KCET - 2021 TEST PAPER WITH ANSWE KEY

Mathematics

1. The equation of the line joining the points $(-3, 4, 11)$ and $(1, -2, 7)$ is

(a) $\frac{x+3}{2} = \frac{y-4}{3} = \frac{z-11}{4}$

(b) $\frac{x+3}{-2} = \frac{y-4}{3} = \frac{z-11}{2}$

(c) $\frac{x+3}{-2} = \frac{y+4}{3} = \frac{z+11}{4}$

(d) $\frac{x+3}{2} = \frac{y+4}{-3} = \frac{z+11}{2}$

2. The angle between the lines whose direction cosines are $\left(\frac{\sqrt{3}}{4}, \frac{1}{4}, \frac{\sqrt{3}}{2}\right)$ and $\left(\frac{\sqrt{3}}{4}, \frac{1}{4}, \frac{-\sqrt{3}}{2}\right)$ is

(a) π (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{4}$

3. If a plane meets the coordinate axes at A, B and C in such a way that the centroid of ΔABC is at the point $(1, 2, 3)$, then the equation of the plane is

(a) $\frac{x}{1} + \frac{y}{2} + \frac{z}{3} = 1$ (b) $\frac{x}{3} + \frac{y}{6} + \frac{z}{9} = 1$

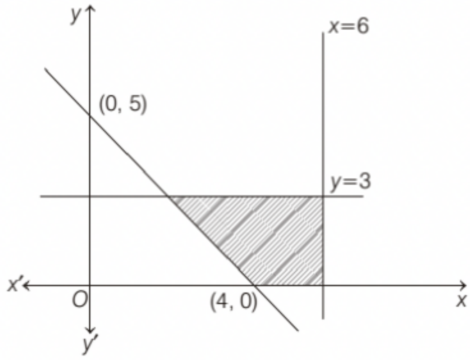
(c) $\frac{x}{1} + \frac{y}{2} + \frac{z}{3} = \frac{1}{3}$ (d) $\frac{x}{1} - \frac{y}{2} + \frac{z}{3} = -1$

4. The area of the quadrilateral $ABCD$ when $A(0, 4, 1)$, $B(2, 3, -1)$, $C(4, 5, 0)$ and $D(2, 6, 2)$ is equal to

(a) 9 sq units (b) 18 sq units

(c) 27 sq units (d) 81 sq units

5. The shaded region is the solution set of the inequalities



(a) $5x + 4y \geq 20, x \leq 6, y \geq 3, x \geq 0, y \geq 0$
(b) $5x + 4y \leq 20, x \leq 6, y \leq 3, x \geq 0, y \geq 0$
(c) $5x + 4y \geq 20, x \leq 6, y \leq 3, x \geq 0, y \geq 0$
(d) $5x + 4y \geq 20, x \geq 6, y \leq 3, x \geq 0, y \geq 0$

6. Given that, A and B are two events such that $P(B) = \frac{3}{5}, P\left(\frac{A}{B}\right) = \frac{1}{2}$ and $P(A \cup B) = \frac{4}{5}$, then $P(A)$ is equal to

(a) $\frac{3}{10}$ (b) $\frac{1}{2}$ (c) $\frac{1}{5}$ (d) $\frac{3}{5}$

7. If A, B and C are three independent events such that $P(A) = P(B) = P(C) = P$, then P (at least two of A, B and C occur) is equal to

(a) $P^3 - 3P$ (b) $3P - 2P^2$
(c) $3P^2 - 2P^3$ (d) $3P^2$

8. Two dice are thrown. If it is known that the sum of numbers on the dice was less than 6 the probability of getting a sum as 3 is

(a) $\frac{1}{18}$ (b) $\frac{5}{18}$ (c) $\frac{1}{5}$ (d) $\frac{2}{5}$

9. A car manufacturing factory has two plants X and Y. Plant X manufactures 70% of cars and plant Y manufactures 30% of cars. 80% of cars at plant X and 90% of cars at plant Y are rated as standard quality. A car is chosen at random and is found to be standard quality. The probability that it has come from plant X is

