# HORIZON ACADEMY®

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Name.: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ Date : 27/09/2015

Test No.: 0 7

Subject Code.: 1 1 1

**Time : 3 Hrs.** **M.M. : 360**

# HORIZON TEST SERIES

*for*

## Engineering Entrance Exam.

## 2016

**[ Test No. 7 ]**

### INSTRUCTIONS FOR STUDENTS

1. Read each question carefully.
2. It is mandatory to use Blue/Black Ball Point Pen to darken the appropriate circle in the answer sheet.
3. Mark should be dark and should complete fill the circle.
4. Rough work must not be done on the Question Paper, no additional sheet will be provided for this purpose.
5. Do not use white-fluid or any other rubbing material on answer sheet. No change in the answer once marked.
6. Student cannot use log tables and calculators or any other material in the examination hall.
7. Before attempting the question paper, student should ensure that the test paper contains all pages and no page is missing.
8. Each correct answer carries four marks. One mark will be deducted for each incorrect answer from the total score.
9. Before handing over the answer sheet to the invigilator, candidate should check the particulars have been filled and marked correctly.
10. Immediately after the prescribed examination time is over, the answer sheet to be returned to the invigilator.
11. Use of Calculator and other Electronic device is not permitted.

# Test No. 7

## Topics of The Test

| | |
|---|---|
| **Physics** | Vectors + Laws of Motion |
| **Chemistry** | Solid state |
| **Maths** | Matrix and determinants, Trigonometry, Sequence and Series. |

# Test No. 7

## [PHYSICS]

1. The component of vector $\mathbf{A} = a_x\hat{\mathbf{i}} + a_y\hat{\mathbf{j}} + a_z\hat{\mathbf{k}}$ along the direction of $\hat{\mathbf{i}} - \hat{\mathbf{j}}$ is

(A) $a_x - a_y + a_z$ (B) $a_x - a_y$

(C) $(a_x - a_y)/\sqrt{2}$ (D) $a_x + a_y + a_z$

2. At what angle must the two forces $(x + y)$ and (x–y) acts so that the resultant may be $\sqrt{(x^2 + y^2)}$ ?

(A) $\cos^{-1}\left[-\dfrac{x^2 + y^2}{2(x^2 - y^2)}\right]$

(B) $\cos^{-1}\left[\dfrac{-2(x^2 - y^2)}{x^2 + y^2}\right]$

(C) $\cos^{-1}\left[-\dfrac{(x^2 + y^2)}{(x^2 - y^2)}\right]$

(D) $\cos^{-1}\left[-\dfrac{(x^2 - y^2)}{(x^2 + y^2)}\right]$

3. A particle moves in the x-y plane under the influence of a force such that its linear momentum is

$$\mathbf{p}(t) = A[\hat{\mathbf{i}}\cos(kt) - \hat{\mathbf{j}}\sin(kt)]$$

where $A$ and $k$ are constants. The angle between the force and momentum is

(A) 0° (B) 30°

(C) 45° (D) 90°

4. The position vector of a point is $\mathbf{R} = x\hat{\mathbf{i}} + y\hat{\mathbf{j}} + z\hat{\mathbf{k}}$ and another vector is $\mathbf{A} = 3\hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 5\hat{\mathbf{k}}$. Which of the mathematical relations is correct ?

(A) $\nabla(\mathbf{A}\cdot\mathbf{R}) = 0$ (B) $\nabla(\mathbf{A}\cdot\mathbf{R}) = \mathbf{A}$

(C) $\nabla(\mathbf{A}\cdot\mathbf{R}) = \mathbf{R}$ (D) None of these

5. The sum of two vectors **A** and **B** is at right angles to their difference. Then

(A) $A = B$

(B) $A = 2B$

(C) $B = 2A$

(D) A and B have the same direction

6. If the angle between the vectors **A** and **B** is $\theta$, the value of the product $(\mathbf{B}\times\mathbf{A})\cdot\mathbf{A}$ is equal to

(A) $BA^2\cos\theta$ (B) $BA^2\sin\theta$

(C) $BA^2\sin\theta\cos\theta$ (D) zero

7. If $|\mathbf{A}\times\mathbf{B}| = \sqrt{3}\mathbf{A}\cdot\mathbf{B}$, then the value of $|\mathbf{A}+\mathbf{B}|$ is

(A) $(A^2 + B^2 + AB)^{1/2}$ (B) $\left(A^2 + B^2 + \dfrac{AB}{\sqrt{3}}\right)^{1/2}$

