



First Order & First Degree ODE - II

Detailed Course on Differential Equation for IIT JAM' 23 - II



Gajendra Purohit

Legend in CSIR-UGC NET & IIT-JAM

- Unlock Code : GPSIR ~ PhD, CSIR NET (Maths) | Youtuber(800K+165K Sub.)/Dr.Gajendra Purohit (Maths), 17+ Yr. Experience, Author

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CRACK IIT JAM IN FIRST ATTEMPT

Total applicants last 3 years

Approx. 12000 to 14000

EXAM PATTERN

MARKS DISTRIBUTION

SECTION-A:-MCQ	MARKS	NEGATIVE MARKS
Total 30 Questions		
SECTION-A:-MCQ	10 questions x 1 marks each = 10 marks	1/3rd for 1 mark question
	20 questions x 2 marks each = 40 marks	2/3rd for 2 mark question
Total 10 Questions		
SECTION-B:-MSQ	2 marks each	No negative marking
	10 x 2 = 20 marks	No partial marking
Total 20 Questions		
SECTION-C:-CAT	10 questions x 1 marks each = 10 marks	No negative marking
	10 questions x 2 marks each = 20 marks	No partial marking

Total Marks - 100

IIT JAM LAST 3 YEAR CUT OFFs

MATHEMATICS

Test Paper(s)	Number of Appeared Candidates	IIT JAM Cutoffs Marks		
		Gen.	OBC (NCL) EWS	SC/ST Pwd
2021	13186	24.69	22.22	12.35
2020	14374	33.65	30.29	16.82
2019	12863	22.96	20.66	11.48

PREPARATION STRATEGY

SUBJECT	LAST 3 YEARS AVERAGE MARKS
Real Analysis	21 Marks
Abstract Algebra	10 Marks
Calculus of Single Variable	18 Marks
Calculus of Two-Variable	14 Marks
Vector Calculus	14 Marks
Differential Equation	11 Marks

STRATEGY

PART A	PART B	PART C
$5 \times 1 = 5$ marks		$5 \times 1 = 5$ marks
$8 \times 2 = 16$ marks	$4 \times 2 = 8$ marks	$4 \times 2 = 8$ marks
Total = 21 Marks	Total = 8 Marks	Total = 13 Marks
Total = 21+8+13 = 42		

IIT JAM

How to Prepare?

When to Start?



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1. **Linear differential equation** : A differential equation is called linear if
 - (i) All derivative and dependent variable is of degree one.
 - (ii) There is no product of derivative and dependent variable.
2. **Non-linear differential equation** : A differential equation which is not linear is called non-linear differential equation.

Note: A differentiable equation is non – linear if it contain $\sin y$, $\cos y$, e^y etc. where y is dependent variable

- Q1.** The differential equation $\frac{d^2y}{dx^2} + \frac{dy}{dx} + \sin y = 0$ is
- (a) linear
 - (b) nonlinear
 - (c) Order 3
 - (d) of degree 2

Q2. The differential equation $\frac{d^2y}{dx^2} + (x^2 + 4x)\frac{dy}{dx} + y = x^8 - 8$

is

- (a) Partial differential equation
- (b) nonlinear
- (c) second order linear
- (d) linear

Q3. The differential equation representing the family of circles touching y-axis at the origin is [IIT: JAM-2006]

- (a) Linear and of first order
- (b) Linear and of second order
- (c) Nonlinear and of first order
- (d) Nonlinear and of second order

Solution of DE : Let $f(x, y, y', \dots, y^{(n)})$ be the n^{th} order

linear differential equation then $\phi(x)$ is the solution of the
DE if

- (i) $\phi, \phi', \dots, \phi^{(n)}$ exists.
- (ii) $\phi(x)$ satisfy the DE i.e. $f(x, \phi, \phi', \phi'', \dots, \phi^{(n)}) = 0$

Q.4. Let $y(x)$ be the solution of DE $y' = y^2 + t$, then

- (a) y is thrice differentiable but 3rd order does not exist.
- (b) y is thrice differentiable but higher order derivative does not exist.
- (c) y is infinite time differentiable.
- (d) None of these

General Solution : A solution of DE in which number of arbitrary constant is equal to the order of DE is called general solution.

Particular Solution : A solution of the DE obtain from general solution by taking some particular value of arbitrary constant is called particular solution (there are always infinite particular solution).

