TECHNO INDIA GROUP PUBLIC SCHOOLS

JEE (Main)-XI

Monthly Mock Test - 2 (29-08-2025)

Time Allowed: **3 hours**   Maximum Marks: **300**

General Instructions:

1. There are three subjects in the question paper consisting of Physics (Q. no. 1 to 25), Chemistry (Q, no. 26 to 50), and Mathematics (Q. no. 51 to 75).

2. Each subject is divided into two sections. Section A consists of 20 multiple-choice questions & Section B consists of 5 numerical value-type questions.

3. There will be only one correct choice in the given four choices in Section A. For each question for Section A, 4 marks will be awarded for correct choice, 1 mark will be deducted for incorrect choice questions and zero marks will be awarded for not attempted questions.

4. For Section B questions, 4 marks will be awarded for correct choice, 1 mark will be deducted for incorrect choice questions and zero marks will be awarded for not attempted questions.

5. Any textual, printed, or written material, mobile phones, calculator etc. is not allowed for the students appearing for the test.

6. All calculations/written work should be done in the rough sheet, provided with the Question Paper.

PHYSICS

SECTION A

Section A consists of 20 questions of 4 marks each.
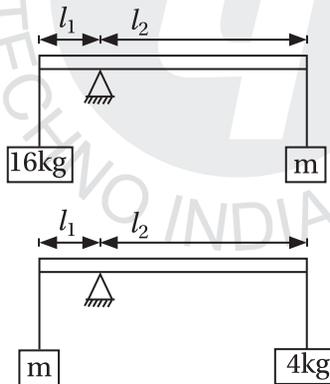
1. A rod AB of mass M and Length L is hang with two strings connected at A and C as shown in diagram then T_1 and T_2 will be respectively :
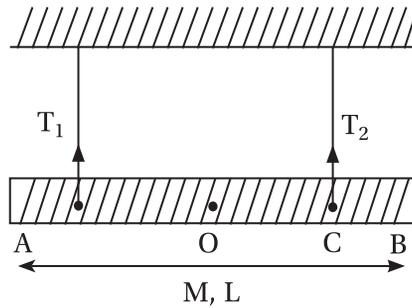
① $\dfrac{Mg}{3}, \dfrac{2Mg}{3}$
② $\dfrac{Mg}{3}, \dfrac{Mg}{3}$
③ $\dfrac{2Mg}{3}, \dfrac{Mg}{3}$
④ $\dfrac{2Mg}{3}, \dfrac{2Mg}{3}$

2. In an experiment with a beam balance an unknown mass m is balanced by two known masses of 16 kg and 4 kg as shown in figure.

   The value of the unknown mass m is :

① 10 kg
② 6 kg
③ 8 kg
④ 12 kg

3. A uniform rod of mass M and length L is free to rotate in XZ-plane, i.e., $\vec{F} = (3i + 2\hat{j} + 6\hat{k})$ N is acting on the rod at (L/2, 0, 0) in the situation shown in figure. the angular acceleration of rod is : (Take M = 6 kg and L = 4m)
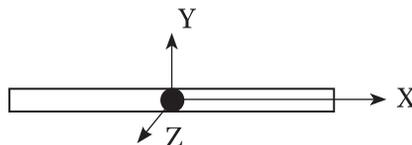
① $-\dfrac{3}{2}\hat{j} + \dfrac{1}{2}\hat{k}$
② $-\dfrac{3}{2}\hat{j}$
③ $\dfrac{1}{2}\hat{k}$
④ $4\hat{j}$

4. A particle of mass m is projected with a velocity v making an angle of 45° with the horizontal. The

magnitude of angular momentum of the projectile about an axis of projection when the particle is at maximum height h is :