(C) $A + B$ (D) $(A^2 + B^2 + \sqrt{3}AB)^{1/2}$

8. Vector which is perpendicular to $a\cos\theta\hat{\mathbf{i}} + b\sin\theta\hat{\mathbf{j}}$ is

(A) $b\sin\theta\hat{\mathbf{i}} - a\cos\theta\hat{\mathbf{j}}$ (B) $\dfrac{1}{a}\sin\theta\hat{\mathbf{i}} - \dfrac{1}{b}\cos\theta\hat{\mathbf{j}}$

(C) $5\hat{\mathbf{k}}$ (D) All of these

**Space for Rough Work**

9. The position vector of a particle is

$$\mathbf{r} = (a\cos\omega t)\hat{\mathbf{i}} + (a\sin\omega t)\hat{\mathbf{j}}$$

The velocity vector of the particle is
(A) parallel to position vector
(B) perpendicular to position vector
(C) directed towards the origin
(D) directed away from the origin

10. When $\mathbf{A}\cdot\mathbf{B} = -|\mathbf{A}|\cdot|\mathbf{B}|$, then
(A) **A** and **B** are perpendicular to each other
(B) **A** and **B** act in the same direction
(C) **A** and **B** act in the opposite direction
(D) **A** and **B** can act in any direction

11. Two trains are moving with equal speed in opposite directions along two parallel railway tracks. If the wind is blowing with speed *u* along the track so that the relative velocities of the trains with respect to the wind are in the ratio 1 : 2, then the speed of each train must be
(A) 3u (B) 2u
(C) 5u (D) 4u

12. A machine gun fires a bullet of mass 40 g with a velocity 1200 $ms^{-1}$. The man holding it can exert a maximum force of 144 N on the gun. How many bullets can be fired per second at the most ?
(A) Only one
(B) Three
(C) Can fire any number of bullets
(D) 144×48

13. A person is sitting in a lift accelerating upwards. Measured weight of person will be
(A) less than actual weight
(B) equal to actual weight
(C) more than actual weight
(D) None of the above

14. A monkey climbs up and another monkey climbs down a rope hanging from a tree with same uniform acceleration separately. If the respective masses of monkeys are in the ratio 2 : 3 the common acceleration must be
(A) $g/5$ (B) $6g$
(C) $g/2$ (D) $g$

15. A lift is moving down with acceleration *a*. A man in the lift drops a ball inside the lift. The acceleration of the ball as observed by the man in the lift and a man standing stationary on the ground are respectively
(A) $g, g$ (B) $g-a, g-a$
(C) $g-a, g$ (D) $a, g$

16. If the resultant of all the external forces acting on a system of particles is zero, then from an inertial frame, one can surely say that
(A) linear momentum of the system does not change in time
(B) kinetic energy of the system does not change in time
(C) angular momentum of the system does not change in time
(D) potential energy of the system does not change in time

17. A player kicks a football of mass 0.5 kg and the football begins to move with a velocity of 10 m/s. If the contact between the leg and the football lasts for $\frac{1}{50}s$, then the force acted on the ball should be
(A) 2500 N (B) 1250 N
(C) 250 N (D) 625 N

18. Consider the following statement. When jumping from some height, you should bend your kness as you come to rest instead of keeping your legs stiff. Which of the following relations can be useful in explaining the statement ?
(A) $\Delta\mathbf{p}_1 = -\Delta\mathbf{p}_2$ (B) $\Delta E = -\Delta(PE + \text{KE}) = 0$
(C) $\mathbf{F}\Delta t = m\Delta\mathbf{v}$ (D) $\Delta\mathbf{x} \propto \Delta\mathbf{F}$

19. In the motion of a rocket, physical quantity which is conserved is
(A) angular momentum
(B) linear momentum
(C) force
(D) work

20. If two particles collide at constant temperature then which of the following is conserved ?
(A) Kinetic energy (B) Momentum
(C) Temperature (D) Velocity

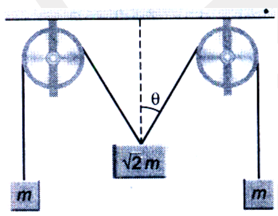
**Space for Rough Work**

21. When the speed of a moving body is doubled
(A) its acceleration is doubled
(B) its momentum is doubled
(C) its kinetic energy is doubled
(D) its potential energy is doubled