(a) $\frac{56}{73}$ (b) $\frac{56}{84}$ (c) $\frac{56}{83}$ (d) $\frac{56}{79}$

10. In a certain two 65% families own cell phones, 15000 families own scooter and 15% families own both. Taking into consideration that the families own at least one of the two, the total number of families in the town is

(a) 20000 (b) 30000
(c) 40000 (d) 50000

11. A and B are non-singleton sets and $n(A \times B) = 35$. If $B \subset A$, then ${}^{n(A)}C_{n(B)}$ is equal to

(a) 28 (b) 35 (c) 42 (d) 21

12. Domain of $f(x) = \frac{x}{1 - |x|}$ is

(a) $R - [-1, 1]$ (b) $(-\infty, 1)$
(c) $(-\infty, 1) \cup (0, 1)$ (d) $R - \{-1, 1\}$

13. The value of $\cos 1200^\circ + \tan 1485^\circ$ is

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

14. The value of $\tan 1^\circ \tan 2^\circ \tan 3^\circ \ldots \tan 89^\circ$ is

(a) 0 (b) 1
(c) $\frac{1}{2}$ (d) -1

15. If $\left(\frac{1+i}{1-i}\right)^x = 1$, then

(a) $x = 4n + 1, n \in N$ (b) $x = 2n + 1, n \in N$
(c) $x = 2n, n \in N$ (d) $x = 4n, n \in N$

16. The cost and revenue functions of a product are given by $c(x) = 20x + 4000$ and $R(x) = 60x + 2000$ respectively, where x is the number of items produced and sold. The value of x to earn profit is

(a) > 50 (b) > 60
(c) > 80 (d) > 40

17. A student has to answer 10 questions, choosing at least 4 from each of the parts A and B. If there are 6 questions in part A and 7 in part B, then the number of ways can the student choose 10 questions is

(a) 256 (b) 352 (c) 266 (d) 426

18. If the middle term of the AP is 300, then the sum of its first 51 terms is

(a) 15300 (b) 14800
(c) 16500 (d) 14300

19. The equation of straight line which passes through the point $(a\cos^3\theta, a\sin^3\theta)$ and perpendicular to $x\sec\theta + y\operatorname{cosec}\theta = a$ is

(a) $\frac{x}{a} + \frac{y}{a} = a\cos\theta$
(b) $x\cos\theta - y\sin\theta = a\cos 2\theta$
(c) $x\cos\theta + y\sin\theta = a\cos 2\theta$
(d) $x\cos\theta - y\sin\theta = a\cos 2\theta$

20. The mid points of the sides of triangle are $(1, 5, -1)$ $(0, 4, -2)$ and $(2, 3, 4)$ then centroid of the triangle

(a) $(1, 4, 3)$ (b) $\left(1, 4, \frac{1}{3}\right)$
(c) $(-1, 4, 3)$ (d) $\left(\frac{1}{3}, 2, 4\right)$

21. Consider the following statements

Statement 1 : $\lim_{x \to 1} \frac{ax^2 + bx + c}{cx^2 + bx + a}$ is 1 (where $a + b + c \neq 0$).

Statement 2 : $\lim_{x \to 2} \frac{\frac{1}{x} + \frac{1}{2}}{x + 2}$ is $\frac{1}{4}$.

(a) Only statement 2 is true.
(b) Only statement 1 is true.
(c) Both statements 1 and 2 are true.
(d) Both statements 1 and 2 are false.

22. If a and b are fixed non-zero constants, then the derivative of $\frac{a}{x^4} - \frac{b}{x^2} + \cos x$ is $ma + nb - p$, where

(a) $m = 4x^3$, $n = \frac{-2}{x^3}$ and $p = \sin x$
(b) $m = \frac{-4}{x^5}$, $n = \frac{2}{x^3}$ and $p = \sin x$
(c) $m = \frac{-4}{x^5}$, $n = \frac{-2}{x^3}$ and $p = \sin x$
(d) $m = 4x^3$, $n = \frac{2}{x^3}$ and $p = -\sin x$