① zero   ② $\dfrac{mv^3}{4\sqrt{2}\,g}$ ③ $\dfrac{mv^2}{\sqrt{2g}}$ ④ $m(2gh^3)$

5. A uniform rod of mass m is leaning at rest against a smooth wall as shown. Contact force between the rod and the ground is $(\cot\theta = 2\sqrt{3})$:
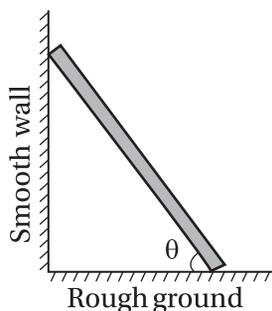
① 1 mg   ② $\sqrt{3}$ mg   ③ 2 mg   ④ $\sqrt{5}$ mg

6. A uniform rod AB of length l and mass m is free to rotate about point A. The rod is released from rest in the horizontal position. Given that the moment of intertia of the rod about A is $ml^2/3$, the initial angular acceleration of the rod will be :
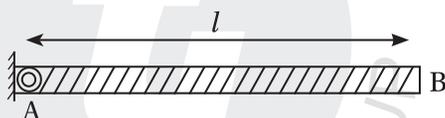
① $\dfrac{mgl}{2}$ ② $\dfrac{3mgl}{2}$ ③ $\dfrac{3g}{2l}$ ④ $\dfrac{2g}{3l}$

7. If $\vec{F}$ is the force acting on a particle having position vector $\vec{r}$ and $\vec{\tau}$ be the torque of this force about the origin, then :

① $\vec{r}.\vec{\tau} > 0$ and $\vec{F}.\vec{\tau} < 0$ ② $\vec{r}.\vec{\tau} = 0$ and $\vec{F}.\vec{\tau} = 0$ ③ $\vec{r}.\vec{\tau} = 0$ and $\vec{F}.\vec{\tau} \neq 0$ ④ $\vec{r}.\vec{\tau} \neq 0$ and $\vec{F}.\vec{\tau} = 0$

8. A force $\vec{F} = a\hat{i} + 3\hat{j} + 6\hat{k}$ is acting at a point $\vec{r} = 2\hat{i} - 6\hat{j} - 12\hat{k}$. The value of a for which angular momentum about the origin is conserved is :

① zero   ② 1   ③ –1   ④ 2

9. Two rods of equal mass m and length L lies along the x-axis and y-axis with their centres origin. What is the moment of inertia of both about the line x = y ?

① $\dfrac{mL^2}{3}$ ② $\dfrac{mL^2}{4}$ ③ $\dfrac{mL^2}{12}$ ④ $\dfrac{mL^2}{6}$

10. The radius of gyration of a rod of length L and mass M about an axis perpendicular to its length and passing through a point at a disance L/3 from one of its ends is

① $\dfrac{\sqrt{7}}{6}L$ ② $\dfrac{2L}{9}$ ③ $\dfrac{L}{3}$ ④ $\dfrac{\sqrt{5}}{2}L$

11. A uniform bar of length '6l' and mass '8m' wlies on a smooth horizontal table. Two point masses m and 2m are moving in the same horizontal plane with speed 2v and v respectively, strike the bar (as shown

in the fig.) and stick to the bar after collision. Total energy after collision (about the center of mass c) will be :
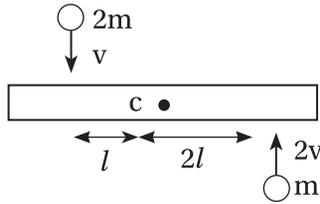
① $\dfrac{2mv^2}{5}$ ② $\dfrac{mv^2}{5}$ ③ $\dfrac{3mv^2}{5}$ ④ mv^2

12. Given below are two statements :

Statement I : The moment of force is maximum for a point if force applied on it and its position vector w.r.t. the point of rotation are perpendicular.

Statement II : The magnitude of torque is independent of the direction of application of force. In the light of the above statements. Choose the most appropriate answer from the options given below :

① Statement I is incorrect but Statement II is correct.

② Both Statement I and Statement II are incorrect.

③ Both Statement I and Statement II are incorrect.