22. A particle moves in x-y plane under the action of force **F** and the value of its linear momentum **p** at a given time $t$ is $p_x = 2\cos t, p_y = 2\sin t$. Then the angle $\theta$ between **F** and **p** at a given time $t$ is
(A) $\theta = 30°$ (B) $\theta = 180°$
(C) $\theta = 0°$ (D) $\theta = 90°$

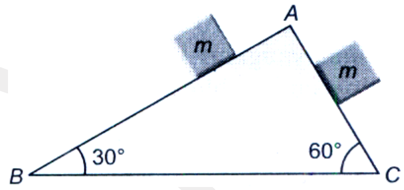
23. A peice of wire is bent in the shape of a parabola $y = kx^2$ (y-axis vertical) with a bead of mass $m$ on it. The bead can slide on the wire without friction. It stays at the lowest point of the parabola when the wire is at rest. The wire is now accelerated parallel to the x-axis with a constant acceleration $a$. The distance of the new equilibrium position of the bead, where the bead can stays at rest with respect to the wire, from the y-axis is
(A) $\frac{a}{gk}$ (B) $\frac{a}{2gk}$
(C) $\frac{2a}{gk}$ (D) $\frac{a}{4gk}$

24. The pulleys and strings shown in the figure are smooth and of negligible mass. For the system to remain in equilibrium, the angle $\theta$ should be



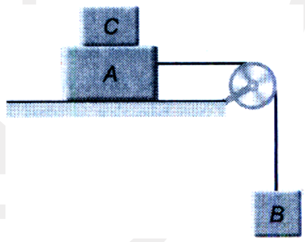

(A) 0° (B) 30°
(C) 45° (D) 60°

25. Two blocks of equal masses m are released from the top of a smooth fixed wedge as shown in the figure. The acceleration of the centre of mass of the two blocks is




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

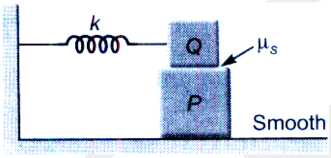
26. Two masses A and B of 15 kg and 10 kg are connected with a string passing over a frictionless pulley fixed at the corner of a table (as shown in figure). The coefficient of friction between the table and block is 0.4. The minimum mass of C, that may be placed on A to prevent it from moving is




(A) 10 kg (B) 5 kg
(C) zero (D) 15 kg

**Space for Rough Work**

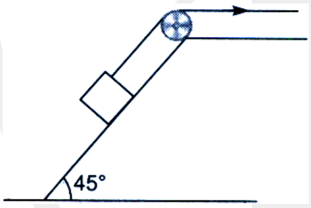
27. A block P of mass $m$ is placed on a frictionless horizontal surface. Another block Q of same mass is kept on P and connected to the wall with the help of a spring of spring constant $k$ as shown in the figure. $\mu_s$ is the coefficient of friction between P and Q. The blocks move together performing SHM of amplitude A. The maximum value of the friction force between P and Q is




(A) $kA$ (B) $\frac{kA}{2}$

(C) zero (D) $\mu_s mg$

28. A block of mass 200 kg is being pulled up by men on an inclined plane at angle of 45° as shown in the figure. The coefficient of static friction is 0.5. Each man can only apply a maximum force of 500 N. Calculate the number of men required for the block to just start moving up the plane.




(A) 10 (B) 15
(C) 5 (D) 3

29. A smooth block released at rest on a 45° incline and then slides a distance $d$. The time taken to slide is $n$ times as much to slide on rough incline than on a smooth incline. The coefficient of friction is

(A) $\mu_k = 1 - \frac{1}{n^2}$ (B) $\mu_k = \sqrt{1 - \frac{1}{n^2}}$

(C) $\mu_s = 1 - \frac{1}{n^2}$ (D) $\mu_s = \sqrt{1 - \frac{1}{n^2}}$

30. A block is kept on an inclined plane of inclination $\theta$ and length $l$. The velocity of particle at the bottom of incline is (the coefficient of friction is $\mu$ )

(A) $\sqrt{2gl(\mu\cos\theta - \sin\theta}$

(B) $\sqrt{2gl(\sin\theta - \mu\cos\theta)}$

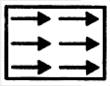
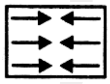
(C) $\sqrt{2gl(\sin\theta + \mu\cos\theta)}$

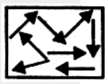
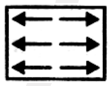
(D) $\sqrt{2gl(\cos\theta - \mu\sin\theta)}$

