EXERCISE - O

SINGLE CORRECT TYPE QUESTIONS

1. If $\sin x + \sin^2 x = 1$, then the value of $\cos^2 x + \cos^4 x$ is -

(A) 0 (B) 2 (C) 1 (D) 3

MTR001

2. The value of $\sin 10° + \sin 20° + \sin 30° + \ldots + \sin 360°$ is equal to -

(A) 0 (B) 1 (C) $\sqrt{3}$ (D) 2

MTR002

3. If $\cos x + \cos y + \cos\alpha = 0$ and $\sin x + \sin y + \sin\alpha = 0$, then $\cot\left(\frac{x+y}{2}\right) =$

(A) $\sin\alpha$ (B) $\cos\alpha$ (C) $\cot\alpha$ (D) $2\sin\alpha$

MTR003

4. $\frac{\sin(A-C)+2\sin A+\sin(A+C)}{\sin(B-C)+2\sin B+\sin(B+C)}$ is equal to -

(A) $\tan A$ (B) $\frac{\sin A}{\sin B}$ (C) $\frac{\cos A}{\cos B}$ (D) $\frac{\sin C}{\cos B}$

MTR004

5. The expression $\frac{\sin 8\theta\cos\theta - \sin 6\theta\cos 3\theta}{\cos 2\theta\cos\theta - \sin 3\theta\sin 4\theta}$ is equals -

(A) $\tan\theta$ (B) $\tan 2\theta$ (C) $\sin 2\theta$ (D) $\cos 2\theta$

MTR005

6. $\frac{1+\sin 2\theta+\cos 2\theta}{1+\sin 2\theta-\cos 2\theta} =$

(A) $\frac{1}{2}\tan\theta$ (B) $\frac{1}{2}\cot\theta$ (C) $\tan\theta$ (D) $\cot\theta$

MTR006

7. If $A = \tan 6° \tan 42°$ and $B = \cot 66° \cot 78°$, then -

(A) $A = 2B$ (B) $A = 1/3B$ (C) $A = B$ (D) $3A = 2B$

MTR007

8. In a right angled triangle, the hypotenuse is $2\sqrt{2}$ times the perpendicular drawn from the opposite vertex. Then the other acute angles of the triangle are

(A) $\frac{\pi}{3}$ and $\frac{\pi}{6}$ (B) $\frac{\pi}{8}$ and $\frac{3\pi}{8}$ (C) $\frac{\pi}{4}$ and $\frac{\pi}{4}$ (D) $\frac{\pi}{5}$ and $\frac{3\pi}{10}$

MTR008

9. If $\tan\alpha = (1 + 2^{-x})^{-1}$, $\tan\beta = (1 + 2^{x+1})^{-1}$, then $\alpha + \beta =$

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$

MTR009

10. If $\tan B = \frac{n\sin A\cos A}{1-n\cos^2 A}$ then $\tan(A + B)$ equals

(A) $\frac{\sin A}{(1-n)\cos A}$ (B) $\frac{(n-1)\cos A}{\sin A}$ (C) $\frac{\sin A}{(n-1)\cos A}$ (D) $\frac{\sin A}{(n+1)\cos A}$

MTR010

11. The value of $\operatorname{cosec}\frac{\pi}{18}-\sqrt{3}\sec\frac{\pi}{18}$ is a

(A) surd
(B) rational which is not integral
(C) negative integer
(D) natural number

MTR011

12. The value of $\cot x+\cot(60°+x)+\cot(120°+x)$ is equal to :

(A) $\cot 3x$ (B) $\tan 3x$ (C) $3\tan 3x$ (D) $\frac{3-9\tan^2 x}{3\tan x-\tan^3 x}$

MTR012

13. If $\frac{5\pi}{2}<x<3\pi$, then the value of the expression $\frac{\sqrt{1-\sin x}+\sqrt{1+\sin x}}{\sqrt{1-\sin x}-\sqrt{1+\sin x}}$ is

(A) $-\cot\frac{x}{2}$ (B) $\cot\frac{x}{2}$ (C) $\tan\frac{x}{2}$ (D) $-\tan\frac{x}{2}$

MTR013

14. The value of $\cot 7\frac{1}{2}^{o}+\tan 67\frac{1}{2}^{o}-\cot 67\frac{1}{2}^{o}-\tan 7\frac{1}{2}^{o}$ is :

(A) a rational number
(B) irrational number
(C) $2(3+2\sqrt{3})$
(D) $2(3-\sqrt{3})$

MTR014

15. If $x+y=3-\cos 4\theta$ and $x-y=4\sin 2\theta$ then

(A) $x^4+y^4=9$ (B) $\sqrt{x}+\sqrt{y}=16$
(C) $x^3+y^3=2(x^2+y^2)$ (D) $\sqrt{x}+\sqrt{y}=2$

MTR015

16. If $\tan A+\tan B+\tan C=\tan A.\tan B.\tan C$, then -

(A) A, B, C must be angles of a triangle
(B) the sum of any two of A, B, C is equal to the third
(C) $A+B+C$ must be n integral multiple of π
(D) None of these

MTR016

17. If $f(x)=\frac{\sin 3x}{\sin x}$, $x\neq n\pi$, then the range of values of $f(x)$ for real values of x is -

(A) $[-1,3]$ (B) $(-\infty,-1]$ (C) $(3,+\infty)$ (D) $[-1,3)$

MTR017

18. Maximum and minimum value of $2\sin^2\theta-3\sin\theta+2$ is -

(A) $\frac{1}{4},-\frac{7}{4}$ (B) $\frac{1}{4},\frac{21}{4}$ (C) $\frac{21}{4},-\frac{3}{4}$ (D) $7,\frac{7}{8}$

MTR018

19. For $\theta\in(0,\pi/2)$, the maximum value of $\sin\left(\theta+\frac{\pi}{6}\right)+\cos\left(\theta+\frac{\pi}{6}\right)$ is attained at θ =

(A) $\frac{\pi}{12}$ (B) $\frac{\pi}{6}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{4}$

