KERALA ENGINEERING ENTRANCE EXAM - 2014

PAPER – II MATHEMATICS

VERSION : B1 – ANSWER KEY

PLEASE ENSURE THAT THIS BOOKLET CONTAINS 120 QUESTIONS SERIALLY NUMBERED FROM 1 TO 120.

1. If the operation $\oplus$ is defined by $a \oplus b = a^2 + b^2$ for all real numbers a and b, then $(2 \oplus 3) \oplus 4 =$

(A) 120 (B) 185 (C) 175 (D) 129 (E) 312

ANSWER : B

2. The number of students who take both the subjects mathematics and chemistry is 30. This represents 10% of the enrolment in mathematics and 12% of the enrolment in chemistry. How many students take at least one of these two subjects?

(A) 520 (B) 490 (C) 560 (D) 480 (E) 540

ANSWER : A

3. Let $f(x) = |x - 2|$, where x is a real number. Which one of the following is true?

(A) f is periodic

(B) $f(x+y) = f(x) + f(y)$

(C) f is an odd function

(D) f is not a 1-1 function

(E) f is an even function

ANSWER : D

4. If $A = \{1, 3, 5, 7\}$ and $B = \{1, 2, 3, 4, 5, 6, 7, 8\}$, then the number of one-to-one functions from A into B is

(A) 1340 (B) 1860 (C) 1430 (D) 1880 (E) 1680

ANSWER : E

5. The range of the function $f(x) = x^2 + 2x + 2$ is

(A) $(1, \infty)$ (B) $(2, \infty)$ (C) $(0, \infty)$ (D) $(1, \infty)$ (E) $(-\infty, \infty)$

ANSWER : NA

6. If $f(x) = \sqrt{x}$ and $g(x) = 2x - 3$, then $(f \circ g)(x)$ is

(A) $(-\infty, -3)$

(B) $\left(-\infty, -\frac{3}{2}\right)$

(C) $\left[-\frac{3}{2}, 0\right]$

(D) $\left[0, \frac{3}{2}\right]$

(E) $\left[\frac{3}{2}, \infty\right)$

ANSWER : E *

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7. If $z = \dfrac{(\sqrt{3}+i)^3(3i+4)^2}{(8+6i)^2}$, then $|z|$ is equal to

(A) 8 (B) 2 (C) 5 (D) 4 (E) 10

ANSWER : B

8. Let $w \neq \pm 1$ be a complex number. If $|w| = 1$ and $z = \dfrac{w-1}{w+1}$, then $\text{Re}(z)$ is equal to

(A) 1 (B) $\dfrac{1}{|w+1|}$ (C) $\text{Re}(w)$ (D) 0 (E) $w+\overline{w}$

ANSWER : D

9. If $z = e^{2\pi i/3}$, then $1+z+3z^2+2z^3+2z^4+3z^5$ is equal to

(A) $-3e^{\pi i/3}$ (B) $3e^{\pi i/3}$ (C) $3e^{2\pi i/3}$ (D) $-3e^{2\pi i/3}$ (E) 0

ANSWER : A

10. If $z_1 = 2\sqrt{2}(1+i)$ and $z_2 = 1+i\sqrt{3}$, then $z_1^2 z_2^3$ is equal to

(A) $128\,i$ (B) $64\,i$ (C) $-64\,i$ (D) $-128\,i$ (E) 256

ANSWER : D

11. If the complex numbers z_1, z_2 and z_3 denote the vertices of an isosceles triangle, right angled at z_1, then $(z_1-z_2)^2+(z_1-z_3)^2$ is equal to

(A) 0 (B) $(z_2+z_3)^2$ (C) 2 (D) 3 (E) $(z_2-z_3)^2$

ANSWER : A

12. If the roots of $x^2-ax+b=0$ are two consecutive odd integers, then a^2-4b is

(A) 3 (B) 4 (C) 5 (D) 6 (E) 7

ANSWER : B

13. If α and β are the roots of $x^2-ax+b^2=0$, then $\alpha^2+\beta^2$ is equal to

(A) a^2+2b^2 (B) a^2-2b^2 (C) a^2-2b (D) a^2+2b (E) a^2-b^2

ANSWER : B

14. If α and β are the roots of the equation $x^2+3x-4=0$, then $\dfrac{1}{\alpha}+\dfrac{1}{\beta}$ is equal to

(A) $\dfrac{-3}{4}$ (B) $\dfrac{3}{4}$ (C) $\dfrac{-4}{3}$ (D) $\dfrac{4}{3}$ (E) $\dfrac{3}{2}$

ANSWER : B

15. The value of x such that $3^{2x}-2(3^{x+2})+81=0$ is

(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

ANSWER : B

16. If the roots of the equation $x^2+2bx+c=0$ are α and β, then $b^2-c=$

(A) $\frac{(\alpha-\beta)^2}{4}$ (B) $(\alpha+\beta)^2-\alpha\beta$ (C) $(\alpha+\beta)^2+\alpha\beta$

(D) $\frac{(\alpha-\beta)^2}{2}+\alpha\beta$ (E) $\frac{(\alpha+\beta)^2}{2}+\alpha\beta$

ANSWER : A

17. The equation whose roots are the squares of the roots of the equation $2x^2+3x+1=0$ is

(A) $4x^2+5x+1=0$ (B) $4x^2-x+1=0$ (C) $4x^2-5x-1=0$

(D) $4x^2-5x+1=0$ (E) $4x^2+5x-1=0$

ANSWER : D

18. The sum of the series $\sum_{n=8}^{17}\frac{1}{(n+2)(n+3)}$ is equal to

(A) $\frac{1}{17}$ (B) $\frac{1}{18}$ (C) $\frac{1}{19}$ (D) $\frac{1}{20}$ (E) $\frac{1}{21}$