## [CHEMISTRY]

31. Unit cell of $Fe_3O_4$ (Ferrous ferrite) has 32 $O^{2-}$ ions in the unit cell. Then the unit cell of $Fe_3O_4$ has :
(A) 16 $Fe^{2+}$ ions
(B) 8 $Fe^{3+}$ ions
(C) 16 $Fe^{3+}$ ions and 8 $Fe^{2+}$ ions
(D) None of these

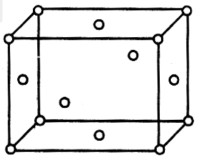
32. Paramagnetic substances are those in which the individual atoms, ions or molecules possess a permanent magnetic dipole moment. In the absence of an external magnetic field, the atomic dipoles of paramagnetic substance are as below :

(A)  (B) 

(C)  (D) 

33. Which of the following materials is not ferromagnetic ?
(A) Iron (B) Cobalt
(C) Nickel (D) Copper

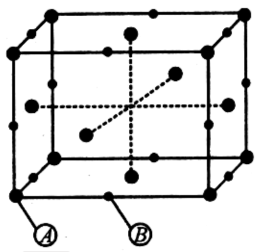
34. For the structure of solid given below if the lattice points represent $A^+$ ions and the $B^-$ ions occupy the tetrahedral voids then coordination number of A is :



(A) 2
(B) 4
(C) 6
(D) 8

Space for Rough Work

35. For a solid with the following structure, the coordination number of the point B is :




(A) 3

(B) 4

(C) 5

(D) 6

36. The structure of sodium chloride crystal is :

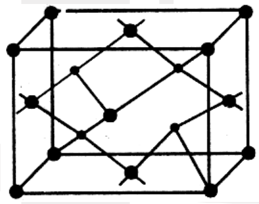
(A) Body centred cubic lattice

(B) Face centred cubic lattice

(C) Octahedral

(D) Square planar

37. The following structure drawn is of :



(A) Fluorite

(B) Cesium chloride

(C) Wurtzite

(D) Zinc blende

38. In solid $NH_3$, each $NH_3$ molecule has six other $NH_3$ molecules as nearest neighbours. $\Delta H$ of sublimation of $NH_3$ at the melting point is 30.8 kJ mol$^{-1}$ and the estimated $\Delta H$ of sublimation in absence of H-bonding is 14.3 kJ mol$^{-1}$. The strength of H-bond in $NH_3$ ion is :

(A) 6.5 kJ mol$^{-1}$ (B) 16.5 kJ mol$^{-1}$

(C) 5.5 kJ mol$^{-1}$ (D) 4.5 kJ mol$^{-1}$

39. Extremely pure samples of Ge and Si are non-conductors, but their conductivity increases suddenly on introducting ..................... in their crystal lattice :

(A) As (B) B

(C) Both (a) and (b) (D) None of these

40. An alloy of Cu, Ag and Au is found to have copper constituting the c.c.p. lattice. If Ag atom occupy the edge centres and Au atom is present at body centre, the formula of this alloy is :

(A) $Cu_4Ag_4Au$ (B) $Cu_4Ag_2Au$

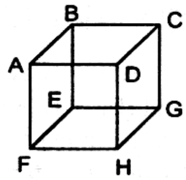
(C) CuAgAu (D) $Cu_4Ag_3Au$

41. The ratio of cations to anion in a octahedral close packing is :

(A) 0.414 (B) 0.225

(C) 0.02 (D) None of these

42. In the cubic lattice given below the three distances between the atoms A $\to$ B, A $\to$ C and A $\to$ G are respectively :



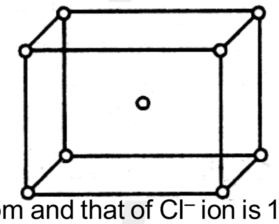

(A) $\frac{a}{2}, \frac{a}{\sqrt{2}}, \frac{\sqrt{3}a}{2}$

(B) $a, \sqrt{3}a, \sqrt{2}a$

(C) $a, \sqrt{2}a, \sqrt{3}a$

(D) $a, \frac{\sqrt{3}a}{2}, \sqrt{2}a$

43. A solid $A^+B^-$ has the $B^-$ ions arranged as below. If the $A^+$ ions occupy half of the tetrahedral sites in the structure. The formula of solid is :



(A) AB

(B) $AB_2$

(C) $A_2B$

(D) $A_3B_4$

44. The radius of the $Na^+$ is 95 pm and that of $Cl^-$ ion is 181 pm. Predict the co-ordination number of $Na^+$ :

(A) 4 (B) 6

(C) 8 (D) unpredictable

45. Silicon doped with arsenic is an example of :

(A) p-type conductor (B) n-type conductor

(C) n-p-type conductor (D) none of these

46. Which of the following statements is not correct :

(A) The co-ordination number of each type of ion in CsCl crystal is 8

(B) A metal that crystallises in b.c.c. structure has a co-ordination no. of 12

(C) A unit cell of an ionic crystal shares some of its ions with other unit cells

