Police DAV Public School, Ludhiana

Class –XII/ Mathematics

Q.1 If A is square matrix of order n x n then adj (adj A) is equal to

(a) $|A|^{n}A$ (b) $|A|^{n-1}A$ (c) $|A|^{n-2}A$ (d) $|A|^{n-3}A$

Q.2 If A is an orthogonal matrix, then A^{-1} equals

(a) A (b) A^T (c) A^2 (d) I

Q.3 If A $\begin{pmatrix} \text{Cos}\,\Theta & \text{Sin}\,\Theta \\ -\text{Sin}\,\Theta & \text{Cos}\Theta \end{pmatrix}$, then $\lim_{n\to\infty} \frac{A^n}{n}$ is

(a) Zero matrix (b) Identity matrix (c) $\begin{pmatrix} 0 & 1 \\ 0 & -1 \end{pmatrix}$ (d) $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$

Q.4 The value of a 3 x 3 determinant is 11, then the value of determinant formed by its cofactors will be

(a) 11 (b) 121 (c) 1331 (d) 14641

Q.5 $f(x) = \begin{vmatrix} \text{Cos } x & x & 1 \\ 2\sin x & x^2 & 2x \\ \tan x & x & 1 \end{vmatrix}$, then $\lim_{x\to 0} \left(\frac{f'(x)}{x}\right)$

(a) 2 (b) -2 (c) 1 (d) -1

Q.6 If $a^2+b^2+c^2+= -2$ and

$$f(x) = \begin{vmatrix} 1+a^2x & (1+b^2)x & (1+C^2)\,x \\ (1+a^2)x & 1+b^2x & (1+c^2)x \\ (1+a^2)x & (1+b^2)x & 1+c^2x \end{vmatrix}$$

Then f(x) is a polynomial of degree

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

Q.7 Let f be a function satisfying $f(x+y) = f(x)\,f(y)\ \forall\ x \in R$. If $f(1) = 3$ then $\sum_{r=1}^{n} f(r)$ is equal to

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

Q.8 $f(x) = \lim_{t\to\infty} \frac{(1+\sin \pi x)^t - 1}{(1+\sin \pi x)^t + 1}$, then range of f (x) is

(a) (-1,1) (b) (0,1) (c) (-1, 0) (d) (-1,0,1)

Q.9 If $f(x) = \frac{4^x}{4^x+2}$, then $f\left(\frac{1}{1997}\right) + f\left(\frac{2}{1997}\right) + f\left(\frac{3}{1997}\right) + \ldots\ldots + f\left(\frac{1996}{1997}\right)$ is equal to

(a) 1997 (b) 998 (c) 0 (d) 997

Q.10 The set of points of discontinuity of $f(x) = \lim_{x \to \infty} \frac{x^{-n} - x^n}{x^{-n} + x^n}$ is

(a) {1} (b) {-1} (c) {-1,1} (d) {0}

Q.11 Let f be a differentiable function such that $f\left(\frac{x}{y}\right) = \frac{f(x)}{f(y)}$ for all x, y € R, y # 0. If f '(1)=2, then f '(x) is equal to

(a) 2f(x) (b) $\frac{f(x)}{x}$ (c) 2xf(x) (d) $\frac{2f(x)}{x}$

Q.12 $\frac{d}{dx} \cos(\sin x^2)$, at $x = \sqrt{\Pi/2}$ is

(a) -1 (b) 1 (c) 2 (d) 0

Q.13 y cos x + x cos y = Π, then y ''(0) is

(a) 1 (b) II (c) 0 (d) -II

Q.14 $f(x) = (1+x)^n$, then value of $f(x) = f(0) + \frac{f^{II}(0)}{2!} + \frac{f^{III}(0)}{3!} + \text{--------} + \frac{f^n(0)}{n!}$ is

(a) n (b) 2^n (c) 2^{n-1} (d) 2^{n-2}

Q.15 If f(x) = x+ tanx, f is inverse of g, then g (x) is equal to

(a) $\frac{1}{1+(g(x)-x)^2}$ (b) $\frac{1}{1-(g(x)-x)^2}$

(c) $\frac{1}{2+(g(x)-x)^2}$ (b) $\frac{1}{2-(g(x)-x)^2}$

Q.16 Range of $f(x) = \sin^{-1} x + \tan^{-1} x + \sec^{-1} x$ is

(a) $\left(\frac{\Pi}{4}, \frac{3\Pi}{4}\right]$ (b) $\left(\frac{\Pi}{4}, \frac{3\Pi}{4}\right]$

(c) $\left(\frac{\Pi}{4}, \frac{3\Pi}{4}\right]$ (d) $\left(\frac{\Pi}{4}, \frac{3\Pi}{4}\right]$

