

JEE ADVANCED

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I. MCQs WITH ONE OR MORE THAN ONE CORRECT

- 1) The minimum value of expression $\sin \alpha + \sin \beta + \sin \gamma$, where (α, β, γ) are real numbers satisfying $(\alpha + \beta + \gamma) = \pi$ is (1995)
 - a) positive
 - b) 0
 - c) negative
 - d) -3
- 2) The number of values of x in the interval $[0, 5\pi]$ satisfying equation $3 \sin(x^2) - 7 \sin x + 2 = 0$ (1998-2 Marks)
 - a) 0
 - b) 5
 - c) 6
 - d) 10
- 3) Which of the following number(s) is/are rational? (1998-2 Marks)
 - a) $\sin 15^\circ$
 - b) $\cos 15^\circ$
 - c) $\sin 15^\circ \cos 15^\circ$
 - d) $\sin 15^\circ \cos 75^\circ$
- 4) For a positive integer n , let $f_n(\theta) = \left(\tan \frac{\theta}{2}\right)(1 + \sec \theta)(1 + \sec 2\theta)(1 + \sec 4\theta) \dots (1 + \sec 2^n \theta)$. Then (1999 - 3Marks)
 - a) $f_2\left(\frac{\pi}{16}\right) = 1$
 - b) $f_3\left(\frac{\pi}{32}\right) = 1$
 - c) $f_4\left(\frac{\pi}{64}\right) = 1$
 - d) $f_5\left(\frac{\pi}{128}\right) = 1$
- 5) If $\frac{\sin^4 x}{2} + \frac{\cos^4 x}{3} = \frac{1}{5}$, Then (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) $\frac{\sin^8 x}{8} + \frac{\cos^8 x}{27} = \frac{2}{125}$
- 6) For $0 < \theta < \frac{\pi}{2}$, the solution(s) of $\sum_{m=1}^6 \operatorname{cosec}\left(\theta + \frac{(m-1)\pi}{4}\right) \operatorname{cosec}(\theta) + \frac{m\pi}{4} = 4\sqrt{2}$ is(are) (2009)
 - a) $\frac{\pi}{4}$
 - b) $\frac{\pi}{6}$
 - c) $\frac{\pi}{12}$
 - d) $\frac{5\pi}{12}$
- 7) Let $\theta, \varphi \in [0, 2\pi]$ be such that $2 \cos(\theta(1 - \sin \varphi)) = \sin^2\left(\theta\left(\tan \frac{\theta}{2}\right) + \cot \frac{\theta}{2}\right) \cos \varphi - 1$, $\tan(2\pi - \theta) > 0$ and $-1 < \sin \theta < -\frac{\sqrt{3}}{2}$, then φ cannot satisfy (2012)
 - a) $0 < \varphi < \frac{\pi}{2}$

- b) $\frac{\pi}{2} < \varphi < \frac{4\pi}{3}$
 c) $\frac{4\pi}{3} < \varphi < \frac{3\pi}{2}$
 d) $\frac{3\pi}{2} < \varphi < 2\pi$

8) The number of points in $(-\infty, \infty)$, for which $x - x \sin x - \cos x = 0$, is (JEE Adv.2013)

- a) 6
 b) 4
 c) 2
 d) 0

9) Let $f(x) = x \sin \pi x$, $x > 0$. Then for all natural numbers n , $f'(x)$ vanishes at (JEE Adv. 2013)

- a) A unique point in the interval $(n, n + \frac{1}{2})$
 b) A unique point in the interval $(n + \frac{1}{2}, n + 1)$
 c) A unique point in the interval $(n, n + 1)$
 d) Two points in the interval $(n, n + 1)$

10) Let α and β be non-zero real numbers such that $2(\cos \beta - \cos \alpha) + \cos \alpha \cos \beta = 1$. Then which of the following is/are true? (JEE Adv.2017)

- a) $\tan\left(\frac{\alpha}{2}\right) + \sqrt{3} \tan\left(\frac{\beta}{2}\right) = 0$
 b) $\sqrt{3} \left(\tan \frac{\alpha}{2}\right) + \tan\left(\frac{\beta}{2}\right) = 0$
 c) $\tan\left(\frac{\alpha}{2}\right) - \tan\left(\frac{\beta}{2}\right) = 0$
 d) $\sqrt{3} \tan\left(\frac{\alpha}{2}\right) - \tan\left(\frac{\beta}{2}\right) = 0$

II. SUBJECTIVE PROBLEMS

- 1) If $\tan \alpha = \frac{m}{m+1}$ and $\tan \beta = \frac{1}{2m+1}$, find the possible values of $(\alpha + \beta)$ (1978)
 2) Draw the graph of $y = \frac{1}{\sqrt{2}} (\sin x + \cos x)$ from $x = -\frac{\pi}{2}$ to $x = \frac{\pi}{2}$
 3) If $\cos(\alpha + \beta) = \frac{4}{5}$, $\sin(\alpha - \beta) = \frac{5}{13}$, and α, β lies between 0 and $\frac{\pi}{4}$, find $\tan 2\alpha$ (1979)
 4) Given $\alpha + \beta - \gamma = \pi$, prove that $\sin^2 \alpha + \sin^2 \beta - \sin^2 \gamma = 2 \sin \alpha \sin \beta \cos \gamma$ (1980)
 5) Given $A = \left\{x : \frac{\pi}{6} \leq x \leq \frac{\pi}{3}\right\}$ and $f(x) = \cos x - x(1 + x)$; find $f(A)$ (1980)
 6) For all θ in $(0, \frac{\pi}{2})$ show that, $\cos(\sin \theta) \geq \sin(\cos \theta)$. (1981-4 Marks)