(D) The length of the unit cell in NaCl is 552 pm ($r_{Na^+} = 95$ pm, $r_{Cl^-} = 181$ pm)

**Space for Rough Work**

47. How many tetrahedral holes are occupied in diamond.
    (A) 25% (b) 50%
    (C) 75% (d) 100%

48. A solid XY has NaCl structure. If radius of $X^+$ is 100 pm. What is the radius of $Y^-$ ion :
    (A) 120 pm (B) 136.6 to 241.6 pm
    (C) 136.6 pm (D) 241.6 pm

49. The density of KBr is 2.75 g $cm^{-3}$ length of the unit cell is 654 pm. K = 39, Br = 80, then what is true about the predicted nature of the solid :
    (A) Solid has face centred cubic system with co-ordination number = 6
    (B) Solid has simple cubic system with co-ordination number = 4
    (C) Solid has face centred cubic system with co-ordination number = 1
    (D) None of these

50. In a face centred cubic arrangement of A and B atoms whose A atoms are at the corner of the unit cell and B atoms at the face centred. One of the A atom is missing from one corner in unit cell. The simplest formula of compound is :
    (A) $A_7B_3$ (B) $AB_3$
    (C) $A_7B_{24}$ (D) $A_{7/8}B_3$

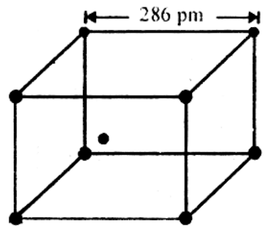
51. The number of atoms per unit cell in a simple cube, face centred cube and body centred cube are respectively :
    (A) 1, 4, 2 (B) 1, 2, 4
    (C) 8, 14, 9 (D) 8, 4, 2

52. A match box exhibits :
    (A) Cubic geometry
    (B) Monoclinic geometry
    (C) Orthorhombic geometry
    (D) Tetragonal geometry

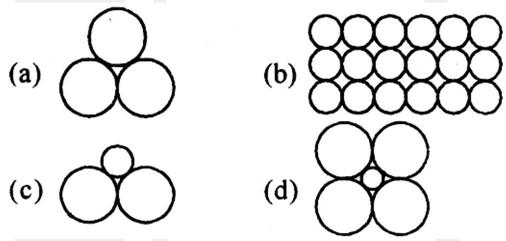
53. Which arrangement of electrons leads to ferromagnetism:
    (a) ↑↑↑↑↑ (b) ↓↑↓↑
    (c) ↑↑↑↓↓ (d) None of these

54. An alloy of copper and gold crystallizes in cubic lattice in which the Au-atoms occupy the lattice points at the corners of cube and Cu-atoms occupy the centre of each face. The formula of this alloy is :
    (A) AuCu (B) $AuCu_2$
    (C) $AuCu_3$ (D) $Au_3Cu$

55. The crystal structure adopted by iron is shown below. The distance between the nearest iron atoms is :
    (A) 286 pm
    (B) 124 pm
    (C) 143 pm
    (D) 247.6 pm




56. Which of the following figure represent the cross section of an octahedral site ?




57. The $Ca^{2+}$ and $F^-$ ions located in $CaF_2$ crystal respectively at fcc lattice points and in :
    (A) Octahedral voids
    (B) Tetrahedral voids
    (C) Half of octahedral voids
    (D) Half of tetrahedral voids

58. CsBr crystallises in a body centred cubic lattice. The unit cell length is 436.6 pm. Given that the atomic mass of Cs = 133 amu and of Br = 80 amu and Avogadro's number being $6.02 \times 10^{23}$ $mol^{-1}$, the density of CsBr is :
    (A) 8.50 $g/cm^3$ (B) 4.25 $g/cm^3$
    (C) 42.5 $g/cm^3$ (D) 0.425 $g/cm^3$

**Space for Rough Work**

59. The appearance of colour in solid state of alkali metal halides is generally due to :

(A) Frenkel defect (B) Interstital positions

(C) F-centres (D) Schottky defect

60. If a stands for the edge length of the cubic systems : simple cubic, body centred cubic and face centred cubic, then the ratio of radii of the spheres in these systems will be respectively.