④ Statement I is correct but Statement II is incorrect.

13. Match Column-I with Column-II.

	Column-I		**Column-II**
(a)	For translational equilibrium	(p)	MK^2
(b)	For rotational equilibrium	(q)	$\sum \vec{F} = 0$ and $\sum \vec{r} = 0$
(c)	Moment of inertia of a body	(r)	$\sum \vec{F} = 0$
(d)	A rigid body is said to be in mechanical equilibrium	(s)	$\sum \vec{r} = 0$

① $(a \to r) ; (b \to q) ; (c \to p) ; (d \to s)$ ② $(a \to q) ; (b \to r) ; (c \to s) ; (d \to p)$
③ $(a \to q) ; (b \to r) ; (c \to p) ; (d \to s)$ ④ $(a \to r) ; (b \to s) ; (c \to p) ; (d \to q)$

14. A cubical block of side a is moving with velocity v on a horizontal smooth plane of as shown. If hits a ridge at point O. The angular speed of the block after it hits at O is :
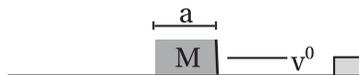
① $3v/4a$ ② $3v/2a$ ③ $\dfrac{\sqrt{3}v}{\sqrt{2}a}$ ④ zero

15. The exhaust velocity of gases with respect to a small rocket of mass 25 kg is 28×10^2 m/s. At what rate the fuel must burn so that it may rise up with an acceleration of 9.8 m/s^2.

① 175 kgs^{-1} ② 1.75 kgs^{-1} ③ 0.175 kgs^{-1} ④ 17.5 kgs^{-1}

16. A rocket of mass 5700 kg ejects mass at a constant rate of 15 kg/s with constan speed of 12 km/s. The acceleration of the rocket 1 minute after the blast is (g = 10 m/s^2)

① 34.9 m/s^2 ② 27.5 m/s^2 ③ 3.50 m/s^2 ④ 13.5 m/s^2

17. Given below are two statements :

Statement I : Impulse generated on one body by another body in a perfectly elastic collision is not zero.

Statement II : In a perfectly elastic collision, momentum of the system is always conserved and not the momentum of the individual bodies.

In the light of the above statements, choose the most appropriate anser from the options given below :

① Statement I is incorrect but Statement II is correct.

② Both Statement I and Statement II are correct.

③ Both Statement I and Statement II are incorrect.

④ Statement I is correct but Statement II is incorrect.

18. A shell initially at rest explodes into two pieces of equal mass, then the two pieces will

① Be at rest

② Move with different velocities in different directions

③ Move with the same velocity in opposite directions.

④ Move with the same velocity in same direction.

19. The position of centre of mass of a system of particles does not depend the

① mass of particles   ② symmetry of the body

③ position of the body   ④ nature of particles

20. The centre of mass of a body

① lies always outside the body   ② may lie within, outside on the surface of the body

③ lies always inside the body   ④ lies always on the surface of the body

SECTION B

Section B consists of 5 questions of 4 marks each.

21. A wheel of moment of inertia about its centre of mass 4 kg-m^2 is spinning with an angular velocity of 15 rad/s. If the wheel is brought to rest by a braking torque in 2.5 second, then value of the torque is (in N – m) _____

22. A 6000 kg rocket is set for firing. If the exhaust speed is 1000 m/s, how much gas must be ejected each second to supply the thrust needed to over come the weight of the rocket ? (in kg) _____ .

23. A bomb of mass 9 kg explodes into two fragments of masses 3 kg and 6 kg. The velocity of mass 3 kg is 16 m/sec. The energy of explosion is equal to _____ (J).

24. A body of mass 5 kg explodes at rest into three fragments with masses in the ratio 1 : 1 : 3. The fragments with equal masses fly off in mutually perpendicular directions with speeds of 21 m/s. The velocity of the heaviest fragment will be (Nearest whole no) _____ .