ANSWER : D

19. If two positive numbers are in the ratio $3+2\sqrt{2} : 3-2\sqrt{2}$, then the ratio between their A.M. and G.M. is

(A) 6 : 1 (B) 3 : 2 (C) 2 : 1 (D) 3 : 1 (E) 1 : 6

ANSWER : D

20. Let $x_1, x_2, \cdots, x_n$ be in an A.P. If $x_1+x_4+x_9+x_{11}+x_{20}+x_{22}+x_{27}+x_{30}=272$, then $x_1+x_2+x_3+\cdots+x_{30}$ is equal to

(A) 1020 (B) 1200 (C) 716 (D) 2720 (E) 2072

ANSWER : A

21. If the second and fifth terms of a G.P. are 24 and 3 respectively, then the sum of first six terms is

(A) 181 (B) $\frac{181}{2}$ (C) 189 (D) $\frac{189}{2}$ (E) 191

ANSWER : D

22. If the sum of first 75 terms of an A.P. is 2625, then the 38th term of the A.P. is

(A) 39 (B) 37 (C) 36 (D) 38 (E) 35

ANSWER : E

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23. If $-5, k, -1$ are in A.P., then the value of k is equal to

(A) -5 (B) -3 (C) -1 (D) 3 (E) 5

ANSWER : B

24. Let T_n denote the number of triangles which can be formed by using the vertices of a regular polygon of n sides. If $T_{n+1} - T_n = 36$, then n is equal to

(A) 2 (B) 5 (C) 6 (D) 8 (E) 9

ANSWER : E

25. The middle term in the expansion of $\left(\frac{10}{x}+\frac{x}{10}\right)^{10}$ is

(A) ${}^{10}C_5$ (B) ${}^{10}C_6$ (C) ${}^{10}C_5\frac{1}{x^{10}}$ (D) ${}^{10}C_5x^{10}$ (E) ${}^{10}C_5 10^{10}$

ANSWER : A

26. The coefficient of x^{49} in the product $(x-1)(x-2)(x-3)\cdots(x-50)$ is

(A) -2250 (B) -1275 (C) 1275 (D) 2250 (E) -49

ANSWER : B

27. The sum of the coefficients in the binomial expansion of $\left(\frac{1}{x}+2x\right)^{6}$ is equal to

(A) 1024 (B) 729 (C) 243 (D) 512 (E) 64

ANSWER : B

28. The value of ${}^{2}P_1 + {}^{3}P_1 + ... + {}^{n}P_1$ is equal to

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

(D) $\frac{n^2-n-1}{2}$ (E) $\frac{n^2+n-2}{2}$

ANSWER : E

29. How many four digit numbers $abcd$ exist such that a is odd, b is divisible by 3, c is even and d is prime?

(A) 380 (B) 360 (C) 400 (D) 520 (E) 480

ANSWER : C

30. If $a_1, a_2, a_3, \ldots$ are in A.P., then the value of $\begin{vmatrix} a_1 & a_2 & 1 \\ a_2 & a_3 & 1 \\ a_3 & a_4 & 1 \end{vmatrix}$ is equal to

(A) $a_4 - a_1$ (B) $\frac{a_1+a_4}{2}$ (C) 1 (D) $\frac{a_2+a_3}{2}$ (E) 0

ANSWER : E

31. If $\begin{vmatrix} 2a & x_1 & y_1 \\ 2b & x_2 & y_2 \\ 2c & x_3 & y_3 \end{vmatrix} = \frac{abc}{2} \neq 0$, then the area of the triangle whose vertices are $\left(\frac{x_1}{a}, \frac{y_1}{a}\right), \left(\frac{x_2}{b}, \frac{y_2}{b}\right)$ and $\left(\frac{x_3}{c}, \frac{y_3}{c}\right)$ is

(A) $\frac{1}{4}abc$ (B) $\frac{1}{8}abc$ (C) $\frac{1}{4}$ (D) $\frac{1}{8}$ (E) $\frac{1}{12}$

ANSWER : D

32. The system of linear equations $3x+y-z=2$, $x-z=1$ and $2x+2y+az=5$ has unique solution when

(A) $a \neq 3$ (B) $a \neq 4$ (C) $a \neq 5$ (D) $a \neq 2$ (E) $a \neq 1$

ANSWER : D

33. If A = $\begin{bmatrix} 2-k & 2 \\ 1 & 3-k \end{bmatrix}$ is a singular matrix, then the value of $5k-k^2$ is equal to

(A) 0 (B) 6 (C) -6 (D) -4 (E) 4

ANSWER : E

34. If a,b,c are non-zero and different from 1, then the value of $\begin{vmatrix} \log_a 1 & \log_a b & \log_a c \\ \log_a\left(\frac{1}{b}\right) & \log_b 1 & \log_a\left(\frac{1}{c}\right) \\ \log_a\left(\frac{1}{c}\right) & \log_a c & \log_c 1 \end{vmatrix}$ is