(A) $\frac{a}{2}:\frac{a\sqrt{3}}{2}:\frac{a\sqrt{2}}{2}$ (B) $1a:\sqrt{3}a:\sqrt{2}a$

(C) $\frac{a}{2}:\frac{a\sqrt{3}}{4}:\frac{a}{2\sqrt{2}}$ (D) $\frac{a}{2}:\sqrt{3}a:\frac{a}{\sqrt{2}}$

## [MATHEMATICS]

61. If the sum of first $n$ terms of an AP is $cn^2$, then the sum of squares of these $n$ terms is

(A) $\frac{n(4n^2-1)c^2}{6}$ (B) $\frac{n(4n^2+1)c^2}{3}$

(C) $\frac{n(4n^2-1)c^2}{3}$ (D) $\frac{n(4n^2+1)c^2}{6}$

62. If $a, b$ and $c$ are in AP, then which one of the following is not true ?

(A) $\frac{k}{a}, \frac{k}{b}$ and $\frac{k}{c}$ are in HP

(B) $a+k, b+k$ and $c+k$ are in AP

(C) $ka, kb$ and $kc$ are in AP

(D) $a^2, b^2$ and $c^2$ are in AP

63. If sum of an infinite geometric series is $\frac{4}{3}$ and its first term is $\frac{3}{4}$, then its common ratio is

(A) $\frac{7}{16}$ (B) $\frac{9}{16}$

(C) $\frac{1}{9}$ (D) $\frac{7}{9}$

64. If $y = 1 + x + x^2 + x^3 + \ldots$, then x is equal to

(A) $\frac{y-1}{y}$ (B) $\frac{1-y}{y}$

(C) $\frac{y}{a-y}$ (D) None of these

65. If $x, y, z$ are in HP, then $\log(x+z)+\log(x-2y+z)$ is equal to

(A) $\log(x-z)$ (B) $2\log(x-z)$

(C) $3\log(x-z)$ (D) $4\log(x-z)$

66. If $a, a_1, a_2, \ldots, a_{2n}, b$ are in arithmetic progression and $a, g_1, g_2, \ldots, g_{2n}, b$ are in geometric progression and $h$ is the harmonic mean of $a$ and $b$, then

$\frac{a_1+a_{2n}}{g_1 g_{2n}}+\frac{a_2+a_{2n-1}}{g_2 g_{2n-1}}+\ldots+\frac{a_n+a_{n+1}}{g_n g_{n+1}}$ is equal to

(A) $2nh$ (B) $\frac{n}{h}$

(C) $nh$ (D) $\frac{2n}{h}$

67. $1+\frac{4}{5}+\frac{7}{5^2}+\frac{10}{5^3}+\ldots$ to $\infty$ is

(A) $\frac{16}{35}$ (B) $\frac{11}{8}$

(C) $\frac{35}{16}$ (D) $\frac{7}{16}$

68. Sum of $n$ terms of the following series $1^3+3^3+5^3+7^3+\ldots$ is

(A) $n^2(2n^2-1)$ (B) $n^3(n-1)$

(C) $n^3+8n+4$ (D) $2n^4+3n^2$

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69. The sum of infinite terms of the series

$$\frac{1}{(1+a)(2+a)}+\frac{1}{(2+a)(3+a)}+\frac{1}{(3+a)(4+a)}+\ldots+$$

to $\infty$, where $a$ is a constant, is

(A) $\frac{1}{1+a}$ (B) $\frac{2}{1+a}$

(C) $\infty$ (D) None of these

70. If $x, y, z$ are three consecutive integers, then

$$\log_e \sqrt{x}+\log_e \sqrt{z}+\left(\frac{1}{2xz+1}\right)+\frac{1}{3}\left(\frac{1}{2xz+1}\right)^3$$

$$+\frac{1}{5}\left(\frac{1}{2xz+1}\right)^5+\ldots \text{ is}$$

(A) $\log_e \sqrt{y}$ (B) $\log_e y$

(C) $\log_e y^2$ (D) None of these

71. The coefficient of $x^n$ in the expansion of $\frac{(a-bx)}{e^x}$ is

(A) $\frac{(-1)^n}{n!}(a+bn)$ (B) $\frac{(-1)^n}{n!}(b+an)$

(C) $\frac{(-1)^{n+1}}{n!}(a+bn)$ (D) None of the above

72. If $A=[a_{ij}]_{2\times 2}$, where $a_{ij}=i+j$, then A is equal to

(A) $\begin{bmatrix}1 & 1\\ 2 & 2\end{bmatrix}$ (B) $\begin{bmatrix}1 & 2\\ 1 & 2\end{bmatrix}$