MTR019

20. Minimum value of the expression $\cos^2\theta-(6\sin\theta\cos\theta)+3\sin^2\theta+2$, is -

(A) $4+\sqrt{10}$ (B) $4-\sqrt{10}$ (C) 0 (D) 4

MTR020

MULTIPLE CORRECT TYPE QUESTIONS

21. If $\cos x = \tan x$, then which of the following is/are true ?

(A) $\frac{1}{\sin x} + \cos^4 x = 1$ (B) $\frac{1}{\sin x} + \cos^4 x = 2$ (C) $\cos^4 x + \cos^2 x = 1$ (D) $\cos^4 x + \cos^2 x = 2$

MTR045

22. If $\cos(A-B) = \frac{3}{5}$ and $\tan A \tan B = 2$, then which of the following is/are correct ?

(A) $\cos A \cos B = -\frac{1}{5}$ (B) $\sin A \sin B = \frac{2}{5}$ (C) $\cos(A+B) = -\frac{1}{5}$ (D) $\sin A \cos B = \frac{4}{5}$

MTR046

23. If $\sin t + \cos t = \frac{1}{5}$, then $\tan\frac{t}{2}$ is equal to

(A) –1 (B) $-\frac{1}{3}$ (C) 2 (D) $-\frac{1}{6}$

MTR047

24. If $3\sin\beta = \sin(2\alpha + \beta)$, then $\tan(\alpha + \beta) - 2\tan\alpha$ is

(A) independent of α (B) independent of β

(C) dependent of both α and β (D) independent of α but dependent of β

MTR048

25. If $x + y = z$, then $\cos^2 x + \cos^2 y + \cos^2 z - 2\cos x \cos y \cos z$ is equal to

(A) $\cos^2 z$ (B) $\sin^2 z$ (C) $\cos(x + y - z)$ (D) 1

MTR051

26. If $L = \cos^2 84° + \cos^2 36° + \cos 36° \cos 84°$

$M = \cot 73° \cot 47° \cot 13°$

$N = 4\sin 156° \sin 84° \sin 36°$, then which of the following option(s) is(are) correct ?

(A) $L < 1$ (B) $M > \tan 2$ (C) $N > \sin\frac{\pi}{4}$ (D) 0 < LMN

MTR049

27. If $P_n = \cos^n\theta + \sin^n\theta$ and $Q_n = \cos^n\theta - \sin^n\theta$, then which of the following is/are true.

(A) $P_n - P_{n-2} = -\sin^2\theta \cos^2\theta\, P_{n-4}$ (B) $Q_n - Q_{n-2} = -\sin^2\theta \cos^2\theta\, Q_{n-4}$

(C) $P_4 = 1 - 2\sin^2\theta \cos^2\theta$ (D) $Q_4 = \cos^2\theta - \sin^2\theta$

MTR054

28. If $\alpha + \beta + \gamma = 2\pi$, then

(A) $\tan\frac{\alpha}{2} + \tan\frac{\beta}{2} + \tan\frac{\gamma}{2} = \tan\frac{\alpha}{2}\tan\frac{\beta}{2}\tan\frac{\gamma}{2}$ (B) $\tan\frac{\alpha}{2}\tan\frac{\beta}{2} + \tan\frac{\beta}{2}\tan\frac{\gamma}{2} + \tan\frac{\gamma}{2}\tan\frac{\alpha}{2} = 1$

(C) $\tan\frac{\alpha}{2} + \tan\frac{\beta}{2} + \tan\frac{\gamma}{2} = -\tan\frac{\alpha}{2}\tan\frac{\beta}{2}\tan\frac{\gamma}{2}$ (D) $\tan\frac{\alpha}{4}\tan\frac{\beta}{4} + \tan\frac{\beta}{4}\tan\frac{\gamma}{4} + \tan\frac{\gamma}{4}\tan\frac{\alpha}{4} = 1$

MTR050

29. Let $y = \frac{\cos x + \cos 2x + \cos 3x + \cos 4x + \cos 5x + \cos 6x + \cos 7x}{\sin x + \sin 2x + \sin 3x + \sin 4x + \sin 5x + \sin 6x + \sin 7x}$, then which of the following hold good?

(A) The value of y when $x = \pi/8$ is not defined.

(B) The value of y when $x = \pi/16$ is 1.

(C) The value of y when $x = \pi/32$ is $\sqrt{2} - 1$.

(D) The value of y when $x = \pi/48$ is $2 + \sqrt{3}$.

MTR053

30. Let $f_n(\theta) = \sum_{r=0}^{n} \frac{1}{4^r}\sin^4\left(2^r\theta\right)$. Then which of the following alternative(s) is/are correct ?

(A) $f_2\left(\frac{\pi}{4}\right) = \frac{1}{\sqrt{2}}$ (B) $f_3\left(\frac{\pi}{8}\right) = \frac{2+\sqrt{2}}{4}$ (C) $f_4\left(\frac{3\pi}{2}\right) = 1$ (D) $f_5(\pi) = 0$

MTR052

COMPREHENSION TYPE QUESTIONS

Paragraph for Question No. 31 to 33

Consider the polynomial $P(x) = (x - \cos 36°)(x - \cos 84°)(x - \cos 156°)$

31. The coefficient of x^2 is

(A) 0 (B) 1 (C) $-\frac{1}{2}$ (D) $\frac{\sqrt{5}-1}{2}$

MTR055

32. The coefficient of x is

(A) $\frac{3}{2}$ (B) $-\frac{3}{2}$ (C) $-\frac{3}{4}$ (D) zero

MTR056

33. The absolute term in $P(x)$ has the value equal to

(A) $\frac{\sqrt{5}-1}{4}$ (B) $\frac{\sqrt{5}-1}{16}$ (C) $\frac{\sqrt{5}+1}{16}$ (D) $\frac{1}{16}$

MTR057

MATCHING LIST TYPE QUESTION

34.