(A) 0 (B) $1+\log_a(a+b+c)$ (C) $\log_a(ab+bc+ca)$

(D) 1 (E) $\log_a(a+b+c)$

ANSWER : A

35. The number of solutions for the system of equations $2x+y=4$, $3x+2y=2$, and $x+y=-2$ is

(A) 1 (B) 2 (C) 3

(D) infinitely many (E) 0

ANSWER : A

36. The number of solutions of the inequation $|x-2|+|x+2|<4$ is

(A) 1 (B) 2 (C) 4 (D) 0 (E) infinite

ANSWER : D

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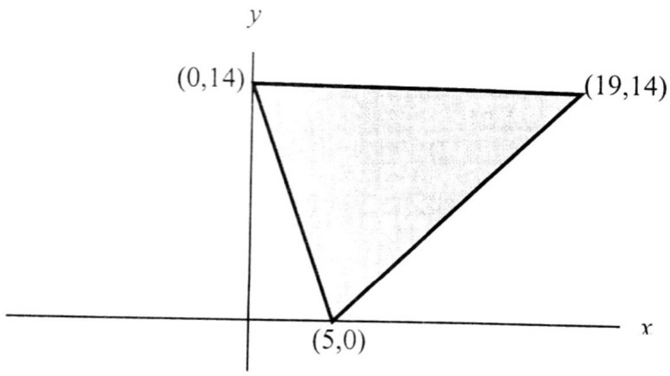
37. The shaded region shown in the figure is given by the inequations



(A) $14x+5y\geq 70,\ y\leq 14$ and $x-y\geq 5$
(B) $14x+5y\leq 70,\ y\leq 14$ and $x-y\geq 5$
(C) $14x+5y\geq 70,\ y\geq 14$ and $x-y\geq 5$
(D) $14x+5y\geq 70,\ y\geq 14$ and $x-y\leq 5$
(E) $14x+5y\geq 70,\ y\leq 14$ and $x-y\leq 5$

ANSWER : E

38. Let p, q and r be any three logical statements. Which one of the following is true?

(A) $\sim\left[p\wedge(\sim q)\right]\equiv(\sim p)\wedge q$
(B) $\sim(p\vee q)\wedge(\sim r)\equiv(\sim p)\vee(\sim q)\vee(\sim r)$
(C) $\sim\left[p\vee(\sim q)\right]\equiv(\sim p)\wedge q$
(D) $\sim\left[p\wedge(\sim q)\right]\equiv(\sim p)\wedge\sim q$
(E) $\sim\left[p\wedge(\sim q)\right]\equiv p\wedge q$

ANSWER : C

39. The truth values of p, q and r for which $(p\wedge q)\vee(\sim r)$ has truth value F are respectively

(A) F, T, F (B) F, F, F (C) T, T, T (D) T, F, F (E) F, F, T

ANSWER : E

40. $\sim\left[(\sim p)\wedge q\right]$ is logically equivalent to

(A) $\sim(p\vee q)$ (B) $\sim\left[p\wedge(\sim q)\right]$ (C) $p\wedge(\sim q)$
(D) $p\vee(\sim q)$ (E) $(\sim p)\vee(\sim q)$

ANSWER : D

41. Let $\theta\in\left[0,\dfrac{\pi}{2}\right]$. Which one of the following is true?

(A) $\sin^2\theta>\cos^2\theta$ (B) $\sin^2\theta<\cos^2\theta$ (C) $\sin\theta>\cos\theta$
(D) $\cos\theta>\sin\theta$ (E) $\sin\theta+\cos\theta\leq\sqrt{2}$

ANSWER : E

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42. The value of $\sin^{-1}\left(\frac{2\sqrt{2}}{3}\right)+\sin^{-1}\left(\frac{1}{3}\right)$ is equal to

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

ANSWER : C

43. If $ab<1$ and $\cos^{-1}\left(\frac{1-a^2}{1+a^2}\right)+\cos^{-1}\left(\frac{1-b^2}{1+b^2}\right)=2\tan^{-1}x$, then x is equal to

(A) $\frac{a}{1+ab}$ (B) $\frac{a}{1-ab}$ (C) $\frac{a-b}{1+ab}$ (D) $\frac{a+b}{1+ab}$ (E) $\frac{a+b}{1-ab}$

ANSWER : E

44. The value of $\tan(1°)+\tan(89°)$ is equal to

(A) $\frac{1}{\sin 1°}$ (B) $\frac{2}{\sin 2°}$ (C) $\frac{2}{\sin 1°}$ (D) $\frac{1}{\sin 2°}$ (E) $\frac{\sin 2°}{2}$

ANSWER : B

45. Let $s_n=\cos\left(\frac{n\pi}{10}\right)$, $n=1,2,3,\ldots$ Then the value of $\frac{s_1 s_2 \ldots s_{10}}{s_1+s_2+\ldots+s_{10}}$ is equal to

(A) $\frac{1}{\sqrt{2}}$ (B) $\frac{\sqrt{3}}{2}$ (C) $2\sqrt{2}$ (D) 0 (E) $\frac{1}{2}$

ANSWER : D

46. $\cos^{-1}\left(\cos\left(\frac{7\pi}{5}\right)\right)=$

(A) $\frac{3\pi}{5}$ (B) $\frac{2\pi}{5}$ (C) $\frac{-7\pi}{5}$ (D) $\frac{7\pi}{5}$ (E) $\frac{-2\pi}{5}$

