

**KCET – 2024 TEST PAPER WITH ANSWER KEY  
(HELD ON THURSDAY 18<sup>TH</sup> APRIL 2024)**

**MATHEMATICS**

1. Two finite sets have  $m$  and  $n$  elements respectively. The total number of subsets of the first set is 56 more than the total number of subsets of the second set. The values of  $m$  and  $n$  respectively are
- (A) 7, 6 (B) 5, 1  
(C) 6, 3 (D) 8, 7

**Ans. C**

2. If  $[x]^2 - 5[x] + 6 = 0$ , where  $[x]$  denotes the greatest integer function, then
- (A)  $x \in [3, 4]$  (B)  $x \in [2, 4)$   
(C)  $x \in [2, 3]$  (D)  $x \in (2, 3]$

**Ans. B**

3. If in two circles, arcs of the same length subtend angles  $30^\circ$  and  $78^\circ$  at the centre, then the ratio of their radii is
- (A)  $\frac{5}{13}$  (B)  $\frac{13}{5}$   
(C)  $\frac{13}{4}$  (D)  $\frac{4}{13}$

**Ans. B**

4. If  $\Delta ABC$  is right angled at  $C$ , then the value of  $\tan A + \tan B$  is
- (A)  $a + b$  (B)  $\frac{a^2}{bc}$   
(C)  $\frac{c^2}{ab}$  (D)  $\frac{b^2}{ac}$

**Ans. C**

5. The real value of ' $\alpha$ ' for which  $\frac{1 - i \sin \alpha}{1 + 2i \sin \alpha}$  is purely real is
- (A)  $(n+1)\frac{\pi}{2}, n \in \mathbb{N}$  (B)  $(2n+1)\frac{\pi}{2}, n \in \mathbb{N}$   
(C)  $n\pi, n \in \mathbb{N}$  (D)  $(2n-1)\frac{\pi}{2}, n \in \mathbb{N}$

**Ans. C**

6. The length of a rectangle is five times the breadth. If the minimum perimeter of the rectangle is 180 cm, then
- (A) Breadth  $\leq 15$  cm (B) Breadth  $\geq 15$  cm  
(C) Length  $\leq 15$  cm (D) Length = 15 cm

**Ans. B**

7. The value of  ${}^{49}C_3 + {}^{48}C_3 + {}^{47}C_3 + {}^{46}C_3 + {}^{45}C_3 + {}^{45}C_4$  is

- (A)  ${}^{50}C_4$  (B)  ${}^{50}C_3$   
 (C)  ${}^{50}C_2$  (D)  ${}^{50}C_1$

**Ans. A**

8. In the expansion of  $(1+x)^n$

$\frac{C_1}{C_0} + 2\frac{C_2}{C_1} + 3\frac{C_3}{2} + \dots + n\frac{C_n}{C_{n-1}}$  is equal to

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

**Ans. A**

9. If  $S_n$  stands for sum to  $n$ -terms of a G.P. with 'a' as the first term and 'r' as the common ratio then  $S_n : S_{2n}$  is

- (A)  $r^n + 1$  (B)  $\frac{1}{r^n + 1}$   
 (C)  $r^n - 1$  (D)  $\frac{1}{r^n - 1}$

**Ans. B**

10. If A.M. and G.M. of roots of a quadratic equation are 5 and 4 respectively, then the quadratic equation is

- (A)  $x^2 - 10x - 16 = 0$  (B)  $x^2 + 10x + 16 = 0$   
 (C)  $x^2 + 10x - 16 = 0$  (D)  $x^2 - 10x + 16 = 0$

**Ans. D**

11. The angle between the line  $x + y = 3$  and the line joining the points (1, 1) and (-3, 4) is

- (A)  $\tan^{-1}(7)$  (B)  $\tan^{-1}\left(-\frac{1}{7}\right)$   
 (C)  $\tan^{-1}\left(\frac{1}{7}\right)$  (D)  $\tan^{-1}\left(\frac{2}{7}\right)$

**Ans. C**

12. The equation of parabola whose focus is (6, 0) and directrix is  $x = -6$  is

- (A)  $y^2 = 24x$  (B)  $y^2 = -24x$   
 (C)  $x^2 = 24y$  (D)  $x^2 = -24y$

**Ans. A**

13.  $\lim_{x \rightarrow \frac{\pi}{4}} \frac{\sqrt{2} \cos x - 1}{\cot x - 1}$  is equal to

