Section - C
MATHEMATICS

Q.1 Let $A\left(\alpha, \frac{1}{\alpha}\right), B\left(\beta, \frac{1}{\beta}\right), C\left(\gamma, \frac{1}{\gamma}\right)$ be the bertices of a ΔABC, where α, β are the toots of the equation $x^2 - 6P_1x + 2 = 0$; β, γ are the roots of the equation $x^2 - 6P_2x + 3 = 0$ and γ, α are the roots of the equation $x^2 - 6P_3x + 6 = 0$, P_1, P_2 and P_3 being positive then the coordinate of the centroid of ΔABC is :

(a) $\left(1, \frac{11}{18}\right)$ (b) $\left(0, \frac{11}{18}\right)$ (c) $\left(2, \frac{11}{18}\right)$ (d) **None of these**

Q.2 If all the permutations of the letters in the word **OBJECT** are arranged in alphabetiical order as in dictionary. The **717** word is :

(a) **TJOECB** (b) **TOJECB** (c) **TOJCBE** (d) **None of these**

Q.3 The value of $\sum_{r=0}^{10} r\, {}^{10}C_r\, 3^r (-2)^{10-r}$ is :

(a) **20** (b) **10** (c) **300** (d) **30**

Q.4 The total number of ways of selecting two numbers from the set **{1, 2, 3, 4, ... 3n}** so that their sum is divisible by **3** :

(a) $\frac{2n^2 - n}{2}$ (b) $\frac{3n^2 - n}{2}$ (c) $2n^2 - n$ (d) $3n^2 - n$

Q.5 The total number of orderd pair **(x , y)** satisfying $|x| + |y| = 4, \sin\left(\frac{\pi x^2}{3}\right) = 1$ is equal to :

(a) **2** (b) **3** (c) **4** (d) **5**

Q.6 Let **P(n)** be the statement $2^n < n!$ where n is a natural number, then **P (n)** is true for :

(a) **all n** (b) **all n > 2** (c) **all n > 3** (d) **None of these**

Q.7 There a point **A 100 meter** east of a tower. From **'A'** at **50 m** distance towards **S 30° E** is point **B**. Angle of elevation of top of tower from **'B'** is **30°**, then **h** is :

(a) $\frac{100}{\sqrt{3}}$ (b) $\frac{100\sqrt{7}}{\sqrt{3}}$ (c) $\frac{50\sqrt{7}}{\sqrt{3}}$ (d) $\frac{50}{\sqrt{3}}$

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Q.8 The Mean deviation about A.M. of the numbers **3, 4, 5, 6, 7** is :

(a) **25** (b) **5** (c) **1.2** (d) **0**

Q.9 If $|\mathbf{cosec\ x}| = \frac{5\pi}{4} + \frac{x}{2}$ for $x \in (-2\pi, \pi)$ then the number of solutions is :

(a) **8** (b) **7** (c) **6** (d) **5**

Q.10 The most general solution of the equations **tan θ = – 1, cosq = 1 / √2** is :

(a) $n\pi + 7\pi/4$ (b) $n\pi + (-1)^n \frac{7\pi}{4}$

(c) $2n\pi + \frac{7\pi}{4}$ (d) **None of these**

Q.11 If **tan β = 2 sin α, sin γ, cosec (α + γ)**, then **cot α, cot β, cot γ** are in :

(a) **A.P.** (b) **G.P.** (c) **H.P.** (d) **None of these**

Q.12 Let $\vec{a} = 3\hat{i} + 2\hat{j} + 2\hat{k}$ $b = \hat{i} + 2\hat{j} - 2\hat{k}$. Then a unit vector perpendicular to both $\vec{a} - \vec{b}$ and $\vec{a} + \vec{b}$ is :

(a) $\frac{-1}{3}\left(-2\hat{i} + 2\hat{j} + \hat{k}\right)$ (b) $\frac{1}{3}\left(-2\hat{i} + 2\hat{j} - \hat{k}\right)$ (c) $\frac{1}{3}\left(2\hat{i} - 2\hat{j} + \hat{k}\right)$ (d) $\frac{1}{3}\left(\hat{i} + \hat{j} + \hat{k}\right)$

