ZEPHYR
The Dream Team in Entrance Coaching

M.O: Kunnumpuram, Ayurveda College Jn., Trivandrum-1, (: 0471-2573040, 2473040
E-mail: info@zephyrentrance.in, Website: www.zephyrentrance.in

BRANCHES | KOCHI Puthussery Building, Kaloor (: 0484-2531040 | KOLLAM Sivajyothi Complex, Polayathode (: 0474-2743040

KEAM (ENGINEERING) ANSWER KEY 2018

PAPER II – MATHEMATICS

QUESTIONS & ANSWERS

1. The value of $\frac{2(\cos 75^\circ + i\sin 75^\circ)}{0.2(\cos 30^\circ + i\sin 30^\circ)}$ is

(A) $\frac{5}{\sqrt{2}}(1+i)$ (B) $\frac{10}{\sqrt{2}}(1+i)$ (C) $\frac{10}{\sqrt{2}}(1-i)$

(D) $\frac{5}{\sqrt{2}}(1-i)$ (E) $\frac{1}{\sqrt{2}}(1+i)$

ANSWER	B

2. If the conjugate of a complex number z is $\frac{1}{i-1}$, then z is

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

ANSWER	D

3. The value of $\left(i^{18} + \left(\frac{1}{i}\right)^{25}\right)^3$ is equal to

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

(D) $\sqrt{2}-\sqrt{2}i$ (E) $2-2i$

ANSWER	E

4. The modulus of $\frac{1+i}{1-i} - \frac{1-i}{1+i}$ is

(A) 2 (B) $\sqrt{2}$ (C) 4 (D) 8 (E) 10

ANSWER	A

5. If $z = e^{i4p/3}$, then $\left(z^{192} + z^{194}\right)^3$ is equal to

(A) –2 (B) –1 (C) $-i$ (D) $-2i$ (E) 0

ANSWER	B

6. If a and b are real numbers and $(a + ib)^{11} = 1 + 3i$, then $(b + ia)^{11}$ is equal to

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

(D) 0 (E) $-i-3$

ANSWER	E

7. If $a \neq b, a^2 = 5a - 3, b^2 = 5b - 3$, then the equation having $\frac{a}{b}$ and $\frac{b}{a}$ as its roots is

(A) $3x^2 - 19x - 3 = 0$ (B) $3x^2 + 19x - 3 = 0$ (C) $x^2 + 19x + 3 = 0$

(D) $3x^2 - 19x - 19 = 0$ (E) $3x^2 - 19x + 3 = 0$

ANSWER	E

8. The focus of the parabola $y^2 - 4y - x + 3 = 0$ is

(A) $\left(\frac{3}{4}, 2\right)$ (B) $\left(\frac{3}{4}, -2\right)$ (C) $\left(2, \frac{3}{4}\right)$ (D) $\left(\frac{-3}{4}, 2\right)$ (E) $\left(2, \frac{-3}{4}\right)$

ANSWER	D

9. If $f : R \to (0, \infty)$ is an increasing function and if , $\lim_{x \to 2018} \frac{f(3x)}{f(x)} = 1$, then

$\lim_{x \to 2018} \frac{f(2x)}{f(x)}$ is equal to

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

ANSWER	E

10. If f is differentiable at x = 1, then $\lim_{x \to 1} \frac{x^2 f(1) - f(x)}{x - 1}$ is

(A) $-f'(1)$ (B) $f(1) - f'(1)$ (C) $2f(1) - f'(1)$ (D) $2f(1) + f'(1)$ (E) $f(1) + f'(1)$

ANSWER	C

11. Eccentricity of the ellipse $4x^2 + y^2 - 8x + 4y - 8 = 0$ is

(A) $\frac{\sqrt{3}}{2}$ (B) $\frac{\sqrt{3}}{4}$ (C) $\frac{\sqrt{3}}{\sqrt{2}}$ (D) $\frac{\sqrt{3}}{8}$ (E) $\frac{\sqrt{3}}{16}$

ANSWER	A

12. The focus of the parabola $(y + 1)^2 = -8(x + 2)$ is

(A) (–4, –1) (B) (–1, –4) (C) (1, 4) (D) (4, 1) (E) (–1, 4)

ANSWER	A

13. Which of the following is the equation of a hyperbola?

(A) $x^2 - 4x + 16y + 17 = 0$ (B) $4x^2 + 4y^2 - 16x + 4y - 60 = 0$

(C) $x^2 + 2y^2 + 4x + 2y - 27 = 0$ (D) $x^2 - y^2 + 3x - 2y - 43 = 0$

(E) $x^2 + 4x + 6y - 2 = 0$

ANSWER	D

14. Let $f(x) = px^2 + qx + r$, where p, q, r are constants and $p \neq 0$. If $f(5) = -3f(2)$ and $f(-4) = 0$, then the other root of f is