25. A bomb explodes in air when it has a horizontal speed of 100 km/h. It breaks into two pieces A, B of mass ratio 1 : 2. If A goes vertically up at a speed of 400 km/h, the speed of B is _____ km/h.

CHEMISTRY

SECTION A

Section A consists of 20 questions of 4 marks each.

26. The correct increasing order of the ionic radii is :

① $Ca^{2+} < K^+ < Cl^- < S^{2-}$ ② $S^{2-} < Cl^- < Ca^{+2} < K^+$ ③ $K^+ < S^{2-} < Ca^{2+} < Cl^-$ ④ $Cl^- < Ca^{2+} < K^+ < S^{2-}$

27. Which of the following represents the correct order of increasing first ionization enthalpy for Ca, Ba, S, Se and Ar ?

① Ca < Ba < S < Se < Ar   ② Ca < S < Ba < Se < Ar   ③ S < Se < Ca < Ba < Ar   ④ Ba < Ca < Se < S < Ar

28. Which of the following molecules has the maximum dipole moment ?

① NH_3 ② PF_5 ③ CH_4 ④ NF_3

29. Correct solubility order of AgF, AgCl, AgBr, AgI in water is :

① AgF < AgCl > AgBr > AgI   ② AgI < AgBr < AgCl < AgF

③ AgF < AgI < AgBr < AgCl   ④ AgCl > AgBr > AgF > AgI

30. Which compound exhibits maximum dipole moment among the following ?
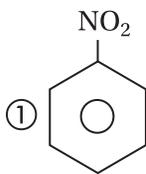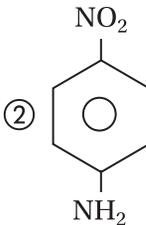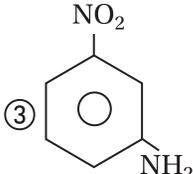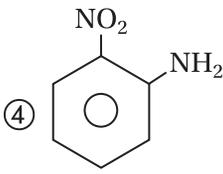
31. Which of the following contains maximum number of lone pairs on the central atom?

① ClO_3^- ② XeF_4 ③ SF_4 ④ $I_3^{\ominus}$

32. match list I with List II.

	List I Compound/species		List II Shape/Geometry
A.	SF_4	I.	Tetrahedral
B.	BrF_3	II.	Pyramidal
C.	BrO_3^-	III.	See Saw
D.	NH_4^+	IV.	Bent T-Shape

Choose the correct answer from the options given below :

① A – III, B – II, C – IV, D – I

② A – II, B – IV, C – III, D – I

③ A – II, B – III, C – I, D – IV

④ A – III, B – IV, C – II, D – I

33. The pair of species showing perfect tetrahedral geometry :

① PCl_4^+ and NH_4^+ ② BF_4^- & NH_3 ③ SF_4 and CCl_4 ④ SF_4 and $CH_3^{\ominus}$

34. The compound with two lone pairs of electrons on the central atom is :

① BrF_5 ② ClF_3 ③ XeF_6 ④ SF_4

35. The molecule / ion with square pyramidal shape is :

① $[Ni(CN)_4]^{2-}$ ② PF_5 ③ PCl_5 ④ BrF_5

36. The species in which nitrogen atom is in a state of Sp hybridisation is :

① NO_3^- ② NO_2 ③ $\overset{+}{N}O_2$ ④ $NO_2^{\ominus}$
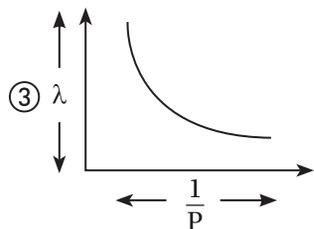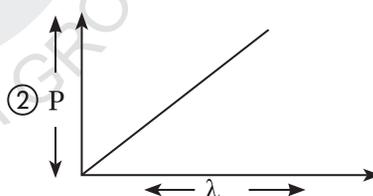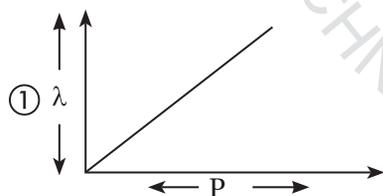
37. Which of the following is paramagnetic ?

