

- 1) The differential equations satisfied by the system of parabolas $y^2 = 4a(x + a)$ is :
[Mar-2021]
- $y\left(\frac{dy}{dx}\right) + 2x\left(\frac{dy}{dx}\right) - y = 0$
 - $y\left(\frac{dy}{dx}\right)^2 + 2x\left(\frac{dy}{dx}\right) - y = 0$
 - $y\left(\frac{dy}{dx}\right)^2 - 2x\left(\frac{dy}{dx}\right) - y = 0$
 - $y\left(\frac{dy}{dx}\right)^2 - 2x\left(\frac{dy}{dx}\right) + y = 0$
- 2) The number of integral values of m so that the abscissa of point of intersection of lines $3x + 4y = 9$ and $y = mx + 1$ is also an integer, is: [Mar-2021]
- 3
 - 2
 - 1
 - 0
- 3) Let $(1 + x + 2x^2)^0 = a_0 + a_1x + a_2x^2 + \dots + a_{40}x^{40}$. Then $a_1 + a_3 + a_5 + \dots + a_{37}$ is equal to : [Mar-2021]
- $2^{20}(2^{20} - 21)$
 - $2^{19}(2^{20} - 21)$
 - $2^{19}(2^{20} + 21)$
 - $2^{20}(2^{20} + 21)$
- 4) The solutions of the equation
- $$\begin{vmatrix} 1 + \sin^2 x & \sin^2 x & \sin^2 x \\ \cos^2 x & 1 + \cos^2 x & \cos^2 x \\ 4 \sin 2x & 4 \sin 2x & 1 + 4 \sin 2x \end{vmatrix} = 0$$
- , $(0 < x < \pi)$, are: [Mar-2021]
- $\frac{\pi}{6}, \frac{5\pi}{6}$
 - $\frac{7\pi}{12}, \frac{11\pi}{12}$
 - $\frac{5\pi}{12}, \frac{7\pi}{12}$
 - $\frac{\pi}{12}, \frac{\pi}{6}$
- 5) Choose the correct statement about two circles whose equations are given below:
 $x^2 + y^2 - 10x - 10y + 41 = 0$
 $x^2 + y^2 - 22x - 10y + 137 = 0$ [Mar-2021]
- circles have no meeting point
 - circles have two meeting points
 - circles have only one meeting point
 - circles have the same centre

- 6) Let α, β, γ be the roots of the equation, $x^3 + ax^2 + bx + c = 0$, ($a, b, c \in R$ and a, b and $a, b \neq 0$). The system of equations (in u, v, w) given by $\alpha u + \beta v + \gamma w = 0$; $\beta u + \gamma v + \alpha w = 0$; $\gamma u + \alpha v + \beta w = 0$ has non-trivial solutions, then the value of $\frac{a^2}{b}$ is [Mar-2021]

- a) 5
- b) 1
- c) 0
- d) 3

- 7) The integral $\int \frac{(2x-1) \cos \sqrt{(2x-1)^2 + 5}}{\sqrt{4x^2 - 4x + 6}} dx$ is equal to (where c is a constant of integration) [Mar-2021]

- a) $\frac{1}{2} \sin \sqrt{(2x+1)^2 + 5} + c$
- b) $\frac{1}{2} \sin \sqrt{(2x-1)^2 + 5} + c$
- c) $\frac{1}{2} \cos \sqrt{(2x+1)^2 + 5} + c$
- d) $\frac{1}{2} \cos \sqrt{(2x-1)^2 + 5} + c$

- 8) The equation of one of the straight lines which passes through the point $(1, 3)$ and makes an angles $\tan^{-1}(\sqrt{2})$ with the straight line, $y + 1 = 3\sqrt{2}x$ is [Mar-2021]

- a) $4\sqrt{2}x + 5y - (15 + 4\sqrt{2}) = 0$
- b) $5\sqrt{2}x + 4y - (15 + 4\sqrt{2}) = 0$
- c) $4\sqrt{2}x + 5y - 4\sqrt{2} = 0$
- d) $4\sqrt{2}x - 5y - (5 + 4\sqrt{2}) = 0$

- 9) If $\lim_{x \rightarrow 0} \frac{\sin^{-1} x - \tan^{-1} x}{3x^3}$ is equal to L , then the value of $(6L + 1)$ is [Mar-2021]

- a) $\frac{1}{6}$
- b) $\frac{1}{2}$
- c) 6
- d) 2

- 10) A vector \mathbf{a} has components $3p$ and 1 with respect to a rectangular Cartesian system. This system is rotated through a certain angle about the origin in the counterclockwise sense. If with respect to the new system, \mathbf{a} has components $p + 1$ and $\sqrt{10}$, then a value of p is equal to: [Mar-2021]

- a) 1
- b) -1
- c) $\frac{4}{5}$
- d) $-\frac{5}{4}$

- 11) If the equation $a|z|^2 + \bar{\alpha}z + \alpha\bar{z} + d = 0$ represents a circle where a, d are real constants then which of the following conditions are correct? [Mar-2021]

- a) $|\alpha|^2 - ad \neq 0$
- b) $|\alpha|^2 - ad > 0$ and $a \in R - \{0\}$
- c) $\alpha = 0, a, d \in R^+$
- d) $|\alpha|^2 - ad \geq 0$ and $a \in R$

- 12) For the four circles M, N, O and P , following four equations are given :

Circle M : $x^2 + y^2 = 1$

Circle N : $x^2 + y^2 - 2x = 0$

Circle O : $x^2 + y^2 - 2x - 2y + 1 = 0$

Circle P : $x^2 + y^2 - 2y = 0$

If the centre of circle M is joined with the centre of circle N , further the centre of circle N is joined with centre of circle O , centre of circle O is joined with centre of circle P and lastly, centre of circle P is joined with centre of circle M , then these lines form the sides of a : [Mar-2021]

- a) Rhombus
- b) Square
- c) Rectangle
- d) Parallelogram

- 13) If α, β are natural numbers such that $100^\alpha - 199\beta = (100)(100) + (99)(101) + (98)(102) + \dots + (1)(199)$, then the slope of the line passing through (α, β) and origin is: [Mar-2021]

- a) 510
- b) 550
- c) 540
- d) 530

- 14) The real-valued function $f(x) = \frac{\operatorname{cosec}^{-1} x}{\sqrt{x - [x]}}$, where $[x]$ denotes the greatest integer less than or equal to x , is defined for all x belonging to : [Mar-2021]

- a) all non- integers except the interval $[-1, 1]$
- b) all integers except $0, -1, 1$
- c) all reals except integers
- d) all reals except the interval $[-1, 1]$

- 15) $\frac{1}{3^2-1} + \frac{1}{5^2-1} + \frac{1}{7^2-1} + \dots + \frac{1}{201^2-1}$ is equal to : [Mar-2021]

- a) $\frac{101}{404}$
- b) $\frac{101}{408}$
- c) $\frac{400}{25}$
- d) $\frac{25}{101}$