Q.17 If $x^2+y^2+z^2=r^2$, the $\tan^{-1}\left(\frac{xy}{zr}\right) + \tan^{-1}\left(\frac{yz}{xr}\right) + \tan^{-1}\left(\frac{zx}{yr}\right)$ is

(a) Π (b) $\frac{\Pi}{2}$ (c) 0 (d) $\frac{-\Pi}{2}$

Q.18 Sum of series $\text{Cot}^{-1}(2) + \text{Cot}^{-1}(8) + \text{Cot}^{-1}(18) + \text{Cot}^{-1}(32)$ …… upto ∞ is equal to

(a) Π (b) $\frac{\Pi}{2}$ (c) $\frac{\Pi}{4}$ (d) 0

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Class –XII/Mathematics

Q.1 Consider $f : R_+ \rightarrow \{-9,\infty)$ given by $f(x) = 5x2 + 6x - 9$. Prove that f is invertible with $f^{-1}(y) = \{\frac{\sqrt{54+5y}-3}{5}\}$

Q.2 If $f : N \rightarrow N$ is defined by

$$f(n) = \begin{cases} \frac{n+1}{2}, & \text{if n is odd} \\ \frac{n}{2}, & \text{if n is even} \end{cases} \quad \text{for all } n \in N$$

Find whether the function f is bijective.

Q.3 Express the following matrix as a sum of a symmetric and a skew-symetric matrices and verify your result.

$$\begin{pmatrix} 3 & -2 & -4 \\ 3 & -2 & -5 \\ -1 & 1 & 2 \end{pmatrix}$$

Q.4 Find inverse using elementary transformation.

$$\begin{pmatrix} -1 & 3 & 0 \\ 0 & -2 & 1 \end{pmatrix}$$

Q.5 Using properties of determinants, prove that

$$\begin{pmatrix} x^2+1 & xy & xz \\ xy & y^2+1 & yz \\ xz & yz & z^2+1 \end{pmatrix} = 1 + x^2 + y^2 + z^2$$

Q.6 If $A = \begin{pmatrix} 1 & -2 & 0 \\ 2 & 1 & 3 \\ 0 & -2 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 7 & 2 & -6 \\ -2 & 1 & -3 \\ -4 & 2 & 5 \end{pmatrix}$

Find AB and hence solve system of equations $x - 2y = 10$, $2x + y + 3z = 8$, $-2y + z = 7$.

Q.7 If $A = \begin{pmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{pmatrix}$

Then find AB. Use this to solve this to system of equations: $x - y = 3$, $2x + 3y + 4z = 17$, $y + 2z = 7$.

Q.8 $$f(x) = \begin{cases} \frac{1-\cos 4x}{x^2}, & \text{when } x<0 \\ a, & \text{when } x = 0 \\ \frac{\sqrt{x}}{\sqrt{16-\sqrt{x}} - 4}, & \text{when } x > 0 \end{cases}$$

and f is continuous at $x = 0$, then find the value of a.

Q.9 Find the value of k, for which

$$f(x) = \begin{cases} \dfrac{\sqrt{1+kx} - \sqrt{1-kx}}{x} & \text{if } -1 \le x < 0 \\ \dfrac{2x+1}{x-1} & \text{if } 0 \le x < 1 \end{cases}$$

is continuous at x = 0.

Q.10 If $e^x + e^y = e^{x+y}$, prove that $\dfrac{dy}{dx} + e^{y-x} = 0$

Q.11 Differentiate $\tan^{-1}\left(\dfrac{\sqrt{1-x^2}}{x}\right)$ w.r.t $\cos^{-1}(2x\sqrt{1-x^2})$, when $x \neq 0$

Q.12 Differentiate the following with respect to x

$$\sin^{-1}\left(\frac{2^{x+1}.\,3^x}{1+(36)^x}\right)$$

Q.13 If $(\cos x)^y = (\cos y)^x$, the find $\dfrac{dy}{dx}$

Q.14 If sin y = x sin (a+y), then prove that

$$\frac{dy}{dx} = \frac{\sin^2(a+y)}{\sin a}$$

Q.15 If $(\tan^{-1}x)^y + y^{\cot x} = 1$, then find dy/dx.

Q.16 Find the intervals in which the function given by f(x) = sin x + cos x, $0 \le x \le 2\pi$ is

(i) increasing (ii) decreasing

Q.17 Find the point on the curve $9y^2 = x^3$, where the normal to the curve makes equal intercepts on the axes.

Q.18 Find the equations of tangents to the curve $3x^2 - y^2 = 8$, which passes through the point $\left(\frac{4}{3}, 0\right)$

Q.19 Show that the semi-vertical angle of the cone of the maximum volume and of given slant height is $\cos^{-1} 1/\sqrt{3}$.

Q.20 Show that of all the rectangles of given area, the square has the smallest perimeter.

Q.21 AB is diameter of a circle and C is any point on the circle. Show that the area of ΔABC is maximum when it is isosceles.