03-17-2021 SHIFT-1-1-15

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1) Which of the following is true for $y(x)$ that satisfies the differential equation $\left(\frac{dy}{dx}\right) = xy - 1 + x - y; y(0) = 0$
   a) $y(1) = 1$
   b) $y(1) = e^{\frac{1}{2}} - 1$
   c) $y(1) = e^{\frac{1}{2}} - e^{\frac{-1}{2}}$
   d) $y(1) = e^{\frac{-1}{2}} - 1$

2) The system of equations $kx + y + z = 1, x + ky + z = k$ and $x + y + zk = k^2$ has no solution if k is equal to
   a) -2
   b) -1
   c) 1
   d) 0

3) The value of $4 + \frac{1}{5+\frac{1}{4+\frac{1}{5+\frac{1}{4+\ldots\infty}}}}$
   a) $2 + \left(\frac{4}{\sqrt{5}}\right)\left(\sqrt{30}\right)$
   b) $4 + \left(\frac{4}{\sqrt{5}}\right)\left(\sqrt{30}\right)$
   c) $2 + \left(\frac{2}{5}\right)\left(\sqrt{30}\right)$
   d) $5 + \left(\frac{2}{5}\right)\left(\sqrt{30}\right)$

4) If the Boolean expression $(p \implies q) \Leftrightarrow (q * (\sim p))$ is a tautology, then the Boolean expression $p * (\sim q)$ is equivalent to:
   a) $p \implies \sim q$
   b) $p \implies q$
   c) $q \implies p$
   d) $\sim q \implies p$

5) Choose the incorrect statement about the two circles whose equations are given below: $x^2 + y^2 - 10x - 10y + 41 = 0$ and $x^2 + y^2 - 16x - 10y + 80 = 0$
   a) Distance between two centres is the average radii of both the circles
   b) Circles have two intersection points
   c) Both circles centres lie inside the region of one another
   d) Both circles pass through the centre of each other

6) The sum of possible values of x for $\tan^{-1}(x+1) + \cot^{-1}\left(\frac{1}{(x-1)}\right) = \tan^{-1}\left(\frac{8}{31}\right)$ is:
   a) $-\frac{33}{4}$
   b) $-\frac{32}{4}$
   c) $-\frac{31}{4}$
   d) $-\frac{30}{4}$

7) Let $\mathbf{a} = 2i - 3j + 4k, \mathbf{b} = 7i + j - 6k$. If $\mathbf{r} \times \mathbf{a} = \mathbf{r} \times \mathbf{b}, \mathbf{r}.(i + 2j + k) = -3$, then $\mathbf{r}.(2i - 3j + k) =$ is equal to
   a) 10
   b) 13
   c) 12
   d) 8

8) The equation of the plane which contains the $y - axis$ and passes through the point $(1, 2, 3)$ is:
   a) $3x + z = 6$
   b) $3x - z = 0$
   c) $x + 3z = 10$
   d) $x + 3z = 0$

9) If $A = \begin{pmatrix} 0 & \sin\alpha \\ \sin\alpha & 0 \end{pmatrix}$ and $\det\left(A^2 - \left(\frac{1}{2}\right)I\right) = 0$,then a possible value of a is:
   a) $\frac{\pi}{6}$
   b) $\frac{\pi}{2}$
   c) $\frac{\pi}{3}$
   d) $\frac{\pi}{4}$

10) The line $2x - y + 1 = 0$ is a tangent to the circle at the point $(2, 5)$ and the centre of the circle lies on $x - 2y = 4$. Then, the radius of the circle is:
   a) $4\sqrt{5}$
   b) $3\sqrt{5}$
   c) $5\sqrt{3}$
   d) $5\sqrt{4}$

11) Team **A** consists of 7 boys and n girls and Team **B** has 4 boys and 6 girls. If a total of 52 single matches can be arranged between these two teams when a boy plays against a boy and a girl plays against a girl, then n is equal to
   a) 5
   b) 6
   c) 2
   d) 4

12) In a triangle PQR, the coordinates of the points P and Q are $(-2, 4)$ and $(4, -2)$ respectively. If the equation of the perpendicular bisector of PR is $2x - y + 2 = 0$, then the centre of the circumcircle of the $\triangle PQR$ is:
   a) $(-2, -2)$
   b) $(0, 2)$
   c) $(-1, 0)$
   d) $(1, 4)$

13) If $\cot^{-1}(a) = \cot^{-1}(2) + \cot^{-1}(8) + \cot^{-1}(18) + \cot^{-1}(32) \ldots$ upto 100 terms, then a is:
   a) 1.03
   b) 1.00
   c) 1.01
   d) 1.01

14) Which of the following statements is incorrect for the function $g(a)$ for $a \in \mathbf{R}$ such that $g(a) = \int_{\frac{\pi}{3}}^{\frac{\pi}{6}} \frac{\sin^a x}{(\cos^a x + \sin^a x)} dx$
   a) $g(a)$ is a strictly decreasing function
   b) $g(a)$ has an inflexion point a $a = \frac{-1}{2}$
   c) $g(a)$ is an even function
   d) $g(a)$ is a strictly increasing function

15) If the fourth term in the expansion of $\left(x + x^{\log_2 x}\right)^7$ is 4480, then the value of x where $x \in N$ is equal to:
   a) 4
   b) 3
   c) 2
   d) 1