23. The standard deviation of the numbers 31, 32, 33 … 46, 47 is

(a) $\sqrt{\frac{17}{12}}$ (b) $\sqrt{\frac{47^2 - 1}{12}}$ (c) $2\sqrt{6}$ (d) $4\sqrt{3}$

24. If $P(A) = 0.59, P(B) = 0.30$ and $P(A \cap B) = 0.21$ then $P(A' \cap B')$ is equal to

(a) 0.11 (b) 0.38 (c) 0.32 (d) 0.35

25. $f : R \to R$ defined by $f(x)$ is equal to $\begin{cases} 2x, & x > 3 \\ x^2, & 1 < x \leq 3 \\ 3x, & x \leq 1 \end{cases}$, then $f(-2) + f(3) + f(4)$ is

(a) 14 (b) 9 (c) 5 (d) 11

26. Let $A = \{x : x \in R$, x is not a positive integer)

Define $f : A \to R$ as $f(x) = \frac{2x}{x - 1}$, then f is

(a) injective but not surjective.
(b) surjective but not injective.
(c) bijective.
(d) neither injective nor surjective.

27. The function $f(x) = \sqrt{3} \sin 2x - \cos 2x + 4$ is one-one in the interval

(a) $\left[\frac{-\pi}{6}, \frac{\pi}{3}\right]$ (b) $\left[\frac{\pi}{6}, \frac{-\pi}{3}\right]$
(c) $\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$ (d) $\left[\frac{-\pi}{6}, \frac{-\pi}{3}\right]$

28. Domain of the function

$f(x) = \frac{1}{\sqrt{[x^2] - [x] - 6}}$,

where $[x]$ is greatest integer $\leq x$ is

(a) $(-\infty, -2) \cup [4, \infty)$ (b) $(-\infty, -2) \cup [3, \infty]$
(c) $[-\infty, -2] \cup [4, \infty]$ (d) $[-\infty, -2] \cup [3, \infty)$

29. $\cos\left[\cot^{-1}(-\sqrt{3}) + \frac{\pi}{6}\right]$ is equal to

(a) 0 (b) 1 (c) $\frac{1}{\sqrt{2}}$ (d) -1

30. $\tan^{-1}\left[\frac{1}{\sqrt{3}} \sin \frac{5\pi}{2}\right] \sin^{-1}\left[\cos\left(\sin^{-} \frac{\sqrt{3}}{2}\right)\right]$ is equal to

(a) 0 (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{3}$ (d) π

31. If $A = \begin{bmatrix} 1 & -2 & 1 \\ 2 & 1 & 3 \end{bmatrix} B = \begin{bmatrix} 2 & 1 \\ 3 & 2 \\ 1 & 1 \end{bmatrix}$, then $(AB)'$ is equal to

(a) $\begin{bmatrix} -3 & -2 \\ 10 & 7 \end{bmatrix}$ (b) $\begin{bmatrix} -3 & 10 \\ -2 & 7 \end{bmatrix}$
(c) $\begin{bmatrix} -3 & 7 \\ 10 & 2 \end{bmatrix}$ (d) $\begin{bmatrix} -3 & 7 \\ 10 & -2 \end{bmatrix}$

32. Let M be 2×2 symmetric matrix with integer entries, then M is invertible if

(a) the first column of M is the transpose of second row of M.
(b) the second row of M is the transpose of first column of M.
(c) M is diagonal matrix with non-zero entries in the principal diagonal.
(d) The product of entries in the principal diagonal of M is the product of entries in the other diagonal.

33. If A and B are matrices of order 3 and $|A| = 5, |B| = 3$, then $|3AB|$ is

(a) 425 (b) 405 (c) 565 (d) 585

34. If A and B are invertible matrices then which of the following is not correct ?

(a) $\text{adj } A = |A| A^{-1}$ (b) $\det(A^{-1}) = [\det(A)]^{-1}$

(c) $(AB)^{-1} = B^{-1}A^{-1}$ (d) $(A + B)^{-1} = B^{-1} + A^{-1}$

35. If $f(x) = \begin{vmatrix} \cos x & 1 & 0 \\ 0 & 2\cos x & 3 \\ 0 & 1 & 2\cos x \end{vmatrix}$, then $\lim_{x \to \pi} f(x)$ is equal to

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

36. If $x^3 - 2x^2 - 9x + 18 = 0$ and $A = \begin{vmatrix} 1 & 2 & 3 \\ 4 & x & 6 \\ 7 & 8 & 9 \end{vmatrix}$, then the maximum value of A is

(a) 96 (b) 36

(c) 24 (d) 120

37. At $x = 1$, the function

$f(x) = \begin{cases} x^3 - 1, & 1 < x < \infty \\ x - 1, & -\infty < x \le 1 \end{cases}$ is

(a) continuous and differentiable.