(A) 3 (B) –7 (C) –2 (D) 2 (E) 6

ANSWER	A

15. Let $f : \mathbf{R} \to \mathbf{R}$ satisfy $f(x) f(y) = f(xy)$ for all real numbers x and y. If $f(2) = 4$, then $f\left(\frac{1}{2}\right) =$

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

ANSWER	B

16. Sum of last 30 coefficients in the binomial expansion of $(1 + x)^{59}$ is

(A) 2^{29} (B) 2^{59} (C) 2^{58} (D) $2^{59} - 2^{29}$ (E) 2^{60}

ANSWER	C

17. $\left(\sqrt{3} + \sqrt{2}\right)^4 - \left(\sqrt{3} - \sqrt{2}\right)^4 =$

(A) $20\sqrt{6}$ (B) $30\sqrt{6}$ (C) $5\sqrt{10}$
(D) $40\sqrt{6}$ (E) $10\sqrt{6}$

ANSWER	D

18. Three players *A, B* and *C* play a game. The probability that *A, B* and *C* will finish the game are respectively $\frac{1}{2}, \frac{1}{3}$ and $\frac{1}{4}$. The probability that the game is finished is

(A) $\frac{1}{8}$ (B) 1 (C) $\frac{1}{4}$ (D) $\frac{3}{4}$ (E) $\frac{1}{2}$

ANSWER	D

19. If $z_1 = 2 - i$ and $z_2 = 1 + i$, then $\left|\frac{z_1 + z_2 + 1}{z_1 - z_2 + i}\right|$ is

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

ANSWER	NA

20. If $f(x) = \sqrt{\frac{x - \sin x}{x + \cos^2 x}}$, then $\lim_{x \to \infty} f(x)$ is equal to

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

ANSWER	A

21. The value of $\sin \frac{31}{3}p$ is

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

ANSWER	A

22. The sum of odd integers from 1 to 2001 is

(A) $(1121)^2$ (B) $(1101)^2$ (C) $(1001)^2$
(D) $(1021)^2$ (E) $(1011)^2$

ANSWER	C

23. If $y = \frac{\sin^2 x}{1+\cot x} + \frac{\cos^2 x}{1+\tan x}$, then $y'(x)$ is equal to

(A) $2\cos^2 x$ (B) $2\cos^3 x$ (C) $-\cos 2x$
(D) $\cos 2x$ (E) $3\cos x$

ANSWER	C

24. The foci of the hyperbola $16x^2 - 9y^2 - 64x + 18y - 90 = 0$ are

(A) $\left(\frac{24 \pm 5\sqrt{145}}{12}, 1\right)$ (B) $\left(\frac{21 \pm 5\sqrt{145}}{12}, 1\right)$ (C) $\left(1, \frac{24 \pm 5\sqrt{145}}{2}\right)$
(D) $\left(1, \frac{21 \pm 5\sqrt{145}}{2}\right)$ (E) $\left(\frac{21 \pm 5\sqrt{145}}{2}, -1\right)$

ANSWER	A

25. If the sum of the coefficients in the expansions of $(a^2x^2 - 2ax + 1)^{51}$ is zero, then a is equal to

(A) 0 (B) 1 (C) –1 (D) –2 (E) 2

ANSWER	B

26. The mean deviation of the data 2,9,9,3,6,9,4 from the mean is

(A) 2.23 (B) 3.23 (C) 2.57 (D) 3.57 (E) 1.03

ANSWER	C

27. The mean and variance of a binomial distribution are 8 and 4 respectively. What is (X = 1) ?

(A) $\frac{1}{2^8}$ (B) $\frac{1}{2^{12}}$ (C) $\frac{1}{2^6}$ (D) $\frac{1}{2^4}$ (E) $\frac{1}{2^5}$

ANSWER	B

28. The number of diagonals of a polygon with 15 sides is

(A) 90 (B) 45 (C) 60 (D) 70 (E) 10

ANSWER	A

29. In a class, 40% of students study maths and science and 60% of students study maths. What is the probability of a student studying science given the student is already studying maths?

