

Questions

For CRT - 14

BY O.P. GUPTA

Max. Marks : 30

INDIRA AWARD WINNER

Time : 60 Minutes

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Topics : Application Of Integrals & Differential Equation

Advanced MATH Classes, 1st Floor (Above Burger Shop), Opp. HP Petrol Pump, Thana Road, Najafgarh.

- Q01. (a) Write the order and degree (if defined) of $t = y \frac{dy}{dt} + \sqrt{a^2 \left(\frac{dy}{dt}\right)^2 + b^2}$:
- (b) Write the order and degree (if defined) of $\left\{1 + \left(\frac{dy}{dx}\right)^2\right\}^{3/4} = \left\{\frac{d^2y}{dx^2}\right\}^{1/3}$.
- (c) What is the differential equation corresponding to the family of curves $y = k(x - k)^2$?
- (d) What is the order and degree of the differential equation of all the parabolas having their axis of symmetry coinciding with the y-axis and vertex at origin?
- Q02. Find the particular solution of $\ln\left(\frac{dy}{dx}\right) = 4x + 3y$, $y(0) = 0$.
- Q03. Find the “area function” of the region : $\{(x, y) : |x + 2| \leq y \leq \sqrt{20 - x^2}\}$. [4×3=12]
- Q04. Find the “area function” of region : $\{(x, y) : 0 \leq y \leq x^2 + 3, 0 \leq y \leq 2x + 3, 0 \leq x \leq 3\}$.
- Q05. Make a rough sketch of the region $y = 1 + |x + 1|$, $|x| = 3$ and $y = 0$. Using integrals, find the area of the region bounded.
- Q06. If a triangular field is bounded by lines $x + 2y = 2$, $y - x = 1$ and $2x + y = 7$. Use integrals to compute the area of the field.
- OR Find the area of circle $x^2 + y^2 = 16$ which is exterior to the parabola $y^2 = 6x$. [6×3=18]

INDIRA Award Winner O.P. Gupta is author of several popular books on Mathematics for Classes 12th & 11th. These can be bought at webstore www.iMathematicia.com.

Solutions Of CRT-14

Q01. (a) Order : 1, Degree : 2.

(b) Order : 2, Degree : 4.

(c) See **Mathematicia** by **O.P. Gupta**

(d) Equation of parabola : $x^2 = ky \Rightarrow \frac{x^2}{y} = k$

$$\Rightarrow \frac{y(2x) - x^2 \frac{dy}{dx}}{y^2} = 0 \quad \therefore x \frac{dy}{dx} = 2y \text{ is the diff. eq.}$$

So, order : 1, degree : 1.

Q02. Use $\ln\left(\frac{dy}{dx}\right) = 4x + 3y \Rightarrow \frac{dy}{dx} = e^{4x+3y} = e^{4x} \times e^{3y}$

$$\Rightarrow \int e^{-3y} dy = \int e^{4x} dx \Rightarrow -\frac{1}{3}e^{-3y} = \frac{1}{4}e^{4x} + C.$$

$$\text{As } y(0) = 0, \text{ so } -\frac{1}{3} \times 1 = \frac{1}{4} \times 1 + C \Rightarrow C = -\frac{7}{12}$$

\therefore required solution is $3e^{4x} + 4e^{-3y} = 7$.

Q03. See **Mathematicia** by **O.P. Gupta**

Q04. See **Mathematicia** by **O.P. Gupta**

Q05. See **Mathematicia** by **O.P. Gupta**

Q06. See **Mathematicia** by **O.P. Gupta**

OR See **Mathematicia** by **O.P. Gupta**.

❖ Dear Student/Teacher,

I would urge you for a little favour. Please notify me about any error (s) which you notice in this (or other Maths) work. It would be beneficial for all the future learners of Maths like us. Any constructive criticism will be well acknowledged.

Please find below my contact info. when you decide to offer me your valuable suggestions.

I'm looking forward for a response.

Apart from this, I would wish if you inform your friend/students about my efforts for Maths so that they may also be benefitted.

Let's learn Maths with smile :-)

☞ For any clarification(s), please contact :

O.P. Gupta, Math Mentor

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