(C) $\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$ (D) $\begin{bmatrix}2 & 3\\ 3 & 4\end{bmatrix}$

73. If $f(x)=x^2-5x$ and $A=\begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix}$, then $f(A)$ is equal to

(A) $\begin{bmatrix}-7 & 0\\ 0 & -7\end{bmatrix}$ (B) $\begin{bmatrix}0 & -7\\ -7 & 0\end{bmatrix}$

(C) $\begin{bmatrix}7 & 0\\ 0 & 7\end{bmatrix}$ (D) $\begin{bmatrix}0 & 7\\ 7 & 0\end{bmatrix}$

74. If $A=\begin{bmatrix}1 & 2 & -1\\ 3 & 0 & 2\\ 4 & 5 & 0\end{bmatrix}$ and $B=\begin{bmatrix}1 & 0 & 0\\ 2 & 1 & 0\\ 0 & 1 & 3\end{bmatrix}$, then $AB$ is equal to

(A) $\begin{bmatrix}5 & 1 & -3\\ 3 & 2 & 6\\ 14 & 5 & 0\end{bmatrix}$ (B) $\begin{bmatrix}11 & 4 & 3\\ 1 & 2 & 3\\ 0 & 3 & 3\end{bmatrix}$

(C) $\begin{bmatrix}1 & 8 & 4\\ 2 & 9 & 6\\ 0 & 2 & 0\end{bmatrix}$ (D) $\begin{bmatrix}0 & 1 & 2\\ 5 & 4 & 3\\ 1 & 8 & 2\end{bmatrix}$

75. Let $a, b, c$ be such that $(b+c)\neq 0$ and

$$\begin{vmatrix}a & a+1 & a-1\\ -b & b+1 & b-1\\ c & c-1 & c+1\end{vmatrix}+\begin{bmatrix}a+1 & b+1 & c-1\\ a-1 & b-1 & c+1\\ (-1)^{n+2}a & (-1)^{n+1}b & (-1)^n c\end{bmatrix}^1=0$$

The the value of $n$ is

(A) zero (B) any even integer

(C) any odd integer (D) any integer

76. The sum of the products of the elements of any row of a determinant A with the cofactors of the corresponding elements is equal to

(A) 1 (B) 0

(C) $|A|$ (D) $\frac{1}{2}|A|$

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77. If $x, y, z$ are different from zero and

$$\Delta = \begin{vmatrix} a & b-y & c-z \\ a-x & b & c-z \\ a-x & b-y & c \end{vmatrix} = 0,$$ then the value of the expression $\frac{a}{x}+\frac{b}{y}+\frac{c}{z}$ is

(A) 0 (B) –1
(C) 1 (D) 2

78. If $D_r = \begin{vmatrix} r & 1 & \frac{n(n+1)}{2} \\ 2r-1 & 4 & n^2 \\ 2^{r-1} & 5 & 2^n-1 \end{vmatrix}$, then the value of $\sum_{r=0}^{n} D_r$ is

(A) 0 (B) 1
(C) $\frac{n(n+1)(2n+1)}{6}$ (D) None of these

79. If $a_1, a_2, \ldots, a_n, \ldots$ are in GP and $a_i > 0$ for each $i$, then the determinant $\Delta = \begin{vmatrix} \log a_n & \log a_{n+2} & \log a_{n+4} \\ \log a_{n+6} & \log a_{n+8} & \log a_{n+10} \\ \log a_{n+12} & \log a_{n+14} & \log a_{n+16} \end{vmatrix}$ is equal to

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

80. Let $A = \begin{bmatrix} 1 & 2 \\ -5 & 1 \end{bmatrix}$ and $A^{-1} = xA + yI$, then the value of x and y are

(A) $x = \frac{-1}{11}, y = \frac{2}{11}$ (B) $x = \frac{-1}{11}, y = \frac{-2}{11}$

(C) $x = \frac{1}{11}, y = \frac{2}{11}$ (D) $x = \frac{1}{11}, y = \frac{-2}{11}$

81. If $A = \begin{bmatrix} 3 & 2 \\ 0 & 1 \end{bmatrix}$, then $(A^{-1})^3$ is equal to

(A) $\frac{1}{27}\begin{bmatrix} 1 & -26 \\ 0 & 27 \end{bmatrix}$ (B) $\frac{1}{27}\begin{bmatrix} -1 & 26 \\ 0 & 27 \end{bmatrix}$