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

**Ans. C**

14. The negation of the statement

“For every real number  $x$  ;  $x^2 + 5$  is positive” is

- (A) For every real number  $x$  ;  $x^2 + 5$  is not positive  
 (B) For every real number  $x$  ;  $x^2 + 5$  is negative  
 (C) There exists at least one real number  $x$  such that  $x^2 + 5$  is not positive  
 (D) There exists at least one real number  $x$  such that  $x^2 + 5$  is positive

**Ans. C**

15. Let  $a, b, c, d$  and  $e$  be the observations with mean  $m$  and standard deviation  $S$ . The standard deviation of the observations  $a + k, b + k, c + k, d + k$  and  $e + k$  is

- (A)  $kS$  (B)  $S + k$   
 (C)  $\frac{S}{k}$  (D)  $S$

**Ans. D**

16. Let  $f : \mathbb{R} \rightarrow \mathbb{R}$  be given  $f(x) = \tan x$ . Then  $f^{-1}(1)$  is

- (A)  $\frac{\pi}{4}$  (B)  $\left\{ n\pi + \frac{\pi}{4} : n \in \mathbb{Z} \right\}$   
 (C)  $\frac{\pi}{3}$  (D)  $\left\{ n\pi + \frac{\pi}{3} : n \in \mathbb{Z} \right\}$

**Ans. A**

17. Let  $f : \mathbb{R} \rightarrow \mathbb{R}$  be defined by  $f(x) = x^2 + 1$ . Then the pre images of 17 and  $-3$  respectively are

- (A)  $\phi, \{4, -4\}$  (B)  $\{3, -3\}, \phi$   
 (C)  $\{4, -4\}, \phi$  (D)  $\{4, -4\}, \{2, -2\}$

**Ans. C**

18. Let  $(g \circ f)(x) = \sin x$  and  $(f \circ g)(x) = (\sin \sqrt{x})^2$ . Then

- (A)  $f(x) = \sin^2 x, g(x) = x$  (B)  $f(x) = \sin \sqrt{x}, g(x) = \sqrt{x}$   
 (C)  $f(x) = \sin^2 x, g(x) = \sqrt{x}$  (D)  $f(x) = \sin \sqrt{x}, g(x) = x^2$

**Ans. C**

19. Let  $A = \{2, 3, 4, 5, \dots, 16, 17, 18\}$ . Let  $R$  be the relation on the set  $A$  of ordered pairs of positive integers defined by  $(a, b) R (c, d)$  if and only if  $ad = bc$  for all  $(a, b), (c, d)$  in  $A \times A$ . Then the number of ordered pairs of the equivalence class of  $(3, 2)$  is

- (A) 4 (B) 5  
(C) 6 (D) 7

Ans. C

20. If  $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = 3\pi$ , then  $x(y+z) + y(z+x) + z(x+y)$  equals to

- (A) 0 (B) 1  
(C) 6 (D) 12

Ans. C

21. If  $2\sin^{-1} x - 3\cos^{-1} x = 4, x \in [-1, 1]$  then  $2\sin^{-1} x + 3\cos^{-1} x$  is equal to

- (A)  $\frac{4-6\pi}{5}$  (B)  $\frac{6\pi-4}{5}$   
(C)  $\frac{3\pi}{2}$  (D) 0

Ans. B

22. If  $A$  is a square matrix such that  $A^2 = A$ , then  $(I + A)^3$  is equal to

- (A)  $7A - I$  (B)  $7A$   
(C)  $7A + I$  (D)  $I - 7A$

Ans. C

23. If  $A = \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$ , then  $A^{10}$  is equal to

- (A)  $2^8 A$  (B)  $2^9 A$   
(C)  $2^{10} A$  (D)  $2^{11} A$

Ans. B

24. If  $f(x) = \begin{vmatrix} x-3 & 2x^2-18 & 2x^3-81 \\ x-5 & 2x^2-50 & 4x^3-500 \\ 1 & 2 & 3 \end{vmatrix}$ , then  $f(1) \cdot f(3) + f(3) \cdot f(5) + f(5) \cdot f(1)$  is

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

Ans. Bonus

25. If  $P = \begin{bmatrix} 1 & \alpha & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 4 \end{bmatrix}$  is the adjoint of a  $3 \times 3$  matrix  $A$  and  $|A| = 4$ , then  $\alpha$  is equal to