	List-I		**List-II**
(I)	The value of $\tan 20° \cdot \tan 40° \cdot \tan 60° \cdot \tan 80°$ is	(P)	Odd natural Number
(II)	The value of $4\left(\sin^4\frac{\pi}{16}+\sin^4\frac{3\pi}{16}+\sin^4\frac{5\pi}{16}+\sin^4\frac{7\pi}{16}\right)$ is	(Q)	Even natural Number
(III)	$\tan\alpha + 2\tan 2\alpha + 4\tan 4\alpha + 8\cot 8\alpha = \lambda\cot\lambda\alpha$ then λ is	(R)	3
(IV)	$(4\cos^2 9° - 3)(4\cos^2 27° - 3) = \tan k°$, then k is	(S)	6
		(T)	1
		(U)	9

Which of the following is **CORRECT** ?

(A) (I) → (P,R) ; (II) → (Q,S) ; (III) → (P,T) ; (IV) → (P, U)
(B) (I) → (P,T) ; (II) → (Q,R) ; (III) → (P,U) ; (IV) → (R, U)
(C) (I) → (R,S) ; (II) → (T,U) ; (III) → (P,T) ; (IV) → (P, Q)
(D) (I) → (P,R) ; (II) → (P,U) ; (III) → (Q,S) ; (IV) → (S, T)

MTR058

MATRIX MATCH TYPE QUESTION

35. In the following matrix match **Column-I** has some quantities and **Column-II** has some comments or other quantities.

Match the each element in **Column-I** with corresponding element(s) in **Column-II**

	Column-I		**Column-II**
(A)	The value of $\left\|4\left(2\cos^3\frac{\pi}{7}-\cos^2\frac{\pi}{7}-\cos\frac{\pi}{7}\right)\right\|$ is	(P)	4
(B)	If $A + B + C = \pi$ and $\cos A = \cos B \cdot \cos C$ then $\tan B \cdot \tan C$ has the value equal to	(Q)	8
(C)	$4\left(\frac{\cos 20° + 8\sin 70°\sin 50°\sin 10°}{\sin^2 80°}\right)$ is equal to	(R)	2
(D)	The maximum value of $12\sin\theta - 9\sin^2\theta$ is	(S)	1
		(T)	6

MTR059

EXERCISE - S

1. $2(\sin^6\theta + \cos^6\theta) - 3(\sin^4\theta + \cos^4\theta) + 1$ is equal to -

MTR021

2. If $x = y\cos\frac{2\pi}{3} = = z\cos\frac{4\pi}{3}$ then $xy + yz + zx =$

MTR022

3. If $\cos(\alpha + \beta) + \sin(\alpha - \beta) = 0$ and $2010\tan\beta + 1 = 0$, then $|\tan\alpha|$ is equal to

MTR023

4. If $\tan x + \tan y = 25$ and $\cot x + \cot y = 30$, then the value of $\tan(x + y)$ is

MTR024

5. If $3\sin\alpha = 5\sin\beta$, then $\dfrac{\tan\frac{\alpha+\beta}{2}}{\tan\frac{\alpha-\beta}{2}} =$

MTR025

6. If $\cos\alpha = \dfrac{2\cos\beta - 1}{2 - \cos\beta}$ then $\tan^2\dfrac{\alpha}{2} \cdot \cot^2\dfrac{\beta}{2}$ has the value equal to {where $\alpha, \beta \in (0, \pi)$}

MTR026

7. If $A = \sin\frac{2\pi}{7} + \sin\frac{4\pi}{7} + \sin\frac{8\pi}{7}$ and $B = \cos\frac{2\pi}{7} + \cos\frac{4\pi}{7} + \cos\frac{8\pi}{7}$ then $A^2 + B^2$ is equal to

MTR027

8. If the value of $\sin\frac{\pi}{14}\sin\frac{3\pi}{14}\sin\frac{5\pi}{14}$ is $\frac{p}{q}$ (in simplest form) then what is the value of $p + q$?

MTR028

9. The exact value of $\dfrac{96\sin 80^\circ \sin 65^\circ \sin 35^\circ}{\sin 20^\circ + \sin 50^\circ + \sin 110^\circ}$ is equal to

MTR029

10. If m and n are positive integers satisfying

$1 + \cos 2\theta + \cos 4\theta + \cos 6\theta + \cos 8\theta + \cos 10\theta = \dfrac{\cos m\theta \cdot \sin n\theta}{\sin\theta}$ then $(m + n)$ is equal to

MTR030

11. If acute angle $A = 3B$ and $\sin A = \frac{4}{5}$ then $\left|\dfrac{3\sec B - 4\operatorname{cosec} B}{2}\right|$ is

MTR060

12. If $k_1 = \tan 27\theta - \tan\theta$ and $k_2 = \dfrac{\sin\theta}{\cos 3\theta} + \dfrac{\sin 3\theta}{\cos 9\theta} + \dfrac{\sin 9\theta}{\cos 27\theta}$ then $\left(\dfrac{k_1}{k_2}\right)$ is equal to

MTR061

13. If the value of the expression $\sin25°\cdot \sin35°\cdot \sin85°$ can be expressed as $\frac{\sqrt{a}+\sqrt{b}}{c}$, where $a, b, c \in N$ and are in their lowest form, find the value of $\left(\frac{a+b+c}{18}\right)$.

MTR062

14. Given that $(1+\tan1°)(1+\tan2°)\ldots.(1+\tan45°) = 2^n$, find $\left(\frac{n}{4}\right)$.

MTR063

15. Calculate: $\frac{2\cos40°-\cos20°}{\sin20°}$

MTR064

EXERCISE - JEE (Main) PYQ

1. For any $\theta \in \left(\frac{\pi}{4}, \frac{\pi}{2}\right)$, the expression $3(\sin\theta - \cos\theta)^4 + 6(\sin\theta + \cos\theta)^2 + 4\sin^6\theta$ equals : **[JEE (Main) 2019]**

(1) $13 - 4\cos^6\theta$ (2) $13 - 4\cos^4\theta + 2\sin^2\theta\cos^2\theta$

(3) $13 - 4\cos^2\theta + 6\cos^4\theta$ (4) $13 - 4\cos^2\theta + 6\sin^2\theta cos^2\theta$

