25th June, 2022
Shift-2

EE24BTECH11063 - Y.Harsha Vardhan Reddy

SINGLE CORRECT

1) Let $A = \{x \in R : |x+1| < 2\}$ and $B = \{x \in R : |x-1| \geq 2\}$. Then which one of the following statements is **NOT** true?

a) $A - B = (-1, 1)$

b) $B - A = R - (-3, 1)$

c) $A \cap B = (-3, -1]$

d) $A \cup B = R - [1, 3)$

2) Let $a, b \in R$ be such that the equation $ax^2 - 2bx + 15 = 0$ has a repeated root α. If α and β are the roots of the equation $x^2 - 2bx + 21 = 0$, then $\alpha^2 + \beta^2$ is equal to:

a) 37

b) 58

c) 68

d) 92

3) Let z_1 and z_2 be two complex numbers such that $\bar{z_1} = i\bar{z_2}$; and $arg\left(\frac{z_1}{z_2}\right) = \pi$. Then

a) $argz_2 = \frac{\pi}{4}$

b) $argz_2 = -\frac{3\pi}{4}$

c) $argz_1 = \frac{\pi}{4}$

d) $argz_1 = -\frac{3\pi}{4}$

4) The system of equations

$$\begin{aligned} -kx + 3y - 14z &= 25 \\ -15x + 4y - kz &= 3 \\ -4x + y + 3z &= 4 \end{aligned}$$

is consistent for all k in the set

a) R

b) $R - \{-11, 13\}$

c) $R - \{13\}$

d) $R - \{-11, 11\}$

5) $\lim\limits_{x \to 0} \left(\tan^2 x \left(\left(2\sin^2 x + 3\sin x + 4\right)^{\frac{1}{2}} - \left(\sin^2 x + 6\sin x + 2\right)^{\frac{1}{2}}\right)\right)$

a) $\frac{1}{12}$

b) $-\frac{1}{18}$

c) $-\frac{1}{12}$

d) $\frac{1}{6}$

6) The area of the region enclosed between the parabolas $y^2 = 2x - 1$ and $y^2 = 4x - 3$

a) $\frac{1}{3}$ b) $\frac{1}{6}$ c) $\frac{2}{3}$ d) $\frac{3}{4}$

7) The coefficient of x^{101} in the expression

$$(5+x)^{500} + x(5+x)^{499} + x^2(5+x)^{498} + \cdots + x^{500}, x > 0$$

is

a) ${}^{501}C_{101}(5)^{399}$ b) ${}^{501}C_{101}(5)^{400}$ c) ${}^{501}C_{100}(5)^{400}$ d) ${}^{500}C_{101}(5)^{399}$

8) The sum $1 + 2.3 + 3.3^2 + \cdots + 10.3^9$ is equal to :

a) $\frac{2.3^{12}+10}{4}$ b) $\frac{19.3^{10}+1}{4}$

c) $5.3^{10} - 2$ d) $\frac{9.3^{10}+1}{2}$

9) Let P be the plane passing through the intersection of the planes $\vec{r} \cdot \left(\hat{i} + 3\hat{j} - \hat{k}\right) = 5$ and $\vec{r} \cdot \left(2\hat{i} - \hat{j} + \hat{k}\right) = 3$, and the point $(2, 1, -2)$. Let the position vectors of the points X and Y be $\hat{i} - 2\hat{j} + 4\hat{k}$ and $5\hat{i} - \hat{j} + 2\hat{k}$ respectively. Then the points
a) X and $X + Y$ are on the same side of P
b) Y and $Y - X$ are on the opposite sides of P
c) X and Y are on the opposite sides of P
d) $X + Y$ and $X - Y$ are the same side of P

10) A circle touches both the y-axis and the line $x + y = 0$. Then the locus of it's centre is :

a) $y = \sqrt{2}x$ b) $x = \sqrt{2}y$

c) $y^2 - x^2 = 2xy$ d) $x^2 - y^2 = 2xy$

11) Water is being filled at the rate of 1 cm^3/sec in a right circular conical vessel(vertex downwards) of height 35 cm and diameter 14 cm. When the height of the water level is 10cm, the rate (in cm^2/sec) at which the wet conical surface area of the vessel increase is

a) 5 b) $\frac{\sqrt{21}}{5}$ c) $\frac{\sqrt{26}}{5}$ d) $\frac{\sqrt{26}}{10}$

12) If $b_n = \int_0^{\frac{\pi}{2}} \frac{\cos^2 nx}{\sin x}\, dx\ n \in N$, then
a) $b_3 - b_2, b_4 - b_3, b_5 - b_4$ are in A.P. with common difference -2
b) $\frac{1}{b_3-b_2}, \frac{1}{b_4-b_3}, \frac{1}{b_5-b_4}$ are in A.P. with common difference 2
c) $b_3 - b_2, b_4 - b_3, b_5 - b_4$ are in G.P.
d) $\frac{1}{b_3-b_2}, \frac{1}{b_4-b_3}, \frac{1}{b_5-b_4}$ are in A.P. with common difference -2

13) If $y = y(x)$ is the solution of the differential equation $2x^2\frac{dy}{dx} - 2xy + 3y^2 = 0$ such that $y(e) = \frac{e}{3}$, then y(1) is equal to

a) $\frac{1}{3}$ b) $\frac{2}{3}$ c) $\frac{3}{2}$ d) 3

14) If the angle made by the tangent at the point (x_0, y_0) on the curve

$$x = 12\,(t + \sin t \cos t)\,,$$
$$y = 12\,(1 + \sin t)^2\,, 0 < t < \frac{\pi}{2}$$

with the positive x-axis is $\frac{\pi}{3}$, then y_0 is equal to:

a) $6\left(3 + 2\sqrt{2}\right)$ b) $3\left(7 + 4\sqrt{3}\right)$

c) 27 d) 48

15) The value of $2\sin(12°) - \sin(72°)$ is:

a) $\frac{\sqrt{5}(1-\sqrt{3})}{4}$ b) $\frac{1-\sqrt{5}}{8}$

c) $\frac{\sqrt{3}(1-\sqrt{5})}{2}$ d) $\frac{\sqrt{3}(1-\sqrt{5})}{4}$