(b) continuous and non-differentiable.

(c) discontinuous and differentiable.

(d) discontinuous and non-differentiable.

38. If $y = (\cos x^2)^2$, then $\frac{dy}{dx}$ is equal to

(a) $-4x\sin 2x^2$ (b) $-x\sin x^2$

(c) $-2x\sin 2x^2$ (d) $-x\cos 2x^2$

39. For constant a, $\frac{d}{dx}(x^x + x^a + a^x + a^a)$ is

(a) $x^x(1 + \log x) + ax^{a-1}$

(b) $x^x(1 + \log x) + ax^{a-1} + a^x \log a$

(c) $x^x(1 + \log x) + a^a(1 + \log x)$

(d) $x^x(1 + \log x) + a^a(1 + \log a) + ax^{a-1}$

40. Consider the following statements

Statement 1 : If $y = \log_{10} x + \log_e x$, then $\frac{dy}{dx} = \frac{\log_{10} e}{x} + \frac{1}{x}$

Statement 2 : If $\frac{d}{dx}(\log_{10} x) = \frac{\log x}{\log 10}$ and $\frac{d}{dx}(\log_e x) = \frac{\log x}{\log e}$

(a) Statement 1 is true, Statement 2 is false.

(b) Statement 1 is false, statement 2 is true.

(c) Both statements 1 and 2 are true.

(d) Both statements 1 and 2 are false.

41. If the parametric equation of curve is given by $x = \cos\theta + \log\tan\frac{\theta}{2}$ and $y = \sin\theta$, then the points for which $\frac{dy}{dx} = 0$ are given by

(a) $\theta = \frac{n\pi}{2}, n \in Z$

(b) $\theta = (2n + 1)\frac{\pi}{2}, n \in Z$

(c) $\theta = (2n + 1)\pi, n \in Z$

(d) $\theta = n\pi, n \in z$

42. If $y = (x - 1)^2(x - 2)^3(x - 3)^5$, then $\frac{dy}{dx}$ at $x = 4$ is equal to

(a) 108 (b) 54

(c) 36 (d) 516

43. A particle starts form rest and its angular displacement (in radians) is given by $\theta = \frac{t^2}{20} + \frac{t}{5}$. If the angular velocity at the end of $t = 4$ is k, then the value of $5k$ is

(a) 0.6 (b) 5

(c) $5k$ (d) 3

44. If the parabola $y = \alpha x^2 - 6x + \beta$ passes through the point (0, 2) and has its tangent at $x = \frac{3}{2}$ parallel to X-axis, then

(a) $\alpha = 2, \beta = -2$ (b) $\alpha = -2, \beta = 2$

(c) $\alpha = 2, \beta = 2$ (d) $\alpha = -2, \beta = -2$

45. The function $f(x) = x^2 - 2x$ is strictly decreasing in the interval

(a) $(-\infty, 1)$ (b) $(1, \infty)$

(c) R (d) $(-\infty, \infty)$

46. The maximum slope of the curve $y = -x^3 + 3x^2 + 2x - 27$ is

(a) 1 (b) 23 (c) 5 (d) -23

47. $\int \frac{x^3 \sin(\tan^{-1}(x^4))}{1+x^8} dx$ is equal to

(a) $\frac{-\cos(\tan^{-1}(x^4))}{4} + C$ (b) $\frac{\cos(\tan^{-1}(x^4))}{4} + C$
(c) $\frac{-\cos(\tan^{-1}(x^3))}{3} + C$ (d) $\frac{\sin(\tan^{-1}(x^4))}{4} + C$