(A) $\frac{1}{3}$ (B) $\frac{1}{6}$ (C) $\frac{2}{3}$ (D) $\frac{1}{5}$ (E) $\frac{1}{4}$

ANSWER	C

30. The eccentricity of the conic $x^2+2y^2-2x+3y+2=0$ is

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

ANSWER	B

31. If the mean of a set of observations x_1, x_2, …….x_{10} is 20, then the mean of $x_1+4, x_2+8, x_3+12..., x_{10}+40$ is

(A) 34 (B) 32 (C) 42 (D) 38 (E) 40

ANSWER	C

32. A letter is taken at random from the word "GTATISTICS" and another letter is taken at random from the word "ASSISTANT". The probability that they are same letters is

(A) $\frac{1}{45}$ (B) $\frac{13}{90}$ (C) $\frac{19}{90}$ (D) $\frac{5}{18}$ (E) $\frac{9}{10}$

ANSWER	C

33. If sin α and cos α are the roots of the equation $ax^2+bx+c=0$, then

(A) $a^2-b^2+2ac=0$ (B) $(a-c)^2=b^2+c^2$ (C) $a^2+b^2-2ac=0$

(D) $a^2+b^2+2ac=0$ (E) $a+b+c=0$

ANSWER	A

34. If the sides of a triangle are 4, 5 and 6 cms. Then the area of triangle is ……..sq.cms.

(A) $\frac{p}{4}$ (B) $\frac{p}{4}\sqrt{7}$ (C) $\frac{4}{15}$ (D) $\frac{4}{15}\sqrt{7}$ (D) $\frac{15}{4}\sqrt{7}$

ANSWER	E

35. In a group of 6 boys and 4 girls, a team consisting of four children is formed such that the team has atleast one boy. The number of ways of forming a team like this is

(A) 159 (B) 209 (C) 200 (D) 240 (E) 212

ANSWER	B

36. A password is set with 3 distinct letters from the word LOGARITHMS. How many such passwords can be formed?

(A) 90 (B) 720 (C) 80 (D) 72 (E) 120

ANSWER	B

37. If 5^{97} is divided by 52, the remainder obtained is

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

ANSWER	B

38. A quadratic equation $ax^2+bx+c=0$, with distinct coefficients is formed. If *a*, *b*, *c* are chosen from the numbers 2, 3, 5, then the probability that the equation has real roots is

(A) $\frac{1}{3}$ (B) $\frac{2}{5}$ (C) $\frac{1}{4}$ (D) $\frac{1}{5}$ (E) $\frac{2}{3}$

ANSWER	A

39. $\lim_{x\to\infty}\frac{3x^3+2x^2-7x+9}{4x^3+9x-2}$ is equal to

(A) $\frac{2}{9}$ (B) $\frac{1}{2}$ (C) $\frac{-9}{2}$ (D) $\frac{3}{4}$ (E) $\frac{9}{2}$

ANSWER	D

40. The minimum value of $f(x)=\max\{x,1+x,2-x\}$ is

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

ANSWER	B

41. The equations of the asymptotes of the hyperbola $xy+3x-2y-10=0$ are

(A) $x=-2, y=-3$ (B) $x=2, y=-3$ (C) $x=2, y=3$

(D) $x=4, y=3$ (E) $x=3, y=4$

ANSWER	B

42. If $f(x) = x^6 + 6^x$, then $f'(x)$ is equal to

(A) 12 x (B) x + 4 (C) $6x^5 + 6^x \log(6)$ (D) $6x^5 + x6^{x-1}$ (E) x^6

ANSWER	C

43. The standard deviation of the data 6, 5, 9, 13, 12, 8, 10 is

(A) $\frac{\sqrt{52}}{7}$ (B) $\frac{52}{7}$ (C) $\frac{\sqrt{53}}{7}$ (D) $\frac{53}{7}$ (E) 6

ANSWER	NA

44. $\lim_{x\to 0}\frac{1-\cos mx}{1-\cos nx}=$

(A) $\frac{m^2}{n^2}$ (B) $\frac{n^2}{m^2}$ (C) ∞ (D) $-\infty$ (E) 0

ANSWER	A

45. $\lim_{x\to 0} \frac{\sqrt{1+2x-1}}{x} =$

(A) 0 (B) –1 (C) $\frac{1}{2}$ (D) 1 (E) $\frac{-1}{2}$

ANSWER	D

46. Let f and g be differentiable functions such that f(3) = 5, g(3) = 7, f'(3) = 13, g'(3) = 6, f'(7) = 2 and g'(7) = 0. If h(x) = (fog) (x), then h'(3) =