ANSWER : A

47. The value of $\sec^2(\tan^{-1}3)+\text{cosec}^2(\cot^{-1}2)$ is equal to

(A) 5 (B) 13 (C) 15 (D) 23 (E) 25

ANSWER : C

48. If $\sin\theta+\text{cosec}\,\theta=2$, then the value of $\sin^6\theta+\text{cosec}^6\theta$ is equal to

(A) 0 (B) 1 (C) 2 (D) 2^3 (E) 2^6

ANSWER : C

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49. If $0 < x < \pi$, then $\dfrac{\sin 8x + 7\sin 6x + 18\sin 4x + 12\sin 2x}{\sin 7x + 6\sin 5x + 12\sin 3x} =$

(A) $2\sin x$ (B) $\sin x$ (C) $\sin 2x$ (D) $2\cos x$ (E) $\cos x$

ANSWER : D

50. The points (2,5) and (5,1) are the two opposite vertices of a rectangle. If the other two vertices are points on the straight line $y = 2x + k$, then the value of k is

(A) 4 (B) 3 ✓(C) -4 (D) -3 (E) 1

ANSWER : C

51. The circumcentre of the triangle with vertices $(8,6), (8,-2)$ and $(2,-2)$ is at the point

(A) $(2, -1)$ (B) $(1,-2)$ ✓(C) $(5,2)$ (D) $(2,5)$ (E) $(4, 5)$

ANSWER : C

52. The ratio by which the line $2x + 5y - 7 = 0$ divides the straight line joining the points $(-4, 7)$ and $(6,-5)$ is

(A) 1 : 4 (B) 1 : 2 (C) 1 : 1 (D) 2 : 3 (E) 1 : 3

ANSWER : C

53. The number of points (a,b), where a and b are positive integers, lying on the hyperbola $x^2 - y^2 = 512$ is

(A) 3 (B) 4 (C) 5 (D) 6 (E) 7

ANSWER : B

54. If p is the length of the perpendicular from the origin to the line whose intercepts with the coordinate axes are $\frac{1}{3}$ and $\frac{1}{4}$ then the value of p is

(A) $\frac{3}{4}$ (B) $\frac{1}{12}$ (C) 5 (D) 12 ✓(E) $\frac{1}{5}$

ANSWER : E

55. The slope of the straight line joining the centre of the circle $x^2 + y^2 - 8x + 2y = 0$ and the vertex of the parabola $y = x^2 - 4x + 10$ is

(A) $\frac{-5}{2}$ (B) $\frac{-7}{2}$ (C) $\frac{-3}{2}$ (D) $\frac{5}{2}$ (E) $\frac{7}{2}$

ANSWER : B

56. A straight line perpendicular to the line $2x + y = 3$ is passing through $(1,1)$. Its y-intercept is

(A) 1 (B) 2 (C) 3 ✓(D) $\frac{1}{2}$ (E) $\frac{1}{3}$

ANSWER : D

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57. If p and q are respectively the perpendiculars from the origin upon the straight lines whose equations are $x\sec\theta + y\,\text{cosec}\,\theta = a$ and $x\cos\theta - y\sin\theta = a\cos 2\theta$, then $4p^2 + q^2$ is equal to

(A) $5a^2$ (B) $4a^2$ (C) $3a^2$ (D) $2a^2$ (E) a^2

ANSWER : E

58. The shortest distance between the circles $(x-1)^2 + (y+2)^2 = 1$ and $(x+2)^2 + (y-2)^2 = 4$ is

(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

ANSWER : B

59. The centre of the circle whose radius is 5 and which touches the circle $x^2 + y^2 - 2x - 4y - 20 = 0$ at (5, 5) is

(A) (10 , 5) (B) (5 , 8) (C) (5 , 10) (D) (8 , 9) (E) (9 , 8)

ANSWER : E

60. A circle passes through the points (0,0) and (0,1) and also touches the circle $x^2 + y^2 = 16$. The radius of the circle is

(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

ANSWER : B

61. A circle of radius $\sqrt{8}$ is passing through origin and the point (4, 0). If the centre lies on the line $y = x$, then the equation of the circle is

(A) $(x-2)^2 + (y-2)^2 = 8$ (B) $(x+2)^2 + (y+2)^2 = 8$ (C) $(x-3)^2 + (y-3)^2 = 8$

(D) $(x+3)^2 + (y+3)^2 = 8$ (E) $(x-4)^2 + (y-4)^2 = 8$

ANSWER : A

62. The parametric form of the ellipse $4(x+1)^2 + (y-1)^2 = 4$ is

(A) $x = \cos\theta - 1,\ y = 2\sin\theta - 1$ (B) $x = 2\cos\theta - 1,\ y = \sin\theta + 1$

(C) $x = \cos\theta - 1,\ y = 2\sin\theta + 1$ (D) $x = \cos\theta + 1,\ y = 2\sin\theta + 1$

(E) $x = \cos\theta + 1,\ y = 2\sin\theta - 1$

ANSWER : C

63. A point P on an ellipse is at a distance 6 units from a focus. If the eccentricity of the ellipse is $\frac{3}{5}$, then the distance of P from the corresponding directrix is

(A) $\frac{8}{5}$ (B) $\frac{5}{8}$ (C) 10 (D) 12 (E) 15

ANSWER : C

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64. If the length of the latus rectum and the length of transverse axis of a hyperbola are $4\sqrt{3}$ and $2\sqrt{3}$ respectively, then the equation of the hyperbola is

(A) $\frac{x^2}{3}-\frac{y^2}{4}=1$ (B) $\frac{x^2}{3}-\frac{y^2}{9}=1$ (C) $\frac{x^2}{6}-\frac{y^2}{9}=1$