MTR034

2. The value of $\cos\frac{\pi}{2^2}\cdot\cos\frac{\pi}{2^3}\cdot.....\cdot\cos\frac{\pi}{2^{10}}\cdot\sin\frac{\pi}{2^{10}}$ is : **[JEE (Main) 2019]**

(1) $\frac{1}{256}$ (2) $\frac{1}{2}$ (3) $\frac{1}{512}$ (4) $\frac{1}{1024}$

MTR035

3. Let $f_k(x) = \frac{1}{k}(\sin^k x + \cos^k x)$ for $k = 1,2,3,...$ Then for all $x \in R$, the value of $f_4(x) - f_6(x)$ is equal to :- **[JEE (Main) 2019]**

(1) $\frac{5}{12}$ (2) $\frac{-1}{12}$ (3) $\frac{1}{4}$ (4) $\frac{1}{12}$

MTR036

4. The maximum value of $3\cos\theta + 5\sin\left(\theta - \frac{\pi}{6}\right)$ for any real value of θ is : **[JEE (Main) 2019]**

(1) $\sqrt{19}$ (2) $\frac{\sqrt{79}}{2}$ (3) $\sqrt{31}$ (4) $\sqrt{34}$

MTR037

5. Let α and β be two real roots of the equation $(k+1)\tan^2 x - \sqrt{2}\,\lambda\tan x = (1-k)$, where $k \neq -1$ and λ are real numbers. If $\tan^2(\alpha + \beta) = 50$, then a value of λ is ; **[JEE (Main) 2020]**

(1) 5 (2) 10 (3) $5\sqrt{2}$ (4) $10\sqrt{2}$

MTR038

6. The value of $\cos^3\left(\frac{\pi}{8}\right)\cdot\cos\left(\frac{3\pi}{8}\right) + \sin^3\left(\frac{\pi}{8}\right)\cdot\sin\left(\frac{3\pi}{8}\right)$ is : **[JEE (Main) 2020]**

(1) $\frac{1}{4}$ (2) $\frac{1}{\sqrt{2}}$ (3) $\frac{1}{2\sqrt{2}}$ (4) $\frac{1}{2}$

MTR039

7. If $15\sin^4\alpha + 10\cos^4\alpha = 6$, for some $\alpha \in R$, then the value of $27\sec^6\alpha + 8\operatorname{cosec}^6\alpha$ is equal to : **[JEE (Main) 2021]**

(1) 350 (2) 500 (3) 400 (4) 250

MTR040

8. $16\sin(20°)\sin(40°)\sin(80°)$ is equal to : **[JEE (Main) 2022]**

(1) $\sqrt{3}$ (2) $2\sqrt{3}$ (3) 3 (4) $4\sqrt{3}$

MTR041

9. If $\cot\alpha = 1$ and $\sec\beta = -\frac{5}{3}$, where $\pi < \alpha < \frac{3\pi}{2}$ and $\frac{\pi}{2} < \beta < \pi$, then the value of $\tan(\alpha+\beta)$ and the quadrant in which $\alpha+\beta$ lies, respectively are **[JEE (Main) 2022]**

(1) $-\frac{1}{7}$ and IVth quadrant (2) 7 and Ist quadrant

(3) – 7 and IVth quadrant (4) $\frac{1}{7}$ and Ist quadrant

MTR042

10. The value of $\cos\left(\frac{2\pi}{7}\right)+\cos\left(\frac{4\pi}{7}\right)+\cos\left(\frac{6\pi}{7}\right)$ is equal to : **[JEE (Main) 2022]**

(1) –1 (2) $-\frac{1}{2}$ (3) $-\frac{1}{3}$ (4) $-\frac{1}{4}$

MTR043

11. If $\sin^2(10°)\sin(20°)\sin(40°)\sin(50°)\sin(70°) = \alpha - \frac{1}{16}\sin(10°)$, then $16 + \alpha^{-1}$ is equal to _____. **[JEE (Main) 2022]**

MTR044

12. The value of $36\,(4\cos^2 9° - 1)(4\cos^2 27° - 1)(4\cos^2 81° - 1)(4\cos^2 243° - 1)$ is **[JEE (Main) 2023]**

(1) 54 (2) 18 (3) 27 (4) 36

MTR074

13. If $\tan 15° + \frac{1}{\tan 75°} + \frac{1}{\tan 105°} + \tan 195° = 2a$, then the value of $\left(a + \frac{1}{a}\right)$ is : **[JEE (Main) 2023]**

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

MTR075

14. $96\cos\frac{\pi}{33}\cos\frac{2\pi}{33}\cos\frac{4\pi}{33}\cos\frac{8\pi}{33}\cos\frac{16\pi}{33}$ is equal to **[JEE (Main) 2023]**

(1) 3 (2) 2 (3) 4 (4) 1

MTR076

15. Let $f: \mathbb{R} \to \mathbb{R}$ be a function defined by $f(x) = \log_{\sqrt{m}}\left\{\sqrt{2}(\sin x - \cos x) + m - 2\right\}$, for some m, such that the range of f is [0, 2]. Then the value of m is. **[JEE (Main) 2023]**

(1) 5 (2) 3 (3) 2 (4) 4

MTR077

EXERCISE - JEE (Advanced) PYQ

1. Let $\theta \in \left(0, \frac{\pi}{4}\right)$ and $t_1 = (\tan\theta)^{\tan\theta}$, $t_2 = (\tan\theta)^{\cot\theta}$, $t_3 = (\cot\theta)^{\tan\theta}$, $t_4 = (\cot\theta)^{\cot\theta}$, then -

[JEE (Advanced) 2006]

(A) $t_1 > t_2 > t_3 > t_4$ (B) $t_4 > t_3 > t_1 > t_2$

(C) $t_3 > t_1 > t_2 > t_4$ (D) $t_2 > t_3 > t_1 > t_4$

MTR065

2. If $\frac{\sin^4 x}{2} + \frac{\cos^4 x}{3} = \frac{1}{5}$, then **[JEE (Advanced) 2009]**

(A) $\tan^2 x = \frac{2}{3}$ (B) $\frac{\sin^8 x}{8} + \frac{\cos^8 x}{27} = \frac{1}{125}$