(A) 14 (B) 12 (C) 16 (D) 0 (E) 10

ANSWER	B

47. $\frac{\sqrt{3}}{\sin(20^o)} - \frac{1}{\cos(20^o)} =$

(A) 1 (B) $\frac{1}{\sqrt{2}}$ (C) 2 (D) 4 (E) 0

ANSWER	D

48. A poison variate X satisfies P(X = 1) = P(x = 2). P(X = 6) is equal to

(A) $\frac{4}{45}e^{-2}$ (B) $\frac{1}{45}e^{-1}$ (C) $\frac{1}{9}e^{-2}$ (D) $\frac{1}{4}e^{-2}$ (E) $\frac{1}{45}e^{-2}$

ANSWER	A

49. Let a and b be 2 consecutive integers selected from the first 20 natural numbers. The probability that $\sqrt{a^2+b^2+a^2b^2}$ is an odd positive integer is

(A) $\frac{9}{19}$ (B) $\frac{10}{19}$ (C) $\frac{13}{19}$ (D) 1 (E) 0

ANSWER	D

50. An ellipse of eccentricity $\frac{2\sqrt{2}}{3}$ is inscribed in a circle. A point is chosen inside the circle at random. The probability that the point lies outside the ellipse is

(A) $\frac{1}{3}$ (B) $\frac{2}{3}$ (C) $\frac{1}{9}$ (D) $\frac{2}{9}$ (E) $\frac{1}{27}$

ANSWER	B

51. If the vectors $4\hat{i}+11\hat{j}+m\hat{k}$, $7\hat{i}+2\hat{j}+6\hat{k}$ and $\hat{i}+5\hat{j}+4\hat{k}$ are coplanar, then m is equal to

(A) 38 (B) 0 (C) 10 (D) –10 (E) 25

ANSWER	C

52. Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 3\hat{j} + 5\hat{k}$ and $\vec{c} = 7\hat{i} + 9\hat{j} + 11\hat{k}$. Then the area of the parallelogram with diagonals $\vec{a} + \vec{b}$ and $\vec{b} + \vec{c}$ is

(A) $4\sqrt{6}$ (B) $\frac{1}{2}\sqrt{21}$ (C) $\frac{\sqrt{6}}{2}$ (D) $\sqrt{6}$ (E) $\frac{1}{\sqrt{6}}$

ANSWER	A

53. If $|\vec{a}| = 3, |\vec{b}| = 1, |\vec{c}| = 4$ and $\vec{a} + \vec{b} + \vec{c} = 0$, then the value of $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}$ is equal to

(A) 13 (B) 26 (C) –29 (D) –13 (E) –26

ANSWER	D

54. IF $|\vec{a} - \vec{b}| = |\vec{a}| = |\vec{b}| = 1$, then the angle between $\vec{a}$ and $\vec{b}$ is equal to

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

ANSWER	A

55. If the vectors $\vec{a} = \hat{i} - \hat{j} + 2\hat{k}$, $\vec{b} = 2\hat{i} + 4\hat{j} + \hat{k}$ and $\vec{c} = l\hat{i} + 9\hat{j} + m\hat{k}$ are mutually orthogonal, then $l + m$ is equal to

(A) 5 (B) –9 (C) –1 (D) 0 (E) –5

ANSWER	B

56. The solutions of $x^{2/5} + 3x^{1/5} - 4 = 0$ are

(A) 1, 1024 (B) –1, 1024 (C) 1, 1031
(D) –1024, 1 (E) –1,1031

ANSWER	D

57. If the equations $x^2 + ax + 1 = 0$ and $x^2 - x - a = 0$ have a real common root b, then the value of b is equal to

(A) 0 (B) 1 (C) –1 (D) 2 (E) 3

ANSWER	C

58. If $\sin\theta - \cos\theta = 1$, then the value of $\sin^3\theta - \cos^3\theta$ is equal to

(A) 1 (B) –1 (C) 0 (D) 2 (E) –2

ANSWER	A

59. Two dice of different colours are thrown at a time. The probability that the sum is either 7 or 11 is

(A) $\frac{7}{36}$ (B) $\frac{2}{9}$ (C) $\frac{2}{3}$ (D) $\frac{5}{9}$ (E) $\frac{6}{7}$

ANSWER	B

60. $\frac{1}{9!}+\frac{1}{3!7!}+\frac{1}{5!5!}+\frac{1}{7!3!}+\frac{1}{9!}$ is equal to

(A) $\frac{2^9}{10!}$ (B) $\frac{2^{10}}{8!}$ (C) $\frac{2^{11}}{9!}$ (D) $\frac{2^{10}}{7!}$ (E) $\frac{2^8}{9!}$