48. The value of $\int \frac{x^2 dx}{\sqrt{x^6 + a^6}}$ is equal to

(a) $\log |x^3 + \sqrt{x^6 + a^6}| + C$
(b) $\log |x^3 - \sqrt{x^6 + a^6}| + C$
(c) $\frac{1}{3}\log |x^3 + \sqrt{x^6 + a^6}| + C$
(d) $\frac{1}{3}\log |x^3 - \sqrt{x^6 + a^6}| + C$

49. The value of $\int \frac{xe^x dx}{(1+x)^2}$ is equal to

(a) $e^x(1 + x) + C$ (b) $e^x(1 + x^2) + C$
(c) $e^x(1 + x)^2 + C$ (d) $\frac{e^x}{1+x} + C$

50. The value of $\int e^x \left[\frac{1 + \sin x}{1 + \cos x}\right] dx$ is equal to

(a) $e^x \tan\frac{x}{2} + C$ (b) $e^x \tan x + C$
(c) $e^x(1 + \cos x) + C$ (d) $e^x(1 + \sin x) + C$

51. If $I_n = \int_0^{\frac{\pi}{4}} \tan^n x\, dx$, where n is positive integer, then $I_{10} + I_8$ is equal to

(a) 9 (b) $\frac{1}{7}$ (c) $\frac{1}{8}$ (d) $\frac{1}{9}$

52. The value of $\int_0^{4042} \frac{\sqrt{x}dx}{\sqrt{x} + \sqrt{4042 - x}}$ is equal to

(a) 4042 (b) 2021 (c) 8084 (d) 1010

53. The area of the region bounded by $y = -\sqrt{16 - x^2}$ and X-axis is

(a) 8π sq units (b) 20π sq units
(c) 16π sq units (d) 256π sq units

54. If the area of the ellipse is $\frac{x^2}{25} + \frac{y^2}{\lambda^2} = 1$ is 20π sq units, then λ is

(a) ± 4 (b) ± 3
(c) ± 2 (d) ± 1

55. Solution of differential equating $x\,dy - y\,dx = 0$ represents

(a) A rectangular hyperbola.
(b) Parabola whose vertex is at origin.
(c) Straight line passing through origin.
(d) A circle whose centre is origin.

56. The number of solutions of $\frac{dy}{dx} = \frac{y+1}{x-1}$, when $y(1) = 2$ is

(a) three (b) one
(c) infinite (d) two

57. A vector **a** makes equal acute angles on the coordinate axis. Then the projection of vector $\mathbf{b} = 5\hat{\mathbf{i}} + 7\hat{\mathbf{j}} + \hat{\mathbf{k}}$ on **a** is

(a) $\frac{11}{15}$ (b) $\frac{11}{\sqrt{3}}$
(c) $\frac{4}{5}$ (d) $\frac{3}{5\sqrt{3}}$

58. The diagonals of a parallelogram are the vectors $3\hat{\mathbf{i}} + 6\hat{\mathbf{j}} - 2\hat{\mathbf{k}}$. and $-\hat{\mathbf{i}} - 2\hat{\mathbf{j}} - 8\hat{\mathbf{k}}$. Then the length of the shorter side of parallelogram is

(a) $2\sqrt{3}$ b) $\sqrt{14}$
(c) $3\sqrt{5}$ (d) $4\sqrt{3}$

59. If $\mathbf{a} \cdot \mathbf{b} = 0$ and $\mathbf{a} + \mathbf{b}$ makes an angle 60° with **a**, then

(a) $|\mathbf{a}| = 2|\mathbf{b}|$ (b) $2|\mathbf{a}| = |\mathbf{b}|$
(c) $|\mathbf{a}| = \sqrt{3}|\mathbf{b}|$ (d) $\sqrt{3}|\mathbf{a}| = |\mathbf{b}|$

60. If the area of the parallelogram with **a** and **b** as two adjacent sides is 15 sq units, then the area of the parallelogram having $3\mathbf{a} + 2\mathbf{b}$ and $\mathbf{a} + 3\mathbf{b}$ as two adjacent sides in sq units is

(a) 45 (b) 75
(c) 105 (d) 120