- (A) 4 (B) 5  
(C) 11 (D) 0

Ans. C

26. If  $A = \begin{vmatrix} x & 1 \\ 1 & x \end{vmatrix}$  and  $B = \begin{vmatrix} x & 1 & 1 \\ 1 & x & 1 \\ 1 & 1 & x \end{vmatrix}$ , then  $\frac{dB}{dx}$  is

- (A)  $3A$  (B)  $-3B$   
 (C)  $3B + 1$  (D)  $1 - 3A$

**Ans. A**

27. Let  $f(x) = \begin{vmatrix} \cos x & x & 1 \\ 2\sin x & x & 2x \\ \sin x & x & x \end{vmatrix}$ . Then  $\lim_{x \rightarrow 0} \frac{f(x)}{x^2} =$

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

**Ans. B**

28. Which one of the following observations is correct for the features of logarithm function to any base  $b > 1$ ?

- (A) The domain of the logarithm function is  $\mathbb{R}$ , the set of real numbers.  
 (B) The range of the logarithm function is  $\mathbb{R}^+$ , the set of all positive real numbers.  
 (C) The point  $(1, 0)$  is always on the graph of the logarithm function.  
 (D) The graph of the logarithm function is decreasing as we move from left to right.

**Ans. C**

29. The function  $f(x) = |\cos x|$  is

- (A) Everywhere continuous and differentiable  
 (B) Everywhere continuous but not differentiable at odd multiples of  $\frac{\pi}{2}$   
 (C) Neither continuous nor differentiable at  $(2n+1)\frac{\pi}{2}, n \in \mathbb{Z}$   
 (D) Not differentiable everywhere

**Ans. B**

30. If  $y = 2x^{3x}$ , then  $\frac{dy}{dx}$  at  $x = 1$  is

- (A)  $2$  (B)  $6$   
 (C)  $3$  (D)  $1$

**Ans. B**

31. Let the function satisfy the equation  $f(x+y) = f(x)f(y)$  for all  $x, y \in \mathbb{R}$ , where  $f(0) \neq 0$ . If  $f(5) = 3$  and  $f'(0) = 2$ , then  $f'(5)$  is

- (A)  $6$  (B)  $0$   
 (C)  $3$  (D)  $-6$

**Ans. Bonus (If we ignore inconsistency we will get A)**

32. The value of  $C$  in  $(0, 2)$  satisfying the mean value theorem for the function  $f(x) = x(x-1)^2$ ,  $x \in [0, 2]$  is equal to

- (A)  $\frac{3}{4}$  (B)  $\frac{4}{3}$   
 (C)  $\frac{1}{3}$  (D)  $\frac{2}{3}$

**Ans. B**

33.  $\frac{d}{dx} \left[ \cos^2 \left( \cot^{-1} \sqrt{\frac{2+x}{2-x}} \right) \right]$  is

- (A)  $-\frac{3}{4}$  (B)  $-\frac{1}{2}$   
 (C)  $\frac{1}{2}$  (D)  $\frac{1}{4}$

**Ans. D**

34. For the function  $f(x) = x^3 - 6x^2 + 12x - 3$ ;  $x = 2$  is

- (A) A point of minium (B) A point of inflexion  
 (C) Not a critical point (D) A point of maximum

**Ans. B**

35. The function  $x^x$ ;  $x > 0$  is strictly increasing at

- (A)  $\forall x \in \mathbb{R}$  (B)  $x < \frac{1}{e}$   
 (C)  $x > \frac{1}{e}$  (D)  $x < 0$

**Ans. C**

36. The maximum volume of the right circular cone with slant height 6 units is

- (A)  $4\sqrt{3} \pi$  cubic units (B)  $16\sqrt{3} \pi$  cubic units  
 (C)  $3\sqrt{3} \pi$  cubic units (D)  $6\sqrt{3} \pi$  cubic units

**Ans. B**

37. If  $f(x) = x e^{x(1-x)}$  then  $f(x)$  is

- (A) Increasing in  $\mathbb{R}$  (B) Decreasing in  $\mathbb{R}$   
 (C) Decreasing in  $\left[-\frac{1}{2}, 1\right]$  (D) Increasing in  $\left[-\frac{1}{2}, 1\right]$

