JEE Mains 2026 21 Jan Shift 1 Question Paper(Memory Based)

---

1. Two capacitors C and $2C$ charged to V and $2V$ respectively are connected in parallel with opposite polarity. The common potential is:

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

---

2. Ratio of de-Broglie wavelengths of a proton and an alpha particle accelerated through the same potential is:

(A) $1:2$
(B) $2\sqrt{2}:1$
(C) $2:1$
(D) $\sqrt{8}:1$

---

3. Correct order of acidic strength: (I) Phenol, (II) p-Cresol, (III) m-Nitrophenol, (IV) p-Nitrophenol

(A) IV > III > I > II
(B) III > IV > I > II
(C) IV > I > III > II
(D) III > I > IV > II

---

4. Evaluate the limit:

$$\lim_{x \to 0} \frac{\sin(2x) - 2\sin x}{x^3}$$

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

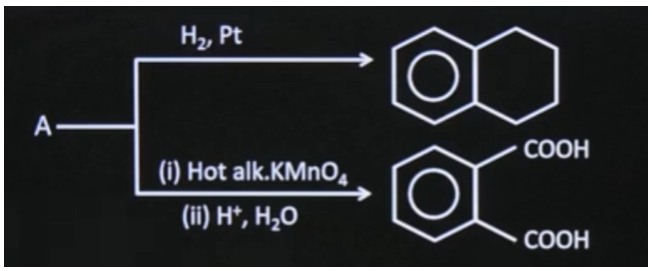
---

5. The value of $\csc 10^\circ - \sqrt{3}\sec 10^\circ$ is:

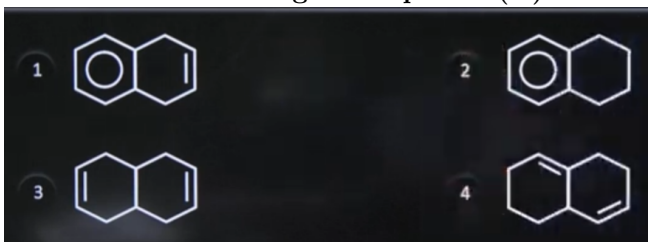
(A) 1
(B) 2
(C) 4
(D) None of these

---

6. An organic compound (A) undergoes the following reactions:



Which of the following is compound (A)?



(A) Structure 1
(B) Structure 2
(C) Structure 3
(D) Structure 4

---

7. If $y = y(x)$ and

$$(1 + x^2)\, dy + (1 - \tan^{-1} x)\, dx = 0$$

and $y(0) = 1$, then $y(1)$ is equal to:

(A) $\dfrac{\pi^2}{32} + \dfrac{\pi}{4} + 1$
(B) $\dfrac{\pi^2}{32} - \dfrac{\pi}{4} + 1$
(C) $\dfrac{\pi^2}{32} - \dfrac{\pi}{2} - 1$
(D) $\dfrac{\pi^2}{32} - \dfrac{\pi}{2} + 1$

---

8. The sum of roots of the equation

$$|x - 1|^2 - 5|x - 1| + 6 = 0$$

is:

---

9. Which of the following is the correct order with respect to the property indicated?

(A) Cl > F (Ionisation energy)
(B) $K_2O > Na_2O > Al_2O_3$ (Basic nature)
(C) K > Na > Al > Mg (Metallic character)
(D) None of these

---

10. Find dimensions of $\frac{A}{B}$ if

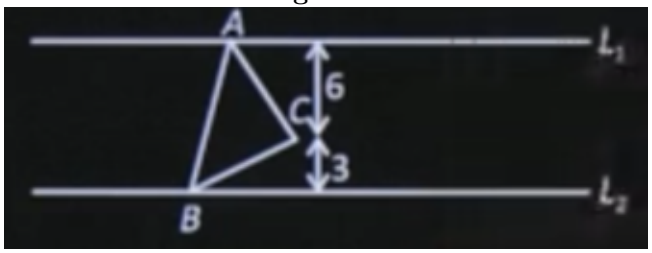
$$\left(P + \frac{A^2}{B}\right) + \frac{1}{2}\rho V^2 = \textbf{constant},$$

where $P \rightarrow$ pressure, $\rho \rightarrow$ density, $V \rightarrow$ speed.

(A) ML^1T^{-4}
(B) $ML^{-1}T^{-4}$
(C) ML^2T^{-4}
(D) $ML^{-1}T^{-2}$

---

11. If L_1 and L_2 are two parallel lines and $\triangle ABC$ is an equilateral triangle as shown in the figure, then the area of triangle ABC is:



(A) $7\sqrt{3}$
(B) $4\sqrt{3}$
(C) $21\sqrt{3}$
(D) 84

---

12. Given below are two statements:
Statement I: Arginine and Tryptophan are essential amino acids.
Statement II: Glycine does not have any chiral carbon.
In the light of the above statements, which is the correct option?