① CO   ② O_2^{2-} ③ NO^+ ④ B_2

38. The correct order of O – O bond length in O_2, H_2O_2 and O_3 is :

① $O_2 > O_3 > H_2O_2$ ② $H_2O_2 > O_3 > O_2$ ③ $O_3 > O_2 > H_2O_2$ ④ $O_3 > H_2O_2 > O_2$

39. According to the wave-particle duality of matter by de-Broglie, which of the following graph plot presents most appropriate relationship between wavelength of electron (λ) and momentum of electron (P).
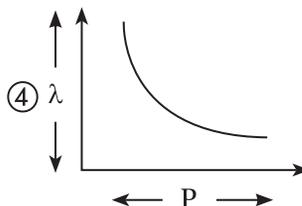
40. If the radius of the first orbit of hydrogen atom is a_0, then de-Broglies wavelength of electron in 3rd orbit is :

① $6\pi a_0$ ② $\dfrac{\pi a_0}{6}$ ③ $\dfrac{\pi a_0}{3}$ ④ $3\pi a_0$

41. 3 g of activated charcoal was added to 50 ml of acetic acid solution (0.06 N) in a flask. After an hour it was filtered and the strength of the filtrate was found to be 0.042 N. The amount of acetic acid absorbed (per gram of charcoal) is

① 42 mg   ② 54 mg   ③ 18 mg   ④ 36 mg

42. The normality of solution obtained by mixing 100 ml of 0.2 (M) H_2SO_4 with 100 ml of 0.2 (M) NaOH is :

① 0.1   ② 0.2   ③ 0.5   ④ .3

43. The weight of KOH in 50 milli equivalent is :

① 1.6 g   ② 2.2 g   ③ 2.8 g   ④ 4.8 g

44. Dissolving 120 g of urea (M.W = 60) in 1000 g of water gave a solution of density 1.15 g/ml. the molarity of the solution is :

① 1.78 M   ② 2.0 M   ③ 2.05 M   ④ 2.22 M

45. The molefraction of glucose in aqueous solution is 0.2, then molality of solution will be :

① 13.8   ② 55.56   ③ 2   ④ 12

SECTION B

Section B consists of 5 questions of 4 marks each.

46. The number of species having a square planar shape from the following is _____ .

Xe F_4, S F_4, Si F_4, B F_4^-,   Br F_4^-, (Cu $(NH_3)_4)^{2+}$, $[FeCl_4]^{2-}$, $[PtCl_4]^{2-}$

47. The number of given orbitals which have electron density along with the axis is _____ .

P_x, P_y, P_z, dxy, dyz, dxz, dz^2, $dx^2 - y^2$

48. The number of electrons present in all the completely filled subshells having n = 4 and $S = +\dfrac{1}{2}$ is_____.

(Where n = principal quantum number and S = spin quantum number).

49. What is the group number of element Une ? _____ .

50. 5.6 litre of the gas have 1 g weight at S.T.P. Then atomic weight of the gas is _____ .

MATHEMATICS

SECTION A

Section A consists of 20 questions of 4 marks each.

51. If n(A) = 1000, n(B) = 500 and if n(A ∩ B) ≥ 1 and n(A ∪ B) = p, then

① 500 ≤ p ≤ 1000   ② 1001 ≤ p ≤ 1498   ③ 1000 ≤ p ≤ 1498   ④ 1001 ≤ p ≤ 1499

52. Let P = { θ : sin θ – cos θ = $\sqrt{2}$ cos θ} and Q = {θ : sin θ + cos θ = $\sqrt{2}$ sin θ } be two sets. Then

① P ⊂ Q and Q – P = φ   ② Q ⊄ P   ③ P ⊄ Q   ④ P = Q

53. Let F_1 be the set of parallelograms, F_2 the set of rectangles, F_3 the set of rhombuses, F_4 the set of squares and F_5 the set of trapeziums in a plane. Then, F_1 may be equal to