ANSWER	C

61. The order and degree of the differential equation $(y'')^2+(y'')^3-(y')^4+y^5=0$ is

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

ANSWER	A

62. $\int_{-2}^{2}|x|\,dx$ is equal to

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

ANSWER	D

63. $\int_{-1}^{0}\frac{dx}{x^2+2x+2}$ is equal to

(A) 0 (B) $\frac{p}{4}$ (C) $\frac{-p}{4}$ (D) $\frac{p}{2}$ (E) $\frac{-p}{2}$

ANSWER	B

64. If $\int_{-1}^{4}f(x)\,dx=4$ and $\int_{2}^{4}(3-f(x))dx=7$, then $\int_{-1}^{2}f(x)\,dx$ is

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

ANSWER	E

65. $\int\frac{xe^x}{(1+x)^2}dx=$

(A) $\frac{e^x}{1+x}+c$ (B) $\frac{e^x}{1+e^x}+c$ (C) $\frac{e^{2x}}{1+e^x}+c$

(D) $\frac{e^{-x}}{1+x}+c$ (E) $\frac{e^{-2x}}{1+x}+c$

ANSWER	A

66. The remainder when 2^{2000} is divided by 17 is

(A) 1 (B) 2 (C) 8 (D) 12 (E) 4

ANSWER	A

67. The coefficient of x^5 in the expansion of $(x + 3)^8$ is

(A) 1542 (B) 1512 (C) 2512 (D) 12 (E) 4

ANSWER	B

68. The maximum value of $5 \cos \theta + 3 \cos \left(q + \frac{p}{3} \right) + 3$ is

(A) 5 (B) 11 (C) 10 (D) –1 (E) 2

ANSWER	C

69. The area of the triangle in the complex plane formed by z, iz and z + iz is

(A) |z| (B) $|\bar{z}|^2$ (C) $\frac{1}{2}|z|^2$ (D) $\frac{1}{2}|z + iz|^2$ (E) $|z + iz|$

ANSWER	C

70. Let $f : ¡ \to ¡$ be a differentiable function. If f is even, then f'(0) is equal to

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

ANSWER	C

71. The coordinate of the point dividing internally the line joining the points (4, –2) and (8, 6) in the ratio 7 : 5 is

(A) (16, 18) (B) (18, 16) (C) $\left(\frac{19}{3}, \frac{8}{3} \right)$ (D) $\left(\frac{8}{3}, \frac{19}{3} \right)$ (E) (7, 3)

ANSWER	C

72. The area of the triangle formed by the points (a, b + c), (b, c + a), (c, a + b) is

(a) abc (B) $a^2 + b^2 + c^2$ (C) ab + bc + ca
(D) 0 (E) a(ab + bc + ca)

ANSWER	D

73. If (x, y) is equidistant from (a + b, b – a) and (a – b, a + b), then

(A) ax + by = 0 (B) ax – by = 0 (C) bx + ay = 0
(D) bx – ay = 0 (E) x = y

ANSWER	D

74. The equation of the line passing through (a, b) and parallel to the line $\frac{x}{a} + \frac{y}{b} = 1$ is

(A) $\frac{x}{a} + \frac{y}{b} = 3$ (B) $\frac{x}{a} + \frac{y}{b} = 2$ (C) $\frac{x}{a} + \frac{y}{b} = 0$
(D) $\frac{x}{a} + \frac{y}{b} + 2 = 0$ (E) $\frac{x}{a} + \frac{y}{b} = 4$

ANSWER	B

75. If the points (2a, a), (a, 2a) and (a, a) enclose a triangle of area 18 square units, then the centroid of the triangle is equal to

(A) (4, 4) (B) (8, 8) (C) (–4, –4) (D) $\left(4\sqrt{2}, 4\sqrt{2}\right)$ (E) (6, 6)

ANSWER	B

76. The area of a triangle is 5 sq. units. Two of its vertices are (2, 1) and (3, –2). The third vertex lies on y = x + 3. The coordinates of the third vertex can be

(A) $\left(\frac{-3}{2}, \frac{-3}{2}\right)$ (B) $\left(\frac{3}{4}, \frac{-3}{2}\right)$ (C) $\left(\frac{7}{2}, \frac{13}{2}\right)$ (D) $\left(\frac{-1}{4}, \frac{1}{2}\right)$ (E) $\left(\frac{3}{2}, \frac{3}{2}\right)$

ANSWER	C

77. If $x^2 + y^2 + 2gx + 2fy + 1 = 0$ represents a pair of straight lines, then $f^2 + g^2$ is equal to

(A) 0 (B) 1 (C) 2 (D) 4 (E) 3

ANSWER	B

78. If θ is the angle between the pair of straight lines $x^2 – 5xy + 4y^2 + 3x – 4 = 0$, then $\tan^2\theta$ is equal to