(A) Both statement-I and statement-II are correct
(B) Both statement-I and statement-II are incorrect
(C) Statement-I is correct and statement-II is incorrect
(D) Statement-I is incorrect and statement-II is correct

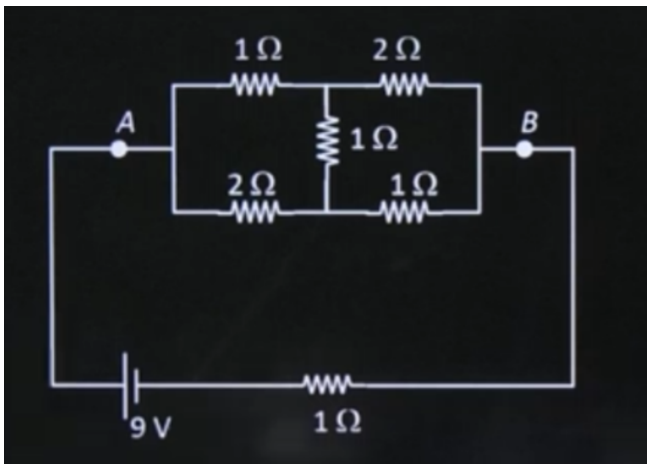
---

13. Consider a set $S = \{a, b, c, d\}$. Then the number of reflexive as well as symmetric relations from $S \rightarrow S$ is:

(A) 1024
(B) 256
(C) 16
(D) 64

---

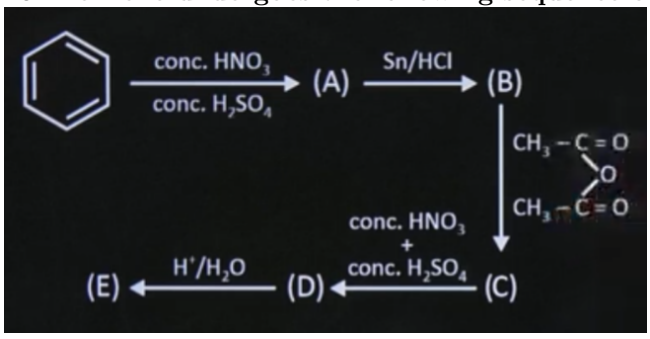
14. Find the heat produced in the external circuit (AB) in one second.



(A) 1181.25 J
(B) 1311.25 J
(C) 1207.50 J
(D) 1410.50 J

---

15. Benzene undergoes the following sequence of reactions:



Find the percentage of nitrogen in compound (E).

---

16. The locus of the point of intersection of tangents drawn to the circle

$$(x-2)^2 + (y-3)^2 = 16,$$

which subtends an angle of 120°, is:

(A) $3x^2 + 3y^2 - 12x - 18y - 25 = 0$
(B) $x^2 + y^2 - 12x - 18y - 25 = 0$
(C) $3x^2 + 3y^2 + 12x + 18y - 25 = 0$
(D) $x^2 + y^2 + 12x + 18y - 25 = 0$

---

17. If $a_1, a_2, a_3, \ldots$ are in increasing geometric progression such that

$$a_1 + a_3 + a_5 = 21, \quad a_1 a_3 a_5 = 64,$$

then $a_1 + a_2 + a_3$ is:

(A) 5
(B) 7

(C) 10
(D) 15

---

18. An α-particle having kinetic energy $7.7\,\text{MeV}$ is approaching a fixed gold nucleus (atomic number $Z = 79$). Find the distance of closest approach.

(A) $1.72\,\text{nm}$
(B) $6.2\,\text{nm}$
(C) $16.8\,\text{nm}$
(D) $0.2\,\text{nm}$

---

19. If O is the vertex of the parabola $x^2 = 4y$, Q is a point on the parabola. If C is the locus of a point which divides OQ in the ratio $2:3$, then the equation of the chord of C which is bisected at the point $(1, 2)$ is:

(A) $5x + 4y + 3 = 0$
(B) $5x - 4y - 3 = 0$
(C) $5x - 4y + 3 = 0$
(D) $5x + 4y - 3 = 0$

---

20. An α-particle having kinetic energy $7.7\,\text{MeV}$ is approaching a fixed gold nucleus (atomic number $Z = 79$). Find the distance of closest approach.