(C) $\frac{1}{27}\begin{bmatrix} 0 & -26 \\ 0 & -27 \end{bmatrix}$ (D) $\frac{1}{27}\begin{bmatrix} -1 & -26 \\ 0 & -27 \end{bmatrix}$

82. Consider the system of equations in $x, y, z$ as

$$x\sin 3\theta - y + z = 0$$

$$x\cos 2\theta + 4y + 3z = 0$$

and $2x + 7y + 7z = 0$

If this system has a non-trivial solution, then for integer $n$, values of $\theta$ are given by

(A) $\pi\left(n + \frac{(-1)^n}{3}\right)$ (B) $\pi\left(n + \frac{(-1)^n}{4}\right)$

(C) $\pi\left(n + \frac{(-1)^n}{6}\right)$ (D) $\frac{n\pi}{2}$

83. If the system of equations $x + ay = 0, az + y = 0$ and $ax + z = 0$ has infinite solutions, then the value of $a$ is

(A) –1 (B) 1
(C) 0 (D) No real values

84. $\sin^2 17.5° + \sin^2 72.5°$ is equal to

(A) $\cos^2 90°$ (B) $\tan^2 45°$
(C) $\cos^2 30°$ (D) $\sin^2 45°$

85. $\left(1+\cos\frac{\pi}{8}\right)\left(1+\cos\frac{3\pi}{8}\right)\left(1+\cos\frac{5\pi}{8}\right)\left(1+\frac{7\pi}{8}\right)$ is equal to

(A) $\frac{1}{2}$ (B) $\cos\frac{\pi}{8}$

(C) $\frac{1}{8}$ (D) $\frac{1+\sqrt{2}}{2\sqrt{2}}$

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86. If $\cos\theta = \dfrac{8}{17}$ and $\theta$ lies in the Ist quadrant, then the value of $\cos(30^\circ+\theta)+\cos(45^\circ-\theta)+\cos(120^\circ-\theta)$ is

(A) $\dfrac{23}{17}\left(\dfrac{\sqrt{3}-1}{2}+\dfrac{1}{\sqrt{2}}\right)$ (B) $\dfrac{23}{17}\left(\dfrac{\sqrt{3}+1}{2}+\dfrac{1}{\sqrt{2}}\right)$

(C) $\dfrac{23}{17}\left(\dfrac{\sqrt{3}-1}{2}-\dfrac{1}{\sqrt{2}}\right)$ (D) $\dfrac{23}{17}\left(\dfrac{\sqrt{3}+1}{2}-\dfrac{1}{\sqrt{2}}\right)$

87. If $5\cos 2\theta + 2\cos^2\dfrac{\theta}{2} + 1 = 0, -\pi < \theta < \pi$, then $\theta$ is equal to

(A) $\dfrac{\pi}{3}$ (B) $\dfrac{\pi}{3}, \cos^{-1}\left(\dfrac{3}{5}\right)$

(C) $\cos^{-1}\left(\dfrac{3}{5}\right)$ (D) $\dfrac{\pi}{3}, \pi - \cos^{-1}\left(\dfrac{3}{5}\right)$

88. Minimum value of $\dfrac{1}{2\sin\theta - 4\cos\theta + 7}$ is

(A) $\dfrac{1}{12}$ (B) $\dfrac{5}{12}$

(C) $\dfrac{7}{12}$ (D) $\dfrac{1}{6}$

89. $\sinh^{-1} 2 + \sinh^{-1} 3 = x \Rightarrow \cosh x$ is equal to

(A) $\dfrac{1}{2}(3\sqrt{5}+2\sqrt{10})$ (B) $\dfrac{1}{2}(3\sqrt{5}-2\sqrt{10})$

(C) $\dfrac{1}{2}(12+2\sqrt{50})$ (D) $\dfrac{1}{2}(12-2\sqrt{50})$

90. The set of values of $\theta$ satisfying the inequation $2\sin^2\theta - 5\sin\theta + 2 > 0$, where $0 < \theta < 2\pi$, is

(A) $\left(0,\dfrac{\pi}{6}\right)\cup\left(\dfrac{5\pi}{6},2\pi\right)$

(B) $\left[0,\dfrac{\pi}{6}\right]\cup\left[\dfrac{5\pi}{6},2\pi\right]$

(C) $\left[0,\dfrac{\pi}{3}\right]\cup\left[\dfrac{2\pi}{3},2\pi\right]$

(D) None of these

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