(C) $\tan^2 x = \frac{1}{3}$ (D) $\frac{\sin^8 x}{8} + \frac{\cos^8 x}{27} = \frac{2}{125}$

MTR066

3. For $0 < \theta < \frac{\pi}{2}$, the solution(s) of $\sum_{m=1}^{6} \text{cosec}\left(\theta + \frac{(m-1)\pi}{4}\right) \text{cosec}\left(\theta + \frac{m\pi}{4}\right) = 4\sqrt{2}$ is (are) -

[JEE (Advanced) 2009]

(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{6}$ (C) $\frac{\pi}{12}$ (D) $\frac{5\pi}{12}$

MTR067

4. The maximum value of the expression $\frac{1}{\sin^2\theta + 3\sin\theta\cos\theta + 5\cos^2\theta}$ is

[JEE (Advanced) 2010]

MTR068

5. Two parallel chords of a circle of radius 2 are at a distance $\sqrt{3}+1$ apart. If the chords subtend at the center, angles of $\frac{\pi}{k}$ and $\frac{2\pi}{k}$ where $k > 0$, then the value of $[k]$ is -

[**Note:** $[k]$ denotes the largest integer less than or equal to k] **[JEE (Advanced) 2010]**

MTR069

6. Let $P = \{\theta : \sin\theta - \cos\theta = \sqrt{2}\cos\theta\}$ and $Q = \{\theta : \sin\theta + \cos\theta = \sqrt{2}\sin\theta\}$ b be two sets. Then

[JEE (Advanced) 2013]

(A) $P \subset Q$ and $Q - P \neq \varnothing$ (B) $Q \not\subset P$

(C) $P \not\subset Q$ (D) $P = Q$

MTR070

7. The value of $\sum_{k=1}^{13} \frac{1}{\sin\left(\frac{\pi}{4} + \frac{(k-1)\pi}{6}\right)\sin\left(\frac{\pi}{4} + \frac{k\pi}{6}\right)}$ is equal to **[JEE (Advanced) 2016]**

(A) $3 - \sqrt{3}$ (B) $2(3 - \sqrt{3})$ (C) $2(\sqrt{3} - 1)$ (D) $2(2 + \sqrt{3})$

MTR071

8. Let α and β be nonzero real numbers such that $2(\cos\beta - \cos\alpha) + \cos\alpha\cos\beta = 1$. Then which of the following is/are true? (where $\alpha, \beta \neq (2k+1)\pi$) **[JEE (Advanced) 2017]**

(A) $\tan\left(\frac{\alpha}{2}\right) - \sqrt{3}\tan\left(\frac{\beta}{2}\right) = 0$

(B) $\sqrt{3}\tan\left(\frac{\alpha}{2}\right) - \tan\left(\frac{\beta}{2}\right) = 0$

(C) $\tan\left(\frac{\alpha}{2}\right) + \sqrt{3}\tan\left(\frac{\beta}{2}\right) = 0$

(D) $\sqrt{3}\tan\left(\frac{\alpha}{2}\right) + \tan\left(\frac{\beta}{2}\right) = 0$

MTR072

9. Let α and β be real numbers such that $-\frac{\pi}{4} < \beta < 0 < \alpha < \frac{\pi}{4}$. If $\sin(\alpha+\beta) = \frac{1}{3}$ and $\cos(\alpha-\beta) = \frac{2}{3}$, then the greatest integer less than or equal to $\left(\frac{\sin\alpha}{\cos\beta} + \frac{\cos\beta}{\sin\alpha} + \frac{\cos\alpha}{\sin\beta} + \frac{\sin\beta}{\cos\alpha}\right)^2$ is _____.

[JEE (Advanced) 2022]

MTR073

JEE (Main) Practice Paper

This paper is for yourself practice and assessment the discussion of this paper is optional though you can see PDF solutions or video solutions or solutions in hardcopy whichever is provided.

SECTION–A

- This section contains **TWENTY** questions.
- Each question has **FOUR** options (1), (2), (3) and (4). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories:

Full Marks : +4, if only the bubble corresponding to the correct option is darkened.
Zero Marks : 0, if none of the bubbles is darkened.
Negative Marks : –1 in all other cases.

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1. If $0 < x < \pi$, and $\cos x + \sin x = \frac{1}{2}$, then $\tan x$ =

(1) $\frac{\left(-4 \pm \sqrt{7}\right)}{3}$ (2) $\frac{(1+\sqrt{7})}{4}$ (3) $\frac{(1-\sqrt{7})}{4}$ (4) $\frac{(-1 \pm \sqrt{7})}{4}$

MTR078

2. If m and M are the minimum and the maximum values of $4 + \frac{1}{2}\sin^2 2x - 2\cos^4 x$, $x \in R$, then $M - m$ is equal to

(1) $\frac{9}{4}$ (2) $\frac{15}{4}$ (3) $\frac{1}{4}$ (4) $\frac{7}{4}$

MTR079

3. If $5(\tan^2 x - \cos^2 x) = 2\cos 2x + 9$, then the value of $\cos 4x$ is :-

(1) $-\frac{7}{9}$ (2) $-\frac{3}{5}$ (3) $\frac{1}{3}$ (4) $\frac{2}{9}$

MTR080

4. Find the value

$$\left\{\frac{1 - \cot^2\left(\frac{\alpha - \pi}{4}\right)}{1 + \cot^2\left(\frac{\alpha - \pi}{4}\right)} + \cos\frac{\alpha}{2}\cot 4\alpha\right\}\sec\frac{9\alpha}{2}$$

(1) $\sec 2\alpha$ (2) $\operatorname{cosec} 4\alpha$ (3) $\sec \alpha$ (4) $\operatorname{cosec} 2\alpha$

MTR081

5. Find the extreme values of $\cos x \cos\left(\frac{2\pi}{3} + x\right)\cos\left(\frac{2\pi}{3} - x\right)$

(1) $\frac{1}{2}, \frac{1}{4}$ (2) $\frac{-1}{2}, \frac{-1}{4}$ (3) $\frac{1}{4}, \frac{1}{6}$ (4) $\frac{-1}{4}, \frac{1}{4}$