Q.13 If **f (x)** and **g (x)** are differentiable functions for $0 \le x \le 1$ such that **f (0) = 2, g (0) = 0, f (1) = 6** and **g (1) = 2**, then in the interval **(0 , 1)** :

(a) **f (x) = 0 for all x** (b) **f′(x) = 2g′(x) for atleast one x**

(c) **f′(x) = 2g′(x) for atmost one x** (d) **None of these**

Q.14 $\int \frac{(x^2 - 1)dx}{(x^2 + 1)\sqrt{x^4 + 1}}$ is equal to :

(a) $\sec^{-1}\left(\frac{x^2 + 1}{\sqrt{2x}}\right) + c$ (b) $\frac{1}{\sqrt{2}}\sec^{-1}\left(\frac{x^2 + 1}{\sqrt{2x}}\right) + c$

(c) $\frac{1}{\sqrt{2}}\sec^{-1}\left(\frac{x^2 + 1}{\sqrt{2}}\right) + c$ (d) **None of these**

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Q.15 $\sin^{-1}\left[x\sqrt{1-x}-\sqrt{x}\sqrt{1-x^2}\right]$ is equal to :

(a) $\sin^{-1}x+\sin^{-1}\sqrt{x}$ (b) $\sin^{-1}x-\sin^{-1}\sqrt{x}$ (c) $\sin^{-1}\sqrt{x}-\sin^{-1}x$ (d) **None of these**

Q.16 Value of the integral $\int_2^8 \frac{[x^2]\,dx}{[x^2-20x+100]+[x^2]}$ where **[.]** denotes the greatest integer function :

(a) **5** (b) $\frac{5}{41}$ (c) **3** (d) **9**

Q.17 If $f(x)=\sqrt{1-\sqrt{1-x^2}}$ then at $x=0$:

(a) **f (x) is differentiable as well as continuous**
(b) **f (x) is differentiable but not continuous**
(c) **f (x) is continuous but not differentiable**
(d) **f (x) is neither continuous nor differentiable**

Q.18 The domain of defination of the function $f(x)=\sqrt{\log_{(x^2-1)}x}$ is :

(a) $(\sqrt{2},\infty)$ (b) $(0,\infty)$ (c) $(1,\infty)$ (d) **None of these**

Q.19 If $f(x)=(\cos x+i\sin x)(\cos 2x+i\sin 2x)(\cos 3x+i\sin 3x).....(\cos nx+i\sin nx)$ and $f(1)=1$ then $f'(1)$ is equal to :

(a) $\frac{n(n+1)}{2}$ (b) $\left[\frac{n(n+1)}{2}\right]^2$ (c) $-\left[\frac{n(n+1)}{2}\right]^2$ (d) **None of these**

Q.20 The value of **k** in $\lim_{x\to 0}\frac{(e^x-1)^4}{\sin\left(\frac{x^2}{k^2}\right)\log\left(1+\frac{x^2}{2}\right)}=8$ is :

(a) **1** (b) **–1** (c) **2** (d) **4**

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Q.21 If $\mathbf{bc+qr=ca+rp=ab+pq=-1}$ and $\mathbf{(abc\ ,\ pqr \neq 0)}$, then $\begin{vmatrix} \mathbf{ap} & \mathbf{a} & \mathbf{p} \\ \mathbf{bq} & \mathbf{b} & \mathbf{q} \\ \mathbf{cr} & \mathbf{c} & \mathbf{r} \end{vmatrix}$ is :

(a) **1** (b) **2** (c) **0** (d) **3**

Q.22 Consider the differential equation $\mathbf{\frac{dy}{dx}+y\tan x+1}$ then :

(a) **the curves satisfying the differential equation are given by y = x + c sinx**

