25-07-2021 Shift-1

EE24BTECH11032- John Bobby

1) A spherical gas balloon of radius 16 meter subtends an angle 60° at the eye of the observer A while the angle of elevation of its center from the eye of A is 75°. Then the height (in meter) of the top most point of the balloon from the level of the observers eye is:
   a) $8\left(2+2\sqrt{3}+\sqrt{2}\right)$
   b) $8\left(\sqrt{6}+\sqrt{2}+2\right)$
   c) $8\left(\sqrt{2}+2+\sqrt{3}\right)$
   d) $8\left(\sqrt{6}-\sqrt{2}+2\right)$
2) Let $f(x)=3\sin^4 x+10\sin^3 x+6\sin^2 x-3,\ x\in\left[\frac{-\pi}{6},\frac{\pi}{2}\right]$. Then f is:
   a) increasing in $\left(\frac{-\pi}{6},\frac{\pi}{2}\right)$
   b) decreasing in $\left(0,\frac{\pi}{2}\right)$
   c) increasing in $\left(\frac{-\pi}{6},0\right)$
   d) decreasing in $\left(\frac{-\pi}{6},0\right)$
3) Let S_n be the sum of first n terms of an arithmetic progression. If $S_{3n}=3S_{2n}$, then the value of $\frac{S_{4n}}{S_{2n}}$ is:
   a) 6
   b) 4
   c) 2
   d) 8
4) The locus of the centroid of the triangle formed by any point P on the hyperbola $16x^2-9y^2+32x+36y-164=0$, and its foci is:
   a) $16x^2-9y^2+32x+36y-36=0$
   b) $9x^2-16y^2+36x+32y-144=0$
   c) $16x^2-9y^2+32x+36y-144=0$
   d) $9x^2-16y^2+36x+32y-36=0$
5) Let the vectors $(2+a+b)\hat{i}+(a+2b+c)\hat{j}-(b+c)\hat{k}$, $(1+b)\hat{i}+2b\hat{j}-b\hat{k}$ and $(2+b)\hat{i}+2b\hat{j}+(1-b)\hat{k}$ a,b,c $\in \mathbf{R}$ be co-planar. Then which of the following is true?
   a) $2b=a+c$
   b) $3c=a+b$
   c) $a=b+2c$
   d) $2a=b+c$
6) Let f:$\mathbf{R}\to\mathbf{R}$ be defined as
   $$f(x)=\begin{cases}\frac{\lambda\left|x^2-5x+6\right|}{\mu\left(5x-x^2-6\right)}, & x<2\\ e^{\frac{\tan(x-2)}{x-\lceil x\rceil}}, & x>2\\ \mu, & x=2\end{cases}$$
   where $\lceil x\rceil$ is the greatest integer less than or equal to x. If f is continuous at $x=2$, Then $\lambda+\mu$ equal to:
   a) e$(-e+1)$
   b) e$(e-2)$

c) 1
d) 2e-1

7) The value of the definite integral
$\int_{\frac{\pi}{24}}^{\frac{5\pi}{24}} \frac{dx}{1+\sqrt[3]{\tan 2x}}$ is:
a) $\frac{\pi}{3}$
b) $\frac{\pi}{6}$
c) $\frac{\pi}{12}$
d) $\frac{\pi}{18}$

8) If b is very small as compared to the value of a, so that the cube and other higher powers of $\frac{b}{a}$ can be neglected in the identity
$\frac{1}{a-b} + \frac{1}{a-2b} + \frac{1}{a-3b} \ldots. + \frac{1}{a-nb} = \alpha n + \beta n^2 + \gamma n^3$, then the value of γ is:
a) $\frac{a^2+b}{3a^3}$
b) $\frac{a+b}{3a^2}$
c) $\frac{b^2}{3a^3}$
d) $\frac{a+b^2}{3a^3}$

9) Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx} = 1 + xe^{y-x}, -\sqrt{2} < x < \sqrt{2}, y(0) = 0$ then, the minimum value of $y(x), x \in \left(-\sqrt{2}, \sqrt{2}\right)$ is equal to:
a) $\left(2 - \sqrt{3}\right) - log_e 2$
b) $\left(2 + \sqrt{3}\right) + log_e 2$
c) $\left(1 + \sqrt{3}\right) - log_e \left(\sqrt{3} - 1\right)$
d) $\left(1 - \sqrt{3}\right) - log_e \left(\sqrt{3} - 1\right)$

10) The Boolean expression
$(p \implies q) \wedge (q \implies \sim p)$ is equivalent to:
a) ~q
b) q
c) p
d) ~p

11) The area (in sq. units) of the region, given by the set $\left\{(x, y) \in \mathbf{RxR} | x \geq 0, 2x^2 \leq y \leq 4 - 2x\right\}$ is
a) $\frac{8}{3}$
b) $\frac{17}{3}$
c) $\frac{13}{3}$
d) $\frac{7}{3}$

12) The sum of all values of x in $[0, 2\pi]$, for which $\sin x + \sin 2x + \sin 3x + \sin 4x = 0$, is equal to:
a) 8π
b) 11π
c) 12π
d) 9π

13) Let g:$\mathbf{N} \to \mathbf{N}$ be defined as
$g(3n + 1) = 3n + 2$
$g(3n + 2) = 3n + 3$
$g(3n + 3) = 3n + 1$, for all $n \geq 0$.
Then whcih of the following statements is true?
a) There exist an onto function f:$\mathbf{N} \to \mathbf{N}$ such that fog=f
b) There exist a one-one function f:$\mathbf{N} \to \mathbf{N}$ such that fog=f
c) gogog=g

d) There exists a function f:$\mathbf{N} \rightarrow \mathbf{N}$ such that gof=f

14) Let f: $[0\ ,\infty) \rightarrow\ [0\ ,\infty)$ be defined as $f\,(x) = \int_0^x \lceil y \rceil\, dy$
where $\lceil x \rceil$ is the greatest integer less then or equal to x.Which of the following is true?

a) f is continuous at every point in $[0\ ,\infty)$ and differentiable except at the integer points.
b) f is both continuous and differentiable except at integer points in $[0\ ,\infty)$.
c) f is continuous everywhere except at the integer points in $[0\ ,\infty)$.
d) f is differentiable at every point in $[0\ ,\infty)$.

15) The values a and b, for which the system of equations
$2x + 3y + 6z = 8$
$x + 2y + az = 5$
$3x + 5y + 9z = b$
has no solution, are:

a) $a = 3, b \neq 13$
b) $a \neq 3, b \neq 3$
c) $a \neq 3, b = 3$
d) $a = 3, b = 13$