MTR082

6. Find the maximum and minimum values of following trigonometric functions

$\cos^2\left(\frac{\pi}{4}+x\right)+\left(\sin x-\cos x\right)^2$

(1) 0, 2 (2) 2, 3 (3) 3, 0 (4) 3, 1

MTR083

7. If $0°<x<90°$ & $\cos x=\frac{3}{\sqrt{10}}$, then the value of $\log_{10}\sin x+\log_{10}\cos x+\log_{10}\tan x$ is

(1) 0 (2) 1 (3) – 1 (4) 2

MTR084

8. The value of the expression $\left(1+\cos\frac{\pi}{10}\right)\left(1+\cos\frac{3\pi}{10}\right)\left(1+\cos\frac{7\pi}{10}\right)\left(1+\cos\frac{9\pi}{10}\right)$ is

(1) $\frac{1}{8}$ (2) $\frac{1}{16}$ (3) $\frac{1}{4}$ (4) 0

MTR085

9. If tan A and tan B are the roots of the quadratic equation $x^2-ax+b=0$, then the value of $\sin^2(A+B)$.

(1) $\frac{a^2}{a^2+(1-b)^2}$ (2) $\frac{a^2}{a^2+b^2}$ (3) $\frac{a^2}{(b+c)^2}$ (4) $\frac{a^2}{b^2(1-a)^2}$

MTR086

10. If tan 25° = x, then $\frac{\tan 155°-\tan 115°}{1+\tan 155°\ \tan 115°}$ is equal to

(1) $\frac{1-x^2}{2x}$ (2) $\frac{1+x^2}{2x}$ (3) $\frac{1+x^2}{1-x^2}$ (4) $\frac{1-x^2}{1+x^2}$

MTR087

11. If cos A = 3/4, then the value of $16\cos^2(A/2)-32\sin(A/2)\sin(5A/2)$ is

(1) – 4 (2) – 3 (3) 3 (4) 4

MTR088

12. If $\tan^2\theta = 2\tan^2\phi + 1$, then the value of $\cos 2\theta + \sin^2\phi$ is

(1) 1 (2) 2 (3) – 1 (4) Independent of ϕ

MTR089

13. $\tan\alpha + 2\tan 2\alpha + 4\tan 4\alpha + 8\cot 8\alpha =$

(1) $\tan\alpha$ (2) $\cot\alpha$ (3) $\cot 16\alpha$ (4) $16\cot\alpha$

MTR090

14. The value of $\cos\frac{\pi}{10}\cos\frac{2\pi}{10}\cos\frac{4\pi}{10}\cos\frac{8\pi}{10}\cos\frac{16\pi}{10}$ is :

(1) $\frac{\sqrt{10+2\sqrt{5}}}{64}$ (2) $-\frac{\cos(\pi/10)}{16}$ (3) $\frac{\cos(\pi/10)}{16}$ (4) $-\frac{\sqrt{10+2\sqrt{5}}}{16}$

MTR091

15. Find the value $\sec^4 A\,(1-\sin^4 A)-2\tan^2 A$

(1) 1 (2) 4 (3) –2 (4) 0

MTR092

16. Simplify the expression $\sqrt{\sin^4 x+4\cos^2 x}-\sqrt{\cos^4 x+4\sin^2 x}$

(1) $\cos 2x$ (2) $\cos x$ (3) $-\cos 2x$ (4) 0

MTR093

17. $\sin 47°+\sin 61°-\sin 11°-\sin 25°$ is equal to

(1) sin 36° (2) cos 36° (3) sin 7° (4) cos 7°

MTR094

18. Suppose θ and ϕ (≠ 0) are such that sec(θ + ϕ), sec θ and sec(θ – ϕ) are in A.P. If $\cos\theta = k\cos\left(\frac{\phi}{2}\right)$ for some k, then k is equal to :-

(1) $\pm\frac{1}{\sqrt{2}}$ (2) $\pm\sqrt{2}$ (3) ±2 (4) ±1

MTR095

19. If $\sin(\theta+\alpha)=a$ & $\sin(\theta+\beta)=b$ $(0<\alpha,\beta,\theta<\pi/2)$ then find the value of $\cos2(\alpha-\beta)-4ab\cos(\alpha-\beta)$

(1) $1+2a^2-2b^2$ (2) $1-2a^2+2b^2$ (3) $1-2a^2-2b^2$ (4) $1+2a^2+2b^2$

MTR096

20. Evaluate: $\cos a\cos 2a\cos 3a\ldots\ldots\ldots\cos 999a$, where $a=\frac{2\pi}{1999}$

(1) $\frac{1}{2^{999}}$ (2) $\frac{1}{2^{997}}$ (3) $\frac{1}{2^{995}}$ (4) $\frac{1}{2^{992}}$

MTR097

SECTION-B

- This section will have **TEN** questions. Candidate can choose to attempt any 5 question out of these 10 questions. In case if candidate attempts more than 5 questions, first 5 attempted questions will be considered for marking.
- The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct numerical value (Answer should be rounded off to the nearest integer).
- Answer to each question will be evaluated according to the following marking scheme:
  Full Marks : +4, if only correct answer is given.
  Zero Marks : 0, if no answer is given.
  Negative Marks : -1 for incorrect answer

1. Let α, β be such that $\pi<\alpha-\beta<3\pi$. If $\sin\alpha+\sin\beta=-\frac{21}{65}$ and $\cos\alpha+\cos\beta=\frac{-27}{65}$ then the value of $\cos\frac{\alpha-\beta}{2}=-\frac{3}{\sqrt{k}}$, find the value of k –

MTR098

2. If the value of $\cos\frac{2\pi}{7}+\cos\frac{4\pi}{7}+\cos\frac{6\pi}{7}+\cos\frac{7\pi}{7}=-\frac{\ell}{2}$. Find the value of ℓ.