(A) $\frac{9}{16}$ (B) $\frac{16}{25}$ (C) $\frac{9}{25}$ (D) $\frac{21}{25}$ (E) $\frac{25}{9}$

ANSWER	C

79. If $3\hat{i} + 2\hat{j} - 5\hat{k} = x\left(2\hat{i} - \hat{j} + \hat{k}\right) + y\left(\hat{i} + 3\hat{j} - 2\hat{k}\right) + z\left(-2\hat{i} + \hat{j} - 3\hat{k}\right)$, then

(A) x = 1, y = 2, z = 3 (B) x = 2, y = 3, z = 1 (C) x = 3, y = 1, z = 2
(D) x = 1, y = 3, z = 2 (E) x = 2, y = 2, z = 3

ANSWER	C

S80. $\sin 15^o$ =

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

ANSWER	A

81. If $\vec{a}$ and $\vec{b} = 3\hat{i} + 6\hat{j} + 6\hat{k}$ are collinear and $\vec{a}.\vec{b} = 27$, then $\vec{a}$ is equal to

(A) $3\left(\hat{i} + \hat{j} + \hat{k}\right)$ (B) $\hat{i} + 2\hat{j} + 2\hat{k}$ (C) $2\hat{i} + 2\hat{j} + 2\hat{k}$
(D) $\hat{i} + 3\hat{j} + 3\hat{k}$ (E) $\hat{i} - 3\hat{j} + 2\hat{k}$

ANSWER	B

82. If $|\vec{a}| = 13$, $|\vec{b}| = 5$ and $\vec{a}.\vec{b} = 30$, then $|\vec{a} \times \vec{b}|$ is equal to

(A) 30 (B) $\frac{30}{25}\sqrt{233}$ (C) $\frac{30}{33}\sqrt{193}$ (D) $\frac{65}{23}\sqrt{493}$ (E) $\frac{65}{13}\sqrt{133}$

ANSWER	E

83. If ${}^{56}P_{r+6} : {}^{54}P_{r+3} = 30800 : 1$, then r is equal to

(A) 69 (B) 41 (C) 51 (D) 61 (E) 49

ANSWER	B

84. Distance between two parallel lines y = 2x + 4 and y = 2x – 1 is

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

ANSWER	C

85. $({}^7C_0 + {}^7C_1) + ({}^7C_2 + {}^7C_3) + ... + ({}^7C_6 + {}^7C_7) =$

(A) $2^8 - 2$ (B) $2^7 - 1$ (C) 2^7 (D) $2^8 - 1$ (E) $2^7 - 2$

ANSWER	C

86. The coefficient of x in the expansion of $(1 - 3x + 7x^2)(1 - x)^{16}$ is

(A) 17 (B) 19 (C) –17 (D) –19 (E) 20

ANSWER	D

87. The equation of the circle with centre (2, 2) which passes through (4, 5) is

(A) $x^2 + y^2 - 4x + 4y - 77 = 0$ (B) $x^2 + y^2 - 4x - 4y - 5 = 0$
(C) $x^2 + y^2 + 2x + 2y - 59 = 0$ (D) $x^2 + y^2 - 2x - 2y - 23 = 0$
(E) $x^2 + y^2 + 4x - 2y - 26 = 0$

ANSWER	B

88. The point in the xy-plane which is equidistant from (2, 0, 3), (0, 3, 2) and (0, 0, 1) is

(A) (1, 2, 3) (B) (–3, 2, 0) (C) (3, –2, 0)
(D) (3, 2, 0) (E) (3, 2, 1)

ANSWER	D

89. Let $f : ¥ \to ¥$ be such that f(1) = 2 and f (x + y) = f(x) f(y) for all natural numbers x and y. If $\sum_{k=1}^{n} f(a+k) = 16\,(2^n - 1)$, then a is equal to

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

ANSWER	A

90. If ${}_nC_{r-1} = 36$, ${}_nC_r = 84$ and ${}_nC_{r+1} = 126$, then n =

(A) 3 (B) 4 (C) 8 (D) 9 (E) 10

ANSWER	D

91. Let $f : (-1, 1) \to (-1, 1)$ be continuous, $f(x) = f(x^2)$ for all $x \in (-1, 1)$ and $f(0) = \frac{1}{2}$, then the value of $4f\left(\frac{1}{4}\right)$ is