TARGETED AUDIENCE

- IIT-JAM
- M.Sc. Entrance Exam

COMPLETE COURSE ON

MATHEMATICS

FOR IIT-JAM 2022

TOPICS TO BE COVERED

- REAL ANALYSIS
- FUNCTION OF ONE & TWO VARIABLE
- LINEAR ALGEBRA
- MODERN ALGEBRA

TOPICS TO BE COVERED

- SEQUENCE & SERIES
- INTEGRAL CALCULUS
- VECTOR CALCULUS
- DIFFERENTIAL EQUATION

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Singular Solution : A solution of DE which is neither general solution nor is particular solution is called singular solution.

Q.6. The number of arbitrary constant in the complete primitive of the differential equation

$$\phi(x, y, dy/dx, d^5y/dx^5)$$

- (a) 1
- (b) 2
- (c) 5
- (d) 4

Q.7. If $f(x)$ and $g(x)$ are two solutions of the

differential equation $\left(a \frac{d^2y}{dx^2} + x^2 \frac{dy}{dx} + y = e^x \right)$,

then $f(x) - g(x)$ is the solution of :

(a) $a^2 \frac{d^2y}{dx^2} + x^2 \frac{dy}{dx} + y = e^x$

(b) $a^2 \frac{d^2y}{dx^2} + y = 0$

(c) $a^2 \frac{d^2y}{dx^2} + x^2 \frac{dy}{dx} + y = 0$

(d) $a \frac{d^2y}{dx^2} + y = 0$

Methods of solving differential equation

Variable separable method

The equation of this type can be put in the form

$$f(x)dx + g(y)dy = 0$$

Integrating both sides, we get the solution

$$\int f(x)dx + \int g(y)dy = C$$

Equation Reducible into Separable Form

If $\frac{dy}{dx} = f(ax + by + c)$, then substitute $u = ax + by + c$ and

corresponding reduced differential equation is

$a + bf(u) = \frac{du}{dx}$ and solution is given by

$$\int \frac{du}{a + bf(u)} = \int dx + c$$

Q.8. The solution of $\frac{dy}{dx} - y^2 = 1$ satisfying the condition

$y(0) = 1$ is

(a) $y = e^{x^2}$

(b) $y = \sqrt{x}$

(c) $y = \cot\left(x + \frac{\pi}{4}\right)$

(d) $y = \tan\left(x + \frac{\pi}{4}\right)$

Q9. If y is the solution of the differential equation

$y^3 \frac{dy}{dx} + x^3 = 0$, $y(0) = 1$, the value of $y(-1)$ is

- (a) -2
 - (b) 1
 - (c) 0
 - (d) 1

Q. 9. Match each differential equation in Group I to its family solution curves from Group II

Group I

A. $\frac{dy}{dx} = \frac{y}{x}$

B. $\frac{dy}{dx} = -\frac{y}{x}$

C. $\frac{dy}{dx} = \frac{x}{y}$

D. $\frac{dy}{dx} = -\frac{x}{y}$

Group II

1. Circles

2. Straight lines

3. Hyperbola

(a) A-2 ,B-3 ,C-3 ,D-1

(b) A-1 ,B-3 ,C-2 ,D-1

(c) A-2 ,B-1 ,C-3 ,D-3

(d) A-3 ,B-2 ,C-1 ,D-2

Q10. Let $y(x)$ be the solution of the differential equation

$$\frac{d}{dx} \left(x \frac{dy}{dx} \right) = x; \quad y(1) = 0, \quad \left. \frac{dy}{dx} \right|_{x=1} = 0. \text{ Then } y(2) \text{ is}$$

[IIT-JAM: 2016]

(a) $\frac{3}{4} + \frac{1}{2} \ln 2$

(b) $\frac{3}{4} - \frac{1}{2} \ln 2$

(c) $\frac{3}{4} + \ln 2$

(d) $\frac{3}{4} - \ln 2$



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Educator highlights

- 📍 Works at Pacific Science College
- 📍 Studied at M.Sc., NET, PhD(Algebra), MBA(Finance), BEd
- 📍 PhD, NET | Plus Educator For CSIR NET | Youtuber (260K+Subs.) | Director Pacific Science College |
- 📍 Lives in Udaipur, Rajasthan, India
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