(A) $1.72\,\text{nm}$
(B) $6.2\,\text{nm}$
(C) $16.8\,\text{nm}$
(D) $0.2\,\text{nm}$

---

21. An air-filled capacitor of capacitance C is filled with a dielectric ($k = 3$) of width $\frac{d}{3}$, where d is the separation between the plates. The new capacitance is:

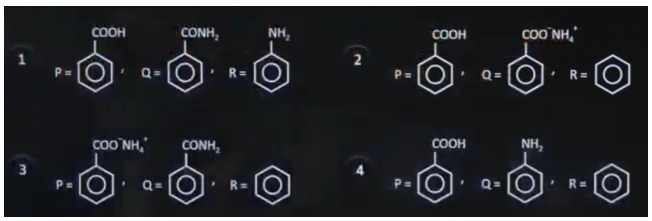
(A) $\frac{9}{5}C$
(B) $\frac{5}{4}C$
(C) $\frac{4}{3}C$
(D) $\frac{9}{7}C$

---

22. Observe the following reaction sequence:

$$(P) \xrightarrow[\Delta]{NH_3} (Q) \xrightarrow{Br_2/KOH} (R)$$

Which of the following is the correct structure for P, Q and R?



(A) P = Benzoic acid ($-COOH$), Q = Benzamide ($-CONH2$), R = Aniline ($-NH2$)
(B) P = Benzoic acid, Q = Ammonium benzoate, R = Benzene
(C) P = Ammonium benzoate, Q = Benzamide, R = Benzene
(D) P = Benzoic acid, Q = Aniline, R = Benzene

---

23. In the following reaction,

$$MnO4^{2-} \xrightarrow{H^+} ?$$

Manganate ion undergoes disproportionation to form:

(A) $MnO2,\ MnO4^-$
(B) $MnO,\ MnO2$
(C) $MnO2,\ MnO$
(D) $MnO4^-,\ MnO$

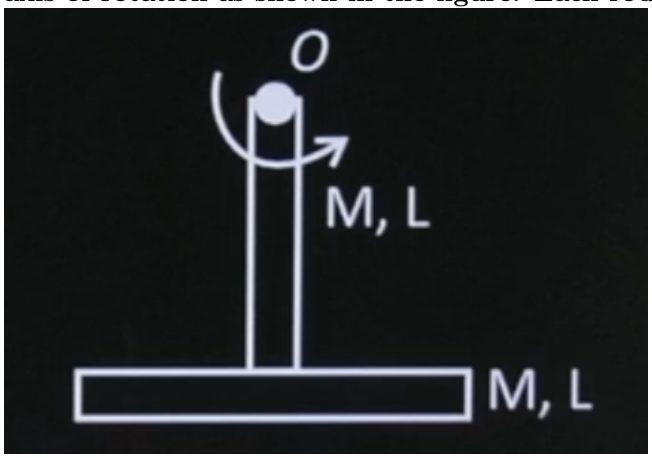
---

24. If $x^2 + x + 1 = 0$, then evaluate

$$\left(x + \frac{1}{x}\right)^4 + \left(x^2 + \frac{1}{x^2}\right)^4 + \left(x^3 + \frac{1}{x^3}\right)^4 + \cdots + \left(x^{25} + \frac{1}{x^{25}}\right)^4.$$

---

25. Find the moment of inertia of the system formed using two identical rods about the given axis of rotation as shown in the figure. Each rod has mass M and length L.



(A) $\frac{17}{12}ML^2$
(B) $\frac{13}{12}ML^2$
(C) $\frac{2}{3}ML^2$
(D) $\frac{3}{4}ML^2$

26. If the electric field of an EM wave is given by

$$60\,[\sin(3\times10^{14}t)+\sin(12\times10^{14}t)]$$

at $x=0$ and it falls on a photosensitive material having work function $2.8\,\text{eV}$, find the maximum kinetic energy (in eV) of the ejected electrons.

(A) $2.52\,\text{eV}$
(B) $2.16\,\text{eV}$
(C) $2.00\,\text{eV}$
(D) $2.34\,\text{eV}$

---

27. $80\,\text{mL}$ of an organic compound is mixed with $264\,\text{mL}$ of O_2 and ignited. It gives $224\,\text{mL}$ of gaseous mixture at NTP. After passing through KOH, $64\,\text{mL}$ of gas remains. The organic compound is:

(A) C_2H_4
(B) C_2H_2
(C) C_4H_{10}
(D) C_3H_6

---

28. Consider the following reaction:

$$Ca+2HCl->CaCl2+H2$$

If $14\,\text{g}$ of calcium reacts with excess HCl, choose the *incorrect* option.