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

ANSWER	B

92. $\lim_{x \to q} \sqrt{x^2 + 1} - \sqrt{x^2 - 1} =$

(A) –1 (B) 1 (C) 0 (D) 2 (E) 4

ANSWER	C

93. If f is differentiable at x = 1 and $\lim_{h \to 0} \frac{1}{h} f(1 + h) = 5$, then $f'(1) =$

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

ANSWER	E

94. The maximum value of the function $2x^3 - 15x^2 + 36x + 4$ is attained at

(A) 0 (B) 3 (C) 4 (D) 2 (E) 5

ANSWER	D

95. If $\int f(x)\cos x\,dx = \frac{1}{2}\{f(x)\}^2 + c$, then $f\left(\frac{p}{2}\right)$ is

(A) c (B) $\frac{p}{2} + c$ (C) c + 1 (D) 2π + c (E) c + 2

ANSWER	C

96. $\int_{p/4}^{3p/4} \frac{x}{1 + \sin x} dx =$

(A) $p\left(\sqrt{2} - 1\right)$ (B) $p\left(\sqrt{2} + 1\right)$ (C) $2p\left(\sqrt{2} - 1\right)$

(D) $2p\left(\sqrt{2} + 1\right)$ (E) $\frac{p}{\sqrt{2} + 1}$

ANSWER	A, E

97. $\int_0^{p/2} \frac{2^{\sin x}}{2^{\sin x} + 2^{\cos x}} dx =$

(A) 2 (B) π (C) $\frac{p}{4}$ (D) 2π (E) 0

ANSWER	C

98. $\lim_{x\to 0}\left(\frac{\int_0^{x^2}\sin\sqrt{t}dt}{x^2}\right)=$

(A) $\frac{2}{3}$ (B) $\frac{2}{9}$ (C) $\frac{1}{3}$ (D) 0 (E) $\frac{1}{6}$

ANSWER	D

99. The area bounded by $y=\sin^2 x, x=\frac{x}{2}$ *and* $x=p$ is

(A) $\frac{p}{2}$ (B) $\frac{p}{4}$ (C) $\frac{p}{8}$ (D) $\frac{p}{16}$ (E) 2π

ANSWER	B

100. The differential equation of the family of curves $y=e^x\ (A\cos x+B\sin x)$. where A and B are arbitrary constants is

(A) $y''-2y'+2y=0$ (B) $y''+2y'-2y=0$ (C) $y''+y'^2+y=0$

(D) $y''+2y'-y=0$ (E) $y''-2y'-2y=0$

ANSWER	A

101. The real part of $\left(i-\sqrt{3}\right)^{13}$ is

(A) 2^{-10} (B) 2^{12} (C) 2^{-12} (D) -2^{-12} (E) 2^{10}

ANSWER	NA

102. $\lim_{x\to 0}\frac{1+x-e^x}{x^2}=$

(A) $\frac{1}{2}$ (B) $\frac{-1}{2}$ (C) 1 (D) –1 (E) 0

ANSWER	B

103. $\int\frac{(\sin x+\cos x)\ (2-\sin 2x)}{\sin^2 2x}dx=$

(A) $\frac{\sin x+\cos x}{\sin 2x}+c$ (B) $\frac{\sin x-\cos x}{\sin 2x}+c$ (C) $\frac{\sin x}{\sin x+\cos x}+c$

(D) $\frac{\sin x}{\sin x-\cos x}+c$ (E) $\frac{\sin x-\cos x}{\sin x+\cos x}+c$

ANSWER	B

104. A plane is at a distance of 5 units from the origin; and perpendicular to the vector $2\hat{i}+\hat{j}+2\hat{k}$. The equation of the plane is

(A) $\vec{r}.\left(2\hat{i}+\hat{j}-2\hat{k}\right)=15$ (B) $\vec{r}.\left(2\hat{i}+\hat{j}-\hat{k}\right)=15$

(C) $\vec{r}.\left(2\hat{i}+\hat{j}+2\hat{k}\right)=15$ (D) $\vec{r}.\left(\hat{i}+\hat{j}+2\hat{k}\right)=15$

(E) $\vec{r}.\left(2\hat{i}-\hat{j}+2\hat{k}\right)=15$

ANSWER	C

105. $\dfrac{\sin A-\sin B}{\cos A+\cos B}$ is equal to

(A) $\sin\left(\dfrac{A+B}{2}\right)$ (B) $2\tan(A+B)$ (C) $\cot\left(\dfrac{A-B}{2}\right)$