① $F_2 \cap F_3$ ② $F_3 \cap F_4$ ③ $F_2 \cup F_5$ ④ $F_2 \cup F_3 \cup F_4 \cup F_1$

54. A survey shows that 73% of the persons working in an office like coffee, whereas 65% in tea. If x denotes the percentage of them, who like both coffee and tea, then x cannot be

① 63   ② 36   ③ 54   ④ 38

55. If $f(1) = 1$, $f(2n) = f(n)$ and $f(2n + 1) = (f(n))^2 - 2$ for $n = 1, 2, 3, ...$, then the value of $f(1) + f(2) + ... + f(25)$ is equal to

① 1   ② – 15   ③ – 17   ④ – 1

56. The relation R defined on the set $A = \{1, 2, 3, 4, 5\}$ by $R = \{(x,y) : |x^2 + y^2| < 16\}$ is given by

① $\{(1, 1), (2, 1), (3, 1), (4, 1), (2, 3)\}$ ② $\{(2, 2), (3, 2), (4, 2), (2, 4)\}$

③ $\{(3, 3), (4, 3), (5, 4), (3, 4)\}$ ④ None of these

57. Find the domain of the function $f(x) = \sqrt{\log_{1/2}\left(\dfrac{5x - x^2}{4}\right)}$

① $(-\infty, 5)$ ② $(0, 1] \cup [4, 5)$ ③ $(0, 5)$ ④ $(4, \infty)$

58. Let $f : R \to R$ be a function defined by $f(x) = \log_{\sqrt{m}}\{\sqrt{2}(\sin x - \cos x) + m - 2\}$, for some m, such that the range of f is $[0, 2]$. Then the value of m is

① 3   ② 5   ③ 4   ④ 2

59. If $2 \sin x \cos x = \sin 2x$, then find the value of $3(\sin x - \cos x)^4 + 6(\sin x + \cos x)^2 + 4(\sin^6 x + \cos^6 x)$.

① 10   ② 0   ③ 1   ④ 13

60. If $x^2 + y^2 = 4$ and $a^2 + b^2 = 8$, then find minimum and maximum value of $(ax + by)$.

① $-\sqrt{2}, \sqrt{2}$ ② $-2\sqrt{2}, 2\sqrt{2}$ ③ 4, 8   ④ $-4\sqrt{2}, 4\sqrt{2}$

61. If $0 < \theta < \dfrac{\pi}{2}$ and $x = \sum\limits_{n=0}^{\infty} \cos^{2n}\theta$, $y = \sum\limits_{n=0}^{\infty} \sin^{2n}\theta$, $z = \sum\limits_{n=0}^{\infty} \cos^{2n}\theta\sin^{2n}\theta$, then

① $xyz = xz + y$ ② $xyz = xy + z$ ③ $xyz = yz + x$ ④ None of these

62. $96 \cos\dfrac{\pi}{33}\cos\dfrac{2\pi}{33}\cos\dfrac{4\pi}{33}\cos\dfrac{8\pi}{33}\cos\dfrac{16\pi}{33}$ is equal to

① 3   ② 2   ③ 1   ④ 4

63. If z_1, z_2, z_3, are 3 distinct complex numbers such that $\dfrac{3}{|z_2 - z_3|} = \dfrac{4}{|z_3 - z_1|} = \dfrac{5}{|z_1 - z_2|}$, then the value of $\dfrac{9}{z_2 - z_3} + \dfrac{16}{z_3 - z_1} + \dfrac{25}{z_1 - z_2}$ equals