(D) $\frac{x^2}{6}-\frac{y^2}{3}=1$ (E) $\frac{x^2}{3}-\frac{y^2}{6}=1$

ANSWER :E

65. If the eccentricity of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is $\frac{5}{4}$ and $2x+3y-6=0$ is a focal chord of the hyperbola, then the length of transverse axis is equal to

(A) $\frac{12}{5}$ (B) 6 (C) $\frac{24}{7}$ (D) $\frac{24}{5}$ (E) $\frac{12}{7}$

ANSWER : D

66. The length of the transverse axis of a hyperbola is $2\cos\alpha$. The foci of the hyperbola are the same as that of the ellipse $9x^2+16y^2=144$. The equation of the hyperbola is

(A) $\frac{x^2}{\cos^2\alpha}-\frac{y^2}{7-\cos^2\alpha}=1$ (B) $\frac{x^2}{\cos^2\alpha}-\frac{y^2}{7+\cos^2\alpha}=1$

(C) $\frac{x^2}{1+\cos^2\alpha}-\frac{y^2}{7-\cos^2\alpha}=1$ (D) $\frac{x^2}{1+\cos^2\alpha}-\frac{y^2}{7+\cos^2\alpha}=1$

(E) $\frac{x^2}{\cos^2\alpha}-\frac{y^2}{5-\cos^2\alpha}=1$

ANSWER : A

67. If $\vec{a}=\hat{i}+2\hat{j}+2\hat{k}$, $|\vec{b}|=5$ and the angle between $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{6}$, then the area of the triangle formed by these two vectors as two sides is

(A) $\frac{15}{4}$ (B) $\frac{15}{2}$ (C) 15 (D) $\frac{15\sqrt{3}}{2}$ (E) $15\sqrt{3}$

ANSWER : A

68. If $\vec{a}\cdot\vec{b}=0$ and $\vec{a}+\vec{b}$ makes an angle of 60° with $\vec{a}$, then

(A) $|\vec{a}|=2|\vec{b}|$ (B) $2|\vec{a}|=|\vec{b}|$ (C) $|\vec{a}|=\sqrt{3}|\vec{b}|$

(D) $|\vec{a}|=|\vec{b}|$ (E) $\sqrt{3}|\vec{a}|=|\vec{b}|$

ANSWER : E

69. If $\hat{i}+\hat{j}$, $\hat{j}+\hat{k}$, $\hat{i}+\hat{k}$ are the position vectors of the vertices of a triangle ABC taken in order, then ∠A is equal to

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

ANSWER : E

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70. Let $\vec{a}=\hat{i}-2\hat{j}+3\hat{k}$. If $\vec{b}$ is a vector such that $\vec{a}\cdot\vec{b}=|\vec{b}|^2$ and $|\vec{a}-\vec{b}|=\sqrt{7}$, then $|\vec{b}|=$

(A) $\sqrt{7}$ (B) $\sqrt{3}$ (C) 7 (D) 3 (E) $7\sqrt{3}$

ANSWER : A

71. If $\vec{a},\vec{b}$ and $\vec{c}$ are three non-zero vectors such that each one of them being perpendicular to the sum of the other two vectors, then the value of $|\vec{a}+\vec{b}+\vec{c}|^2$ is

(A) $|\vec{a}|^2+|\vec{b}|^2+|\vec{c}|^2$ (B) $|\vec{a}|+|\vec{b}|+|\vec{c}|$ (C) $2\left(|\vec{a}|^2+|\vec{b}|^2+|\vec{c}|^2\right)$

(D) $\frac{1}{2}\left(|\vec{a}|^2+|\vec{b}|^2+|\vec{c}|^2\right)$ (E) 0

ANSWER : A

72. Let $\vec{u},\vec{v}$ and $\vec{w}$ be vectors such that $\vec{u}+\vec{v}+\vec{w}=\vec{0}$. If $|\vec{u}|=3, |\vec{v}|=4$ and $|\vec{w}|=5$ then $\vec{u}\cdot\vec{v}+\vec{v}\cdot\vec{w}+\vec{w}\cdot\vec{u}=$

(A) 0 (B) -25 (C) 25 (D) 50 (E) 47

ANSWER : B

73. If $\lambda\left(3\hat{i}+2\hat{j}-6\hat{k}\right)$ is a unit vector, then the values of λ are

(A) $\pm\frac{1}{7}$ (B) ± 7 (C) $\pm\sqrt{43}$

(D) $\pm\frac{1}{\sqrt{43}}$ (E) $\pm\frac{1}{\sqrt{7}}$

ANSWER : A

74. If the direction cosines of a vector of magnitude 3 are $\frac{2}{3},\frac{-a}{3},\frac{2}{3}$, $a>0$, then the vector is

(A) $2\hat{i}+\hat{j}+2\hat{k}$ (B) $2\hat{i}-\hat{j}+2\hat{k}$ (C) $\hat{i}-2\hat{j}+2\hat{k}$

(D) $\hat{i}+2\hat{j}+2\hat{k}$ (E) $\hat{i}+2\hat{j}-2\hat{k}$

ANSWER : B

75. Equation of the plane through the mid-point of the line segment joining the points P(4,5,−10) and Q(−1,2,1) and perpendicular to PQ is

(A) $\vec{r}\cdot\left(\frac{3}{2}\hat{i}+\frac{7}{2}\hat{j}-\frac{9}{2}\hat{k}\right)=45$ (B) $\vec{r}\cdot\left(-\hat{i}+2\hat{j}+\hat{k}\right)=\frac{135}{2}$ (C) $\vec{r}\cdot\left(5\hat{i}+3\hat{j}-11\hat{k}\right)+\frac{135}{2}=0$