(D) $\tan\left(\dfrac{A-B}{2}\right)$ (E) $2\cot(A+B)$

ANSWER	D

106. If $x = A\cos 4t + B\sin 4t$, then $\dfrac{d^2x}{dt^2} =$

(A) x (B) $-16x$ (C) $15x$ (D) $16x$ (E) $-15x$

ANSWER	B

107. The arithmetic mean of ${}^nCo, {}^nC_1, {}^nC_2, ..., {}^nC_n$ is

(A) $\dfrac{2^n}{n+1}$ (B) $\dfrac{2^n}{n}$ (C) $\dfrac{2^{n-1}}{n+1}$ (D) $\dfrac{2^{n-1}}{n}$ (E) $\dfrac{2^{n+1}}{n}$

ANSWER	A

108. The variance of first 20 natural numbers is

(A) $\dfrac{399}{2}$ (B) $\dfrac{379}{12}$ (C) $\dfrac{133}{2}$ (D) $\dfrac{133}{4}$ (E) $\dfrac{169}{2}$

ANSWER	D

109. If S is a set with 10 elements and A = $\{(x,y): x,y\in S, x\neq y\}$, then the number of elements in A is

(A) 100 (B) 90 (C) 80 (D) 150 (E) 45

ANSWER	B

110. A coin is tossed and a die is rolled. The probability that the coin shows head and the die shows 3 is

(A) $\frac{1}{6}$ (B) $\frac{1}{12}$ (C) $\frac{1}{9}$ (D) $\frac{11}{12}$ (E) $\frac{1}{11}$

ANSWER	B

111. If $A = \begin{pmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{pmatrix}$, then the sum of all the diagonal entries of A^{-1} is

(A) 2 (B) 3 (C) –3 (D) –4 (E) 4

ANSWER	E

112. Let $f(x) = \begin{vmatrix} x & 3 & 7 \\ 2 & x & 2 \\ 7 & 6 & x \end{vmatrix}$. If $x = -9$ is a root of $f(x) = 0$, then the other root are

(A) 2 and 7 (B) 3 and 6 (C) 7 and 3
(D) 6 and 2 (E) 6 and 7

ANSWER	A

113. If $[1 \quad x \quad 1]\begin{bmatrix} 1 & 3 & 2 \\ 2 & 5 & 1 \\ 15 & 3 & 2 \end{bmatrix}\begin{bmatrix} 1 \\ 2 \\ x \end{bmatrix} = 0$, then x can be

(A) –2 (B) 2 (C) 14 (D) –14 (E) 0

ANSWER	A, D

114. If $A = \begin{bmatrix} 2x & 0 \\ x & x \end{bmatrix}$ and $A^{-1} = A = \begin{bmatrix} 1 & 0 \\ -1 & 2 \end{bmatrix}$, then x =

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

ANSWER	B

115. If $\begin{vmatrix} x & 2 & x \\ x^2 & x & 6 \\ x & x & 6 \end{vmatrix} = ax^4 + bx^3 + cx^2 + dx + e$, then $5a + 4b + 3c + 2d + e$ is equal to

(A) 11 (B) –11 (C) 12 (D) –12 (E) 13

ANSWER	B

116. $\begin{vmatrix} 1 & a & b+c \\ 1 & b & c+a \\ 1 & c & a+b \end{vmatrix} =$

(A) 1 (B) 0 (C) $(1-a)(1-b)(1-c)$

(D) a + b + c (E) $2(a+b+c)$

ANSWER	B

117. If $f(x) = \begin{vmatrix} 1 & 1 & 1 \\ 2x & x-1 & x \\ 3x(x-1) & (x-1)(x-2) & x(x-1) \end{vmatrix}$, then $f(50) =$

(A) 0 (B) 2 (C) 4 (D) 1 (E) 3

ANSWER	A

118. If $\Delta(x) = \begin{vmatrix} 1 & \cos x & 1-\cos x \\ 1+\sin x & \cos x & 1+\sin x-\cos x \\ \sin x & \sin x & 1 \end{vmatrix}$, then $\int_0^{p/2} \Delta(x)\,dx =$

(A) $\frac{-1}{2}$ (B) $\frac{1}{2}$ (C) 1 (D) –1 (E) 0

ANSWER	A

119. The equation of the plane passing through the points (1,2,3), (–1, 4, 2) and (3, 1,1) is

(A) $5x + y + 12z - 23 = 0$ (B) $5x + 6y + 2z = 23$

(C) $5x + 6y + 2z = 23$ (D) $x + y + z = 13$

(E) $2x + 6y + 5z = 7$

ANSWER	B

120. In an arithmetic progression, if the k^{th} term is 5k + 1, then the sum of first 100 terms is

(A) 50(507) (B) 51(506) (C) 50(506)

(D) 51(507) (E) 52(506)

ANSWER	A