**Ans. D**

38.  $\int \frac{\sin x}{3 + 4\cos^2 x} dx =$

(A)  $-\frac{1}{2\sqrt{3}} \tan^{-1} \left( \frac{2\cos x}{\sqrt{3}} \right) + C$

(B)  $\frac{1}{\sqrt{3}} \tan^{-1} \left( \frac{\cos x}{3} \right) + C$

(C)  $\frac{1}{2\sqrt{3}} \tan^{-1} \left( \frac{\cos x}{3} \right) + C$

(D)  $-\frac{1}{\sqrt{3}} \tan^{-1} \left( \frac{2\cos x}{3} \right) + C$

**Ans. A**

39.  $\int_{-\pi}^{\pi} (1 - x^2) \sin x \cdot \cos^2 x \, dx =$

(A)  $\pi - \frac{\pi^2}{3}$

(B)  $2\pi - \pi^3$

(C)  $\pi - \frac{\pi^3}{2}$

(D) 0

**Ans. D**

40.  $\int \frac{1}{x[6(\log x)^2 + 7\log x + 2]} dx =$

(A)  $\frac{1}{2} \log \left| \frac{2\log x + 1}{3\log x + 2} \right| + C$

(B)  $\log \left| \frac{2\log x + 1}{3\log x + 2} \right| + C$

(C)  $\log \left| \frac{3\log x + 2}{2\log x + 1} \right| + C$

(D)  $\frac{1}{2} \log \left| \frac{3\log x + 2}{2\log x + 1} \right| + C$

**Ans. B**

41.  $\int \frac{\sin \frac{5x}{2}}{\sin \frac{x}{2}} dx =$

(A)  $2x + \sin x + 2\sin 2x + C$

(B)  $x + 2\sin x + 2\sin 2x + C$

(C)  $x + 2\sin x + \sin 2x + C$

(D)  $2x + \sin x + \sin 2x + C$

**Ans. C**

42.  $\int_1^5 (|x - 3| + |1 - x|) dx =$

(A) 12

(B)  $\frac{5}{6}$

(C) 21

(D) 10

**Ans. A**

43.  $\lim_{n \rightarrow \infty} \left( \frac{n}{n^2 + 1^2} + \frac{n}{n^2 + 2^2} + \frac{n}{n^2 + 3^2} + \dots + \frac{1}{5n} \right) =$

(A)  $\frac{\pi}{4}$

(B)  $\tan^{-1} 3$

(C)  $\tan^{-1} 2$

(D)  $\frac{\pi}{2}$

**Ans. C**

44. The area of the region bounded by the line  $y = 3x$  and the curve  $y = x^2$  in sq. units is

(A) 10

(B)  $\frac{9}{2}$

(C) 9

(D) 5

**Ans. B**

45. The area of the region bounded by the line  $y = x$  and the curve  $y = x^3$  is

(A) 0.2 sq. units

(B) 0.3 sq. units

(C) 0.4 sq. units

(D) 0.5 sq. units

**Ans. D**

46. The solution of  $e^{\frac{dy}{dx}} = x + 1, y(0) = 3$  is

(A)  $y - 2 = x \log x - x$

(B)  $y - x - 3 = x \log x$

(C)  $y - x - 3 = (x + 1) \log(x + 1)$

(D)  $y + x - 3 = (x + 1) \log(x + 1)$

**Ans. D**

47. The family of curves whose  $x$  and  $y$  intercepts of a tangent at any point are respectively double the  $x$  and  $y$  coordinates of that point is

(A)  $xy = C$

(B)  $x^2 + y^2 = C$

(C)  $x^2 - y^2 = C$

(D)  $\frac{y}{x} = C$

**Ans. A**

48. The vectors  $\vec{AB} = 3\hat{i} + 4\hat{k}$  and  $\vec{AC} = 5\hat{i} - 2\hat{j} + 4\hat{k}$  are the sides of a  $\Delta ABC$ . The length of the median through A is

(A)  $\sqrt{18}$

(B)  $\sqrt{72}$

(C)  $\sqrt{33}$

(D)  $\sqrt{288}$

**Ans. C**

49. The volume of the parallelopiped whose co-terminous edges are  $\hat{j} + \hat{k}, \hat{i} + \hat{k}$  and  $\hat{i} + \hat{j}$  is