(D) $\vec{r}\cdot\left(4\hat{i}+5\hat{j}-10\hat{k}\right)=85$ (E) $\vec{r}\cdot\left(5\hat{i}+3\hat{j}-11\hat{k}\right)=\frac{135}{2}$

ANSWER : E

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76. The angle between the straight lines $x-1=\frac{2y+3}{3}=\frac{z+5}{2}$ and $x=3r+2;\ y=-2r-1;$ $z=2$, where r is a parameter, is

(A) $\frac{\pi}{4}$ (B) $\cos^{-1}\left(\frac{-3}{\sqrt{182}}\right)$ (C) $\sin^{-1}\left(\frac{-3}{\sqrt{182}}\right)$

(D) $\frac{\pi}{2}$ (E) 0

ANSWER : D

77. Equation of the line through the point (2,3,1) and parallel to the line of intersection of the planes $x-2y-z+5=0$ and $x+y+3z=6$ is

(A) $\frac{x-2}{-5}=\frac{y-3}{-4}=\frac{z-1}{3}$ (B) $\frac{x-2}{5}=\frac{y-3}{-4}=\frac{z-1}{3}$ (C) $\frac{x-2}{5}=\frac{y-3}{4}=\frac{z-1}{3}$

(D) $\frac{x-2}{4}=\frac{y-3}{3}=\frac{z-1}{2}$ (E) $\frac{x-2}{-4}=\frac{y-3}{-3}=\frac{z-1}{2}$

ANSWER : A

78. A unit vector parallel to the straight line $\frac{x-2}{3}=\frac{3+y}{-1}=\frac{z-2}{-4}$ is

(A) $\frac{1}{\sqrt{26}}(3\hat{i}-\hat{j}+4\hat{k})$ (B) $\frac{1}{\sqrt{26}}(\hat{i}+3\hat{j}-\hat{k})$ (C) $\frac{1}{\sqrt{26}}(3\hat{i}-\hat{j}-4\hat{k})$

(D) $\frac{1}{\sqrt{26}}(3\hat{i}+\hat{j}+4\hat{k})$ (E) $\frac{1}{\sqrt{26}}(\hat{i}-3\hat{j}+4\hat{k})$

ANSWER : C

79. The angle between a normal to the plane $2x-y+2z-1=0$ and the z-axis is

(A) $\cos^{-1}\left(\frac{1}{3}\right)$ (B) $\sin^{-1}\left(\frac{2}{3}\right)$ (C) $\cos^{-1}\left(\frac{2}{3}\right)$

(D) $\sin^{-1}\left(\frac{1}{3}\right)$ (E) $\sin^{-1}\left(\frac{3}{5}\right)$

ANSWER : C

80. Foot of the perpendicular drawn from the origin to the plane $2x-3y+4z=29$ is

(A) $(5,-1,4)$ (B) $(7,-1,3)$ (C) $(5,-2,3)$

(D) $(2,-3,4)$ (E) $(1,-3,4)$

ANSWER : D

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81. The distance between the x-axis and the point (3, 12, 5) is

(A) 3 (B) 13 (C) 14 (D) 12 (E) 5

ANSWER : B

82. If $\sum_{i=1}^{9}(x_i - 5) = 9$ and $\sum_{i=1}^{9}(x_i - 5)^2 = 45$, then the standard deviation of the 9 items $x_1, x_2, \cdots, x_9$ is

(A) 9 (B) 4 (C) 3 (D) 2 (E) 1

ANSWER : D

83. If two dice are thrown simultaneously, then the probability that the sum of the numbers which come up on the dice to be more than 5 is

(A) $\frac{5}{36}$ (B) $\frac{1}{6}$ (C) $\frac{5}{18}$ (D) $\frac{7}{18}$ (E) $\frac{13}{18}$

ANSWER : E

84. Let A and B be two events such that $P(A \cup B) = P(A) + P(B) - P(A)P(B)$.
If $0 < P(A) < 1$ and $0 < P(B) < 1$, then $P(A \cup B)' =$

(A) $1 - P(A)$ (B) $1 - P(A')$ (C) $1 - P(A)P(B)$
(D) $[1 - P(A)]P(B')$ (E) 1

ANSWER :D

85. The standard deviation of 9, 16, 23, 30, 37, 44, 51 is

(A) 7 (B) 9 (C) 12 (D) 14 (E) 16

ANSWER : D

86. The value of $\lim_{x\to 3} \frac{x^5 - 3^5}{x^8 - 3^8}$ is equal to

(A) $\frac{5}{8}$ (B) $\frac{5}{64}$ (C) $\frac{5}{216}$ (D) $\frac{1}{27}$ (E) $\frac{1}{63}$

ANSWER :C

87. Let $f(x) = (x^5 - 1)(x^3 + 1)$, $g(x) = (x^2 - 1)(x^2 - x + 1)$ and let $h(x)$ be such that $f(x) = g(x)h(x)$. Then $\lim_{x\to 1} h(x)$ is

(A) 0 (B) 1 (C) 3 (D) 4 (E) 5

ANSWER : E

88. $\lim_{x\to 0} \frac{\log(1+3x^2)}{x(e^{5x} - 1)} =$

(A) $\frac{3}{5}$ (B) $\frac{5}{3}$ (C) $\frac{-3}{5}$ (D) $\frac{-5}{3}$ (E) 1

ANSWER : A

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89. If $f(x)=\dfrac{x+2}{3x-1}$, then $f(f(x))$ is