(b) **The angle at which the curves cut the y-axis is π/2**

(c) **Tangent to all the curves at their point of intersection with y-axis are parallel**

(d) **None of these**

Q.23 If $\mathbf{f(0)=2,\ f'(x)\ ,\ g(x)=x+f(x)}$ then $\mathbf{\int_0^1 f(x)\,g(x)\,dx}$ is equal to :

(a) $\mathbf{e^2}$ (b) $\mathbf{2e^2}$ (c) $\mathbf{e}$ (d) $\mathbf{2e}$

Q.24 $\mathbf{\int 4\cos\left(x+\frac{\pi}{6}\right)\cos 2x.\cos\left(\frac{5\pi}{6}+x\right)dx}$

(a) $\mathbf{-\left(x+\frac{\sin 4x}{4}+\frac{\sin 2x}{2}\right)+c}$ (b) $\mathbf{-\left(x+\frac{\sin 4x}{4}-\frac{\sin 2x}{2}\right)+c}$

(c) $\mathbf{-\left(x-\frac{\sin 4x}{4}+\frac{\sin 2x}{2}\right)+c}$ (d) $\mathbf{-\left(x-\frac{\sin 4x}{4}+\frac{\cos 2x}{2}\right)+c}$

Q.25 If $\mathbf{f(x)=\frac{k\sin x+2\cos x}{\sin x+\cos x}}$ is strictly increasing for all **x** then :

(a) $\mathbf{k<2}$ (b) $\mathbf{k>2}$ (c) $\mathbf{k=2}$ (d) $\mathbf{k\in\phi}$

Q.26 Range of the function $\mathbf{f(x)=(\sin^{-1}x)^2+(\cos^{-1}x)^2}$ is :

(a) $\left[\frac{\pi^2}{8},\frac{5\pi^2}{4}\right]$ (b) $\left[\frac{\pi^2}{8},\frac{3\pi^2}{4}\right]$ (c) $\left[\frac{\pi^2}{8},\frac{\pi^2}{2}\right]$ (d) **None of these**

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Q.27 Let **A = {1, 2, 3, 4}** and **R** be a relation in **A** given by **R = {(1 , 1), (2 , 2), (3 , 3), (4 , 4), (1 , 2), (3 , 1), (1 , 3)}**. Then **R** is :

(a) **Reflexive and transitive only**
(b) **Transitive and symmetric only**
(c) **equivalance**
(d) **reflexive only**

Q.28 If two points **P** and **Q** in the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ whose centre is **C** be such that **CP** is perpendicular to **CQ**, **a < b**. Then the value of $\frac{1}{CP^2}+\frac{1}{CQ^2}$ is :

(a) $\frac{b^2-a^2}{2ab}$
(b) $\frac{1}{a^2}+\frac{1}{b^2}$
(c) $\frac{2ab}{b^2-a^2}$
(d) $\frac{1}{a^2}-\frac{1}{b^2}$

Q.29 If the roots of the equation $ax^2 - bx + c = 0$ are **a**, **b** then the roots of the equation $b^2cx^2 - ab^2x + a^3 = 0$ are :

(a) $\frac{1}{\alpha^3+\alpha\beta}, \frac{1}{\beta^3+\alpha\beta}$
(b) $\frac{1}{\alpha^2+\alpha\beta}, \frac{1}{\beta^2+\alpha\beta}$
(c) $\frac{1}{\alpha^4+\alpha\beta}, \frac{1}{\beta^4+\alpha\beta}$
(d) **None of these**

Q.30 z_1 and z_2 lie on a circle with centre at the origin. The point of intersection z_3 of the tangents at z_1 and z_2 given by :

(a) $\frac{1}{2}(\bar{z}_1+\bar{z}_2)$
(b) $\frac{2z_1z_2}{z_1+z_2}$
(c) $\frac{1}{2}\left(\frac{1}{z_1}+\frac{1}{z_2}\right)$
(d) $\frac{z_1+z_2}{\bar{z}_1\bar{z}_2}$

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