(A) Mass of $CaCl2$ produced is $38.85\,\text{g}$
(B) Moles of $H2$ produced is $0.35\,\text{mol}$
(C) Volume of $H2$ produced at STP is $7.84\,\text{L}$
(D) Mass of $CaCl2$ produced is $3.885\,\text{g}$

---

29. Ellipse $E:\ \dfrac{x^2}{36}+\dfrac{y^2}{16}=1$. A hyperbola is confocal with the ellipse and the eccentricity of the hyperbola is equal to 5. If the principal axis of the hyperbola is the x-axis, then the length of the latus rectum of the hyperbola is:

(A) $\dfrac{96}{\sqrt{5}}$
(B) $24\sqrt{5}$
(C) $18\sqrt{5}$
(D) $12\sqrt{5}$

---

30. If the mean and variance of observations $x, y, 12, 14, 4, 10, 2$ is 8 and 16 respectively, where $x>y$, then the value of $3x-y$ is:

(A) 18
(B) 20
(C) 22
(D) 24

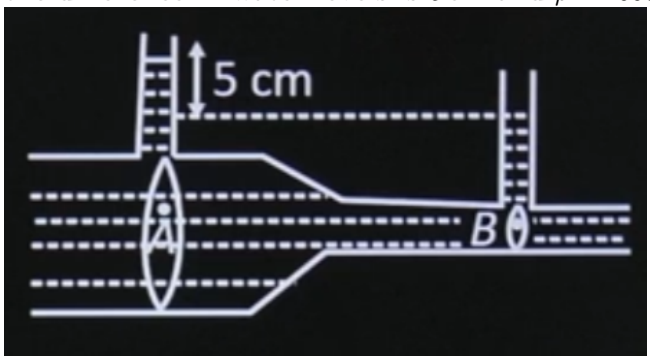
31. If $A = \{1, 2, 3, 4, 5, 6\}$ and $B = \{1, 2, 3, \ldots, 9\}$, then the number of strictly increasing functions $f : A \to B$ such that $f(i) \neq i$ for all $i = 1, 2, 3, 4, 5, 6$ is:

---

32. Find the volume flow rate in the Venturi meter shown below in which water is flowing. Given that the cross-sectional areas at A and B are A and a respectively,

$$\frac{A}{a} = 2, \quad A = \sqrt{3}\,\mathbf{m}^2,$$

the difference in water levels is $5\,\mathbf{cm}$ and $\rho = 1000\,\mathbf{kg\ m^{-3}}$.



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

---

33. An ideal solenoid is kept with its axis vertical. A current I_0 is flowing in the solenoid. A charge q is thrown vertically downward inside the solenoid. The acceleration of the charged particle is:

(A) g downward
(B) g upward
(C) Zero
(D) Depends on the magnitude of current I_0

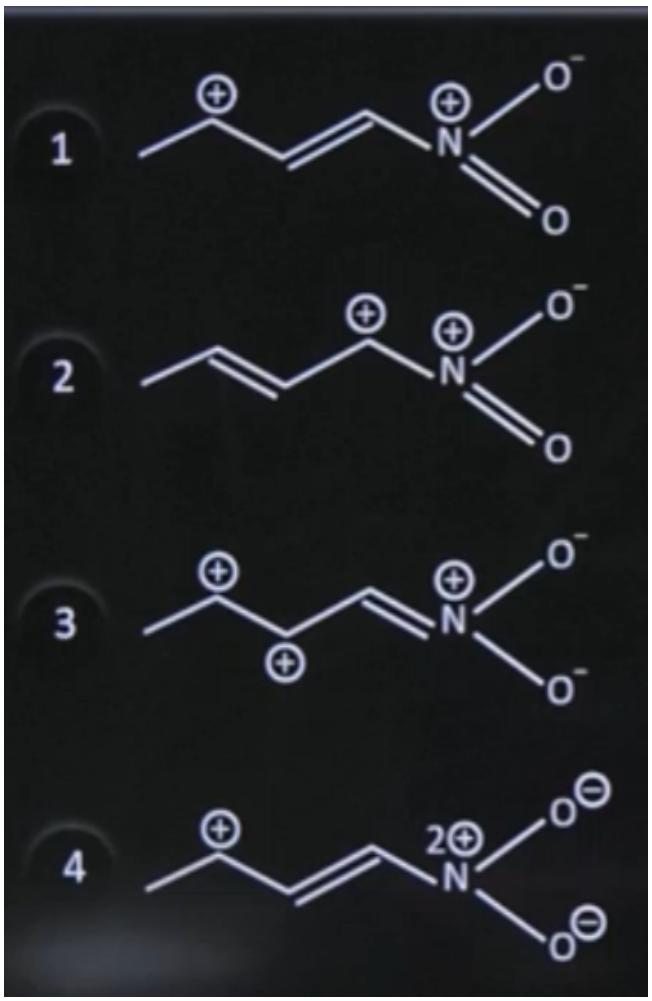
---

34. Given below are two statements:
Statement I: All the pairs of molecules (PbO, PbO_2