(A) x (B) $-x$ (C) $\dfrac{1}{x}$ (D) $-\dfrac{1}{x}$ (E) 0

ANSWER : A

90. Let $f(x)=\begin{cases} ax+3, & x\le 2 \\ a^2x-1, & x>2 \end{cases}$. Then the values of a for which f is continuous for all x are

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

ANSWER : C

91. Let R be the set of all real numbers. Let $f:R\to R$ be a function such that $|f(x)-f(y)|^2 \le |x-y|^3$, $\forall\, x,y\in R$. Then $f'(x)=$

(A) $f(x)$ (B) 1 (C) 0 (D) x^2 (E) x

ANSWER : C

92. Let $f(x)=\int_1^x \sin^2\left(\dfrac{t}{2}\right)dt$. Then the value of $\lim\limits_{x\to 0}\dfrac{f(\pi+x)-f(\pi)}{x}$ is equal to

(A) $\dfrac{1}{4}$ (B) $\dfrac{1}{2}$ (C) $\dfrac{3}{4}$ (D) 1 (E) 0

ANSWER : D

93. If $y=f\left(x^2+2\right)$ and $f'(3)=5$, then $\dfrac{dy}{dx}$ at $x=1$ is

(A) 5 (B) 25 (C) 15 (D) 20 (E) 10

ANSWER : E

94. Let $f(x)=x^2+bx+7$. If $f'(5)=2f'\left(\dfrac{7}{2}\right)$, then the value of b is

(A) 4 (B) 3 (C) -4 (D) -3 (E) 2

ANSWER : C

95. If $x=\sin t$ and $y=\tan t$, then $\dfrac{dy}{dx}=$

(A) $\cos^3 t$ (B) $\dfrac{1}{\cos^3 t}$ (C) $\dfrac{1}{\cos^2 t}$ (D) $\sin^2 t$ (E) $\dfrac{1}{\sin^2 t}$

ANSWER : B

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96. If $x = a\cos^3\theta$ and $y = a\sin^3\theta$, then $1 + \left(\frac{dy}{dx}\right)^2$ is

(A) $\tan\theta$ (B) $\tan^2\theta$ (C) 1 (D) $\sec^2\theta$ (E) $\sec\theta$

ANSWER : D

97. If $y = \sin^{-1}\left(2x\sqrt{1-x^2}\right)$, $-\frac{1}{\sqrt{2}} \le x \le \frac{1}{\sqrt{2}}$, then $\frac{dy}{dx}$ is equal to

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

(D) $\frac{2x}{\sqrt{1-x^2}}$ (E) $\frac{-2x}{\sqrt{1-x^2}}$

ANSWER : C

98. A straight line parallel to the line $2x - y + 5 = 0$ is also a tangent to the curve $y^2 = 4x + 5$. Then the point of contact is

(A) (2, 1) (B) $(-1,1)$ (C) (1, 3)

(D) (3, 4) (E) $(-1, 2)$

ANSWER : B

99. The function $f(x) = 2x^3 - 15x^2 + 36x + 6$ is strictly decreasing in the interval

(A) (2,3) (B) $(-\infty, 2)$ (C) (3,4)

(D) $(-\infty, 3) \cup (4, \infty)$ (E) $(-\infty, 2) \cup (3, \infty)$

ANSWER : A

100. The slope of the tangent to the curve $y^2 e^{xy} = 9e^{-3}x^2$ at $(-1, 3)$ is

(A) $\frac{-15}{2}$ (B) $\frac{-9}{2}$ (C) 15 (D) $\frac{15}{2}$ (E) $\frac{9}{2}$

ANSWER : C

101. The radius of a cylinder is increasing at the rate of 5 cm/min so that its volume is constant. When its radius is 5 cm and height is 3 cm the rate of decreasing of its height is

(A) 6 cm/min (B) 3 cm/min (C) 4 cm/min (D) 5 cm/min (E) 2 cm/min

ANSWER : A

102. The function $f(x) = \begin{cases} 2x^2 - 1 & \text{if } 1 \le x \le 4 \\ 151 - 30x & \text{if } 4 < x \le 5 \end{cases}$ is not suitable to apply Rolle's theorem since

(A) $f(x)$ is not continuous on $[1,5]$ (B) $f(1) \ne f(5)$

(C) $f(x)$ is continuous only at $x = 4$ (D) $f(x)$ is not differentiable in (4, 5)

ANSWER : E

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103. The slope of the normal to the curve $y = x^2 - \frac{1}{x^2}$ at (–1, 0) is

(A) $\frac{1}{4}$ (B) $-\frac{1}{4}$ (C) 4 (D) –4 (E) 0

ANSWER : A

104. The minimum value of $\sin x + \cos x$ is

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

ANSWER : B

105. $\int \frac{1}{x^2\left(x^4+1\right)^{\frac{3}{4}}} dx$ is equal to

(A) $-\frac{(1+x^4)^{\frac{3}{4}}}{x}+C$ (B) $-\frac{(1+x^4)^{\frac{1}{4}}}{2x}+C$ (C) $-\frac{(1+x^4)^{\frac{1}{4}}}{x}+C$

(D) $-\frac{(1+x^4)^{\frac{1}{4}}}{x^2}+C$ (E) $-\frac{(1+x^4)^{\frac{1}{2}}}{x}+C$