MTR099

3. If $\cot(\theta-\alpha)$, $3\cot\theta$, $\cot(\theta+\alpha)$ are in AP (where, $\theta\neq\frac{n\pi}{2},\alpha\neq k\pi,n,k\in I$), then $\frac{2\sin^2\theta}{\sin^2\alpha}$ is equal to

MTR100

4. The value of the expression $\frac{1-4\sin10^\circ\sin70^\circ}{2\sin10^\circ}$ is

MTR101

5. If $\cos(\alpha+\beta)=\frac{4}{5}$; $\sin(\alpha-\beta)=\frac{5}{13}$ & α,β lie between 0 & $\frac{\pi}{4}$, then find the value of $\tan2\alpha$ is $\frac{k}{33}$. Find the value of k –

MTR102

6. If $\frac{1}{100}(\tan9^\circ-\tan27^\circ-\tan63^\circ+\tan81^\circ)$ is $\frac{k}{100}$ then the value of k.

MTR103

7. If $2\cos x+\sin x=1$, then find the sum of all possible values of $7\cos x+6\sin x$.

MTR104

8. If $x\in\left(\pi,\frac{3\pi}{2}\right)$ then $4\cos^2\left(\frac{\pi}{4}-\frac{x}{2}\right)+\sqrt{4\sin^4x+\sin^2 2x}$ is always equal to

MTR105

9. The difference between maximum and minimum value of the expression $y=1+2\sin x+3\cos^2 x$ is $\frac{k}{3}$, then find the value of k

MTR106

10. Find the greatest value of y

$y=3\cos\left(\theta+\frac{\pi}{3}\right)+5\cos\theta+3$

MTR107

JEE (Advanced) Practice Paper

This paper is for yourself practice and assessment the discussion of this paper is optional though you can see PDF solutions or video solutions or solutions in hardcopy whichever is provided.

SECTION-I

- This section contains **FOUR** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories:

Full Marks : +3 If only the bubble corresponding to the correct option is darkened.

Zero Marks : 0 If none of the bubbles is darkened.

Negative Marks : –1 In all other cases

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1. If α, β $(\alpha - \beta \neq 2n\pi, n \in I)$ are different values of θ satisfying the equation $5\cos\theta - 12\sin\theta = 11$.

If the value of $\sin(\alpha + \beta) = -\frac{5k}{169}$, then find the value of k.

(A) 24 (B) 30 (C) 18 (D) 10

MTR108

2. If $\frac{\sin A}{\sin B} = \frac{\sqrt{3}}{2}$ and $\frac{\cos A}{\cos B} = \frac{\sqrt{5}}{2}$, $0 < A, B < \pi/2$, then $\tan A + \tan B$ is equal to

(A) $\sqrt{3}/\sqrt{5}$ (B) $\sqrt{5}/\sqrt{3}$ (C) 1 (D) $(\sqrt{5}+\sqrt{3})/\sqrt{5}$

MTR109

3. Find the value of $\tan 142\frac{1^\circ}{2}$

(A) $2-\sqrt{2}-\sqrt{3}-\sqrt{6}$ (B) $2+\sqrt{2}-\sqrt{3}+\sqrt{6}$

(C) $2+\sqrt{2}+\sqrt{3}+\sqrt{6}$ (D) $2+\sqrt{2}-\sqrt{3}-\sqrt{6}$

MTR110

4. Let $a = \frac{\pi}{7}$. If the value of $\tan^2 a + \tan^2 2a + \tan^2 3a$ is λ and the value of $\tan^2 a \tan^2 2a + \tan^2 2a \tan^2 3a + \tan^2 3a \tan^2 a$ is μ then find $\lambda + \mu$

(A) 56 (B) 35 (C) 21 (D) 50

MTR111

SECTION-II

- This section contains **FIVE** questions.
- Each question has **FOUR** options for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct option(s).
- For each question, choose the correct option(s) to answer the question.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks	: +4	If only (all) the correct option(s) is (are) chosen.
Partial Marks	: +3	If all the four options are correct but ONLY three options are chosen.
Partial Marks	: +2	If three or more options are correct but ONLY two options are chosen, both of which are correct options.
Partial Marks	: +1	If two or more options are correct but ONLY one option is chosen and it is a correct option.
Zero Marks	: 0	If none of the options is chosen (i.e. the question is unanswered).
Negative Marks	: –2	In all other cases.

For Example : If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in –2 marks.

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5. If $\sin t + \cos t = \frac{1}{5}$ then $\tan\frac{t}{2}$ can be

(A) –1 (B) $-\frac{1}{3}$ (C) 2 (D) $-\frac{1}{6}$

MTR112

6. The value of $\frac{\sin x + \cos x}{\cos^3 x}$ =

(A) $1 + \tan x + \tan^2 x - \tan^3 x$ (B) $1 + \tan x + \tan^2 x + \tan^3 x$
(C) $1 - \tan x + \tan^2 x + \tan^3 x$ (D) $(1 + \tan x)\sec^2 x$

MTR113

7. If $\sin x + \sin y = a$ & $\cos x + \cos y = b$, then which of the following may be true.

(A) $\sin(x+y) = \frac{2ab}{a^2 + b^2}$ (B) $\tan\frac{x-y}{2} = \sqrt{\frac{4-a^2-b^2}{a^2+b^2}}$

(C) $\tan\frac{x-y}{2} = -\sqrt{\frac{4-a^2-b^2}{a^2+b^2}}$ (D) $\cos(x+y) = \frac{2ab}{a^2+b^2}$

MTR114

8. $\tan^2\alpha + 2\tan\alpha.\tan 2\beta = \tan^2\beta + 2\tan\beta.\tan 2\alpha$, if

(A) $\tan^2\alpha + 2\tan\alpha.\tan 2\beta = 0$ (B) $\tan\alpha + \tan\beta = 0$
(C) $\tan^2\beta + 2\tan\beta.\tan 2\alpha = 1$ (D) $\tan\alpha = \tan\beta$

MTR115

9. If $(\sec A + \tan A)(\sec B + \tan B)(\sec C + \tan C) = (\sec A - \tan A)(\sec B - \tan B)(\sec C - \tan C)$ represent each sides of equilateral triangle, then each side can be

(A) 1 (B) –1 (C) 0 (D) none

MTR116

SECTION–III

- This section contains **TWO** paragraphs.
- Based on each paragraph, there are **TWO/THREE** questions.
- Each question has **FOUR** options (A), (B), (C) and (D) **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :

Full Marks : +3 if only the bubble corresponding to the correct answer is darkened.