(A) 6 cu. units

(B) 2 cu. units

(C) 4 cu. units

(D) 3 cu. units

**Ans. B**

50. Let  $\vec{a}$  and  $\vec{b}$  be two unit vectors and  $\theta$  is the angle between them. Then  $\vec{a} + \vec{b}$  is a unit vector if

- (A)  $\theta = \frac{\pi}{4}$  (B)  $\theta = \frac{\pi}{3}$   
 (C)  $\theta = \frac{2\pi}{3}$  (D)  $\theta = \frac{\pi}{2}$

Ans. C

51. If  $\vec{a}, \vec{b}, \vec{c}$  are three non-coplanar vectors and  $p, q, r$  are vectors defined by

$$\vec{p} = \frac{\vec{a} \times \vec{c}}{[\vec{a} \vec{b} \vec{c}]}, \vec{q} = \frac{\vec{c} \times \vec{a}}{[\vec{a} \vec{b} \vec{c}]}, \vec{r} = \frac{\vec{a} \times \vec{b}}{[\vec{a} \vec{b} \vec{c}]} \text{ then}$$

$$(\vec{a} + \vec{b}) \cdot \vec{p} + (\vec{b} + \vec{c}) \cdot \vec{q} + (\vec{c} + \vec{a}) \cdot \vec{r} \text{ is}$$

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

Ans. D

52. If lines  $\frac{x-1}{-3} = \frac{y-2}{2k} = \frac{z-3}{2}$  and  $\frac{x-1}{3k} = \frac{y-5}{1} = \frac{z-6}{-5}$  are mutually perpendicular then  $k$  is equal to

- (A)  $-\frac{10}{7}$  (B)  $-\frac{7}{10}$   
 (C)  $-10$  (D)  $-7$

Ans. A

53. The distance between the two planes  $2x + 3y + 4z = 4$  and  $4x + 6y + 8z = 12$  is

- (A) 2 units (B) 8 units  
 (C)  $\frac{2}{\sqrt{29}}$  units (D) 4 units

Ans. C

54. The sine of the angle between the straight line  $\frac{x-2}{3} = \frac{y-3}{4} = \frac{4-z}{-5}$  and the plane  $2x - 2y + z = 5$  is

- (A)  $\frac{1}{5\sqrt{2}}$  (B)  $\frac{2}{5\sqrt{2}}$   
 (C)  $\frac{3}{50}$  (D)  $\frac{3}{\sqrt{50}}$

Ans. A

55. The equation  $xy = 0$  in three-dimensional space represents

- (A) A pair of straight lines (B) A plane  
 (C) A pair of planes at right angles (D) A pair of parallel planes

Ans. C

56. The plane containing the point (3, 2, 0) and the line  $\frac{x-3}{1} = \frac{y-6}{5} = \frac{z-4}{4}$  is

- (A)  $x - y + z = 1$  (B)  $x + y + z = 5$   
 (C)  $x + 2y - z = 1$  (D)  $2x - y + z = 5$

**Ans. A**

57. Corner points of the feasible region for an LPP are (0, 2), (3, 0), (6, 0), (6, 8) and (0, 5). Let  $z = 4x + 6y$  be the objective function. The minimum value of  $z$  occurs at

- (A) Only (0, 2)  
 (B) Only (3, 0)  
 (C) The mid-point of the line segment joining the points (0, 2) and (3, 0)  
 (D) Any point on the line segment joining the points (0, 2) and (3, 0)

**Ans. D**

58. A die is thrown 10 times. The probability that an odd number will come up at least once is

- (A)  $\frac{11}{1024}$  (B)  $\frac{1013}{1024}$   
 (C)  $\frac{1023}{1024}$  (D)  $\frac{1}{1024}$

**Ans. C**

59. A random variable  $X$  has the following probability distribution:

$X$	0	1	2
$P(X)$	$\frac{25}{36}$	$k$	$\frac{1}{36}$

If the mean of the random variable  $X$  is  $\frac{1}{3}$ , then the variance is

- (A)  $\frac{1}{18}$  (B)  $\frac{5}{18}$   
 (C)  $\frac{7}{18}$  (D)  $\frac{11}{18}$

**Ans. B**

60. If a random variable  $X$  follows the binomial distribution with parameters  $n = 5$ ,  $p$  and  $P(X = 2) = 9P(X = 3)$ , then  $p$  is equal to

- (A) 10 (B)  $\frac{1}{10}$   
 (C) 5 (D)  $\frac{1}{5}$

**Ans. B**