

# EE1030: Matrix Theory

EE24BTECH11006 - Arnav Mahishi

## F. Match the Following

In these questions there are entries in columns 1 and 2. Each entry in column 1 is related to exactly one entry in column 2. Write the correct letter from column 2 against the entry number in column 1 in your answer book

1.  $\frac{\sin 3\alpha}{\cos 2\alpha}$  is

[1992 – 2 Marks]

Column I  
(A) Positive  
(B) Negative

Column II  
(p)  $\left(\frac{13\pi}{48}, \frac{14\pi}{48}\right)$   
(q)  $\left(\frac{14\pi}{48}, \frac{18\pi}{48}\right)$   
(r)  $\left(\frac{18\pi}{48}, \frac{23\pi}{48}\right)$   
(s)  $\left(0, \frac{\pi}{2}\right)$

2. Let  $f(x) = \sin(\pi \cos x)$  and  $g(x) = \cos(2\pi \sin x)$  be two functions defined for  $x > 0$ . Define the following sets whose elements are written in the increasing order. [JEE Adv. 2019]

$X = \{x : f(x) = 0\}, Y = \{x : f'(x) = 0\}$   
 $Z = \{x : g(x) = 0\}, W = \{x : g'(x) = 0\}$

Column I  
(A) X  
(B) Y  
(C) Z  
(D) W

Column II  
(p)  $\supseteq \left\{\frac{\pi}{2}, \frac{3\pi}{2}, 4\pi, 7\pi\right\}$   
(q) an arithmetic progression  
(r) NOT an arithmetic progression  
(s)  $\supseteq \left\{\frac{\pi}{6}, \frac{7\pi}{6}, \frac{13\pi}{6}\right\}$

Which of the following is the only CORRECT combination?

- a (IV), (P), (R), (S)
- b (III), (P), (Q), (U)
- c (III), (R), (U)
- d (IV), (Q), (T)

3. Let  $f(x) = \sin(\pi \cos x)$  and  $g(x) = \cos(2\pi \sin x)$  be two functions defined for  $x > 0$ . Define the following sets whose elements are written in the increasing order. [JEE Adv. 2019]

$X = \{x : f(x) = 0\}, Y = \{x : f'(x) = 0\}$   
 $Z = \{x : g(x) = 0\}, W = \{x : g'(x) = 0\}$

Column I  
(A) X  
(B) Y  
(C) Z  
(D) W

Column II  
(p)  $\supseteq \left\{\frac{\pi}{2}, \frac{3\pi}{2}, 4\pi, 7\pi\right\}$   
(q) an arithmetic progression  
(r) NOT an arithmetic progression  
(s)  $\supseteq \left\{\frac{\pi}{6}, \frac{7\pi}{6}, \frac{13\pi}{6}\right\}$

Which of the following is the only CORRECT combination?

- a (I), (Q), (U)
- b (I), (P), (R)
- c (II), (R), (S)
- d (II), (Q), (T)

Paragraph 1

Let O be the origin, and  $\vec{OX}, \vec{OY}, \vec{OZ}$  be three unit vectors in the directions of the sides  $\vec{QR}, \vec{RP}, \vec{PQ}$  respectively, of a triangle PQR. [JEE Adv 2017]

1.  $|\vec{OX} \times \vec{OY}| =$

- a  $\sin(P + Q)$
- b  $\sin 2R$
- c  $\sin(P + R)$
- d  $\sin(Q + R)$

2. If the triangle PQR varies, then the minimum value of  $\cos(P + Q) + \cos(Q + R) + \cos(R + P)$  is.

- a  $-\frac{5}{3}$
- b  $-\frac{1}{3}$
- c  $\frac{1}{3}$
- d  $\frac{5}{3}$

I. Integer value type

1. The number of all possible values of  $\theta$  where  $0 < \theta < \pi$  for which the system of equations

$$1) (y + Z) \cos 3\theta = (xyz) \sin 3\theta$$

$$2) x \sin 3\theta = \frac{2 \cos 3\theta}{y} + \frac{2 \sin 3\theta}{z}$$

$$3) (xyz) \sin 3\theta = (y + 2z) \cos 3\theta + y \sin 3\theta$$

have a solution  $(x_o, y_o, z_o)$  with  $y_o z_o \neq 0$  is (2010)

2. The number of all possible values of  $\theta$  in the interval,  $\left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$  such that  $\theta \neq \frac{n\pi}{5}$  for  $n = 0, \pm 1, \pm 2$  and  $\tan \theta = \cot 5\theta$  as well as  $\sin 2\theta = \cos 4\theta$  is [2010]

3. The maximum value of the expression  $\frac{1}{\sin^2 \theta + 3 \sin \theta \cos \theta + 5 \cos^2 \theta}$  is [2010]

4. 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  $k > 0$ , the value of  $[k]$  is [2010]

5. The positive integer value of  $n > 3$  satisfying the equation  $\frac{1}{\sin\left(\frac{\pi}{n}\right)} = \frac{1}{\sin\left(\frac{2\pi}{n}\right)} + \frac{1}{\sin\left(\frac{3\pi}{n}\right)}$  is [2010]