Zero Marks : 0 in all other cases.

Comprehension # 1 (Q. No. 10 - 12)

If $\cos\alpha + \cos\beta = a$ and $\sin\alpha + \sin\beta = b$ and θ is arithmetic mean between α and β, then

$\sin 2\theta + \cos 2\theta = 1 + \frac{nb(a-b)}{a^2+b^2}$ where, $n \in I$

On the basis of above information answer the following :

10. The value of n is -

(A) 0 (B) 1 (C) 2 (D) –2

MTR117

11. If for n obtained in above question, $\sin^n A = x$, then $\sin A \sin 2A \sin 3A \sin 4A$ is a polynomial in x of degree -

(A) 5 (B) 6 (C) 7 (D) 8

MTR118

12. If degree of polynomial obtained in previous question is p and $(p-5) + \sin\theta, \cos\theta, \tan\theta$ are in G.P., then $\cos^9\theta + \cos^6\theta + 3\cos^5\theta - 1 =$

(A) p (B) 0 (C) $2p$ (D) –1

MTR119

Comprehension # 2 (Q. No. 13 & 14)

Let a, b, c are respectively the sines and p, q, r are respectively the cosines of $\alpha, \alpha+\frac{2\pi}{3}$ and $\alpha+\frac{4\pi}{3}$, then

13. The value of $(a+b+c)+(ab+bc+ca)$ is less than or equal to

(A) 0 (B) $\frac{3}{4}$ (C) 1 (D) $-\frac{3}{4}$

MTR120

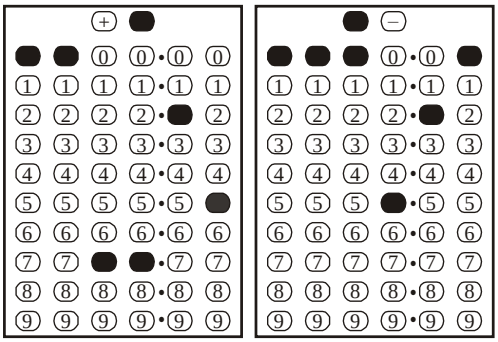
14. The value of $(qc - rb)$ is equal to $\frac{\sqrt{\alpha}}{\beta}$; α, β are coprime then -

(A) $\alpha + \beta = 5$ (B) $\alpha - \beta = -1$ (C) $\alpha - \beta = 1$ (D) $\alpha + \beta = 7$

MTR121

SECTION-IV

- This section contains **FOUR** questions.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (in decimal notation, truncated/ rounded-off to the **second decimal place**; e.g. 6.25, 7.00, –0.33, –.30, 30.27, –127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct) by darken the corresponding bubbles in the ORS.
  For Example : If answer is –77.25, 5.2 then fill the bubbles as follows.



- Answer to each question will be evaluated according to the following marking scheme:
  Full Marks : +3 If ONLY the correct numerical value is entered as answer.
  Zero Marks : 0 In all other cases.

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15. Suppose that $\sin^3 x \sin 3x = \sum_{m=0}^{n} c_m \cos mx$ is an identity in x, where $c_0, c_1, c_2, \ldots, c_n$ are constants and $c_n \neq 0$, find the value of n.

MTR122

16. Two parallel channels of a circle of radius 2 are at a distance $\sqrt{3}+1$ apart. If the chord subtend at the centre, angle of $\frac{\pi}{k}$ and $\frac{2\pi}{k}$ where $k > 0$, then the value of $[K]$ is ___

[**Note: [*k*]** represents the largest integer less than or equal to K]

MTR123

17. If $(1+\tan 5^\circ)(1+\tan 10^\circ)(1+\tan 15^\circ)\ldots\ldots(1+\tan 45^\circ) = 2^k$, then the value of '$k$' is ____

MTR124

18. The value of $\sin^2\frac{\pi}{8} + \sin^2\frac{3\pi}{8} + \sin^2\frac{5\pi}{8} + \sin^2\frac{7\pi}{8}$ is

MTR125

ANSWER KEY

EXERCISE - O

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	C	A	C	B	B	D	C	B	B	A
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	D	D	D	B	D	C	D	D	A	B
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	B,C	B,C	B,C	A,B	C,D	A,B,C,D	A,B,C,D	A,D	B,D	C,D
Que.	31	32	33	34	35					
Ans.	A	C	B	A	A→S; B→R; C→Q; D→P					

EXERCISE - S

1.	0	**2.**	0	**3.**	1	**4.**	150	**5.**	4
6.	3	**7.**	2	**8.**	9	**9.**	24	**10.**	11
11.	5	**12.**	2	**13.**	1.33	**14.**	5.75	**15.**	1.73

EXERCISE - JEE (Main) PYQ

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	1	3	4	1	2	3	4	2	1	2
Que.	11	12	13	14	15					
Ans.	80	4	1	1	1					

EXERCISE - JEE (Advanced) PYQ

Que.	1	2	3	4	5	6	7	8	9	
Ans.	B	A,B	C,D	2	3	D	C	Bonus	1	

JEE (Main) Practice Paper

Section-A	Q.	1	2	3	4	5	6	7	8	9	10
	A.	1	1	1	2	4	3	3	2	1	1
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	3	4	2	2	1	1	4	2	3	1
Section-B	Q.	1	2	3	4	5	6	7	8	9	10
	A.	130	3	3	1	56	4	8	2	16	10

JEE (Advanced) Practice Paper

Section-I	**Q.**	**1**	**2**	**3**	**4**		
	A.	A	D	D	A		
Section-II	**Q.**	**5**	**6**	**7**	**8**	**9**	
	A.	B,C	B,D	A,B,C	B,C,D	A,B	
Section-III	**Q.**	**10**	**11**	**12**	**13**	**14**	
	A.	C	A	B	A,B,C,D	A,C	
Section-IV	**Q.**	**15**	**16**	**17**	**18**		
	A.	6	3	5.00	2		