ANSWER : C

106. $\int \frac{(1+x)e^x}{\sin^2\left(xe^x\right)} dx$ is equal to

(A) $-\cot(e^x)+C$ (B) $\tan(xe^x)+C$ (C) $\tan(e^x)+C$

(D) $\cot(xe^x)+C$ (E) $-\cot(xe^x)+C$

ANSWER : E

107. $\int \frac{xe^x}{(1+x)^2} dx$ is equal to

(A) $\frac{-e^x}{x+1}+C$ (B) $\frac{e^x}{x+1}+C$ (C) $\frac{xe^x}{x+1}+C$ (D) $\frac{-xe^x}{x+1}+C$ (E) $\frac{e^x}{(x+1)^2}+C$

ANSWER : B

108. $\int e^x\left(\sin x + 2\cos x\right)\sin x \, dx$ is equal to

(A) $e^x \cos x + C$ (B) $e^x \sin x + C$ (C) $e^x \sin^2 x + C$

(D) $e^x \sin 2x + C$ (E) $e^x\left(\cos x + \sin x\right) + C$

ANSWER : C

109. $\int\sqrt{1+\cos x}\,dx$ is equal to

(A) $2\sin\left(\frac{x}{2}\right)+C$ (B) $\sqrt{2}\sin\left(\frac{x}{2}\right)+C$ (C) $\frac{1}{2}\sin\left(\frac{x}{2}\right)+C$

(D) $\frac{\sqrt{2}}{2}\sin\left(\frac{x}{2}\right)+C$ (E) $2\sqrt{2}\sin\left(\frac{x}{2}\right)+C$

ANSWER : E

110. $\int\frac{\sqrt{x^2-1}}{x}\,dx$ is equal to

(A) $\sqrt{x^2-1}-\sec^{-1}x+C$ (B) $\sqrt{x^2-1}+\tan^{-1}x+C$ (C) $\sqrt{x^2-1}+\sec^{-1}x+C$

(D) $\sqrt{x^2-1}-\tan x+C$ (E) $\sqrt{x^2-1}+\sec x+C$

ANSWER : A

111. $\int\frac{\sqrt{5+x^2}}{x^4}\,dx$ is equal to

(A) $\frac{1}{15}\left(1+\frac{5}{x^2}\right)^{3/2}+C$ (B) $\frac{-1}{15}\left(1+\frac{1}{x^2}\right)^{3/2}+C$ (C) $\frac{-1}{15}\left(1+\frac{5}{x^2}\right)^{3/2}+C$

(D) $\frac{1}{15}\left(1+\frac{1}{x^2}\right)^{3/2}+C$ (E) $\frac{-1}{10}\left(1+\frac{1}{x^2}\right)^{3/2}+C$

ANSWER : C

112. The value of $\int_0^1\frac{dx}{e^x+e}$ is equal to

(A) $\frac{1}{e}\log\left(\frac{1+e}{2}\right)$ (B) $\log\left(\frac{1+e}{2}\right)$ (C) $\frac{1}{e}\log(1+e)$

(D) $\log\left(\frac{2}{1+e}\right)$ (E) $\frac{1}{e}\log\left(\frac{2}{1+e}\right)$

ANSWER : A

113. Area bounded by the curves $y=e^x, y=e^{-x}$ and the straight line $x=1$ is (in sq. units)

(A) $e+\frac{1}{e}$ (B) $e+\frac{1}{e}+2$ (C) $e+\frac{1}{e}-2$ (D) $e-\frac{1}{e}+2$ (E) $e-\frac{1}{e}$

ANSWER : C

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114. The value of the integral $\int_1^e \frac{1+\log x}{3x}\,dx$ is equal to

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

ANSWER : B

115. The value of the integral $\int_0^1 \frac{x^3}{1+x^8}\,dx$ is equal to

(A) $\frac{\pi}{8}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{16}$ (D) $\frac{\pi}{6}$ (E) $\frac{\pi}{12}$

ANSWER : C

116. The value of the integral $\int_2^4 \left(\frac{\log t}{t}\right) dt$ is equal to

(A) $\frac{1}{2}(\log 2)^2$ (B) $\frac{5}{2}(\log 2)^2$ (C) $\frac{3}{2}(\log 2)^2$ (D) $(\log 2)^2$ (E) $\frac{3}{2}(\log 2)$

ANSWER : C

117. The solution of the differential equation $(kx-y^2)dy=\left(x^2-ky\right)dx$ is

(A) $x^3-y^3=3kxy+C$ (B) $x^3+y^3=3kxy+C$ (C) $x^2-y^2=2kxy+C$
(D) $x^2+y^2=2kxy+C$ (E) $x^3-y^2=3kxy+C$

ANSWER : B

118. The solution of the differential equation $\frac{dy}{dx}=e^x+1$ is

(A) $y=e^x+C$ (B) $y=x+e^x+C$ (C) $y=xe^x+C$
(D) $y=x\left(e^x+1\right)+C$ (E) $y=e^x+Cx$

ANSWER : B

119. The order and degree of the differential equation $\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^{\frac{3}{2}}=y$ are respectively

(A) 1, 1 (B) 1, 2 (C) 1, 3 (D) 2, 1 (E) 2, 2

ANSWER : E

120. An integrating factor of the differential equation $\sin x\frac{dy}{dx}+2y\cos x=1$ is

(A) $\sin^2 x$ (B) $\frac{2}{\sin x}$ (C) $\log|\sin x|$ (D) $\frac{1}{\sin^2 x}$ (E) $2\sin x$

ANSWER : A