① 0   ② 3   ③ 4   ④ 5

64. If the complex number z for which $\arg\left(\dfrac{3z - 6 - 3i}{2z - 8 - 6i}\right) = \dfrac{\pi}{4}$ and $|z - 3 + i| = 3$ are $\left(a - \dfrac{4}{\sqrt{5}}\right) + i\left(1 + \dfrac{2}{\sqrt{5}}\right)$ and $\left(a + \dfrac{4}{\sqrt{5}}\right) + i\left(1 - \dfrac{2}{\sqrt{5}}\right)$, respectively, then 'a' must be equal to

① 5   ② 4   ③ 3   ④ 2

65. The set of values of k for which the equation $z\bar{z} + (-3 + 4i)\bar{z} - (3 + 4i)z + k = 0$, represents a circle is

① $(-\infty, 25]$ ② $[25, \infty)$ ③ $[5, \infty)$ ④ $(-\infty, 5)$

66. If $1, \omega, \omega^2$ are the three cube roots of unity, then for $\alpha, \beta, \gamma, \delta \in R$, the expression $\left(\dfrac{\alpha + \beta\omega + \gamma\omega^2 + \delta\omega^2}{\beta + \alpha\omega^2 + \gamma\omega + \delta\omega}\right)$ is equal to

① 1　　　　　　② ω　　　　　　③ $-\omega$　　　　　　④ ω^{-1}

67. If both the roots of $x^2 + x + a = 0$ exceed a, then

① $2 < a < 3$　　　② $a > 3$　　　③ $-3 < a < 3$　　　④ $a < -2$

68. The condition that one root of the equation $ax^2 + bx + c = 0$ may be square of the other, is

① $a^2c + ac^2 + b^3 - 3abc = 0$　　　　　② $a^2c^2 + ac^2 + b^2 + 3abc = 0$

③ $ac^2 + ac - b^3 - 3abc = 0$　　　　　④ $a^2c + ac^2 - b^3 - 3abc = 0$

69. The values of a for which the roots of the equation $(a + 1) x^2 - 3ax + 4a = 0$ $(a \neq -1)$ are real and greater than 1 are

① $\left[-\dfrac{10}{7}, 1\right]$　　　② $\left[-\dfrac{12}{7}, 0\right]$　　　③ $\left[-\dfrac{16}{7}, -1\right)$　　　④ $\left(-\dfrac{16}{7}, 0\right)$

70. If 'x' is real, the maximum value of $\dfrac{3x^2 + 9x + 17}{3x^2 + 9x + 7}$ is

① 41　　　　　② 1　　　　　③ $\dfrac{17}{7}$　　　　　④ $\dfrac{1}{4}$

SECTION B

Section B consists of 5 questions of 4 marks each.

71. How many natural numbers are there in $A = \left\{x \in Z \middle| \min\left(x + 2, 4 - \dfrac{x}{3}\right) \geq 1\right\}$?

72. Let $f(x) = \begin{vmatrix} x^2 - 3 & x \leq -5 \\ x + \lambda, & -5 < x < -1 \\ (\mu - 7)\big(|1 - x| + |1 + x|\big), & -1 \leq x \leq 1 \\ x + 6, & 1 < x < 5 \\ 3 - x^2 & x \geq 5 \end{vmatrix}$

    If f(x) is an odd function, then the value of $(\lambda + \mu)$ is _____ .

73. The value of $\cot\dfrac{\pi}{32} - \tan\dfrac{\pi}{32} - 2\tan\dfrac{\pi}{16} - 4\tan\dfrac{\pi}{8}$ is

74. Let a, b be the roots of the equation $x^2 - 10cx - 11d = 0$ and c, d be those of $x^2 - 10ax - 11b = 0$. If $a + b + c + d = p^2q$, where p is a prime number, then the value of $p - q$ $(a \neq b \neq c \neq d)$ is _____ .

75. If $\dfrac{3iz_2}{5z_1}$ is purely real, then $5\left|\dfrac{3z_1 + 7z_2}{3z_1 - 7z_2}\right|$ is _____ .