dy}{dx} + 2xy$
 $x^2y = 1 + x^2 \frac{dy}{dx} + 2xy$
 $x^2 y dx + dx + x^2 dy + 2xy dx = c dx$
 $dx + x^2 dy + 2xy dx = c dx$
 $\therefore (x^2y + 1) dx + x^2 dy = 0$ ans.

4. $cy^2 + x^2y$
 $\frac{x^2y}{y^2} = c$
 $\frac{x^2(dx + y dy) - (x^2)dy}{(y^2)^2} = 0$
 $2xy^2 dx + x^2 dy - 2x^2 dy - 2y^3 dy = 0$
 divide by y
 $2xy dx + x^2 dy - 2x^2 dy - 2y^2 dy = 0$
 $\therefore 2xy dx - 2x^2 dy + 2y^2 dy = 0$
 ans.

5. $x = A \sin(\omega t + \phi)$; ω & ϕ are parameters not to be elim.
 $\frac{dx}{dt} = A \omega \cos(\omega t + \phi)$
 $\frac{d^2x}{dt^2} = -A \omega^2 \sin(\omega t + \phi)$
 $= -A \omega^2 x$
 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. $x = C_1 \cos(\omega t) + C_2 \sin(\omega t)$
 ω is a parameter.
 $\frac{dx}{dt} = -C_1 \omega \sin(\omega t) + C_2 \omega \cos(\omega t)$
 $\frac{d^2x}{dt^2} = -C_1 \omega^2 \cos(\omega t) - C_2 \omega^2 \sin(\omega t)$
 $= -\omega^2 (C_1 \cos(\omega t) + C_2 \sin(\omega t))$
 $\frac{d^2x}{dt^2} = -\omega^2 x$
 $\therefore \frac{d^2x}{dt^2} + \omega^2 x = 0$ 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. $y = C_1 e^{\frac{x}{2}}$; C_1 is a parameter, to be eliminated.
 $y' = \frac{1}{2} C_1 e^{\frac{x}{2}} \therefore \omega = y'$
 $\therefore y + 2y' = \frac{y}{y'}$ ans.

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

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

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Karin Nielsen-Saines



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Ordinary Differential Equations and Their Solutions George Moseley Murphy, 2011-01-01 This treatment presents most of the methods for solving ordinary differential equations and systematic arrangements of more than 2 000 equations and their solutions The material is organized so that standard equations can be easily found Plus the substantial number and variety of equations promises an exact equation or a sufficiently similar one 1960 edition The American Mathematical Monthly, 1981 Linear Differential Equations and Oscillators Luis Manuel Braga da Costa Campos, 2019-11-05 Linear Differential Equations and Oscillators is the first book within Ordinary Differential Equations with Applications to Trajectories and Vibrations Six volume Set As a set they are the fourth volume in the series Mathematics and Physics Applied to Science and Technology This first book consists of chapters 1 and 2 of the fourth volume The first chapter covers linear differential equations of any order whose unforced solution can be obtained from the roots of a characteristic polynomial namely those i with constant coefficients ii with homogeneous power coefficients with the exponent equal to the order of derivation The method of characteristic polynomials is also applied to iii linear finite difference equations of any order with constant coefficients The unforced and forced solutions of i ii iii are examples of some general properties of ordinary differential equations The second chapter applies the theory of the first chapter to linear second order oscillators with one degree of freedom such as the mechanical mass damper spring force system and the electrical self resistor capacitor battery circuit In both cases are treated free undamped damped and amplified oscillations also forced oscillations including beats resonance discrete and continuous spectra and impulsive inputs Describes general properties of differential and finite difference equations with focus on linear equations and constant and some power coefficients Presents particular and general solutions for all cases of differential and finite difference equations Provides complete solutions for many cases of forcing including resonant cases Discusses applications to linear second order mechanical and electrical oscillators with damping Provides solutions with forcing including resonance using the characteristic polynomial Green s functions trigonometrical series Fourier integrals and Laplace transforms **Notices of the American Mathematical Society** American Mathematical Society, 1981 **Catalog of Copyright Entries. Third Series** Library of Congress. Copyright Office, 1967 Includes Part 1 Number 1 Books and Pamphlets Including Serials and Contributions to Periodicals January June *Low Back Pain* Ali Asghar Norasteh, 2012-05-09 This book includes two sections Section one is about basic science epidemiology risk factors and evaluation section two is about clinical science especially different approach in exercise therapy I envisage that this book will provide helpful information and guidance for all those practitioners involved with managing people with back pain physiotherapists osteopaths chiropractors and doctors of orthopedics rheumatology rehabilitation and manual medicine Likewise for students of movement and those who are involved in re educating movement exercise physiologists Pilates and yoga teachers etc **Modeling with Differential Equations in Chemical Engineering** Stanley M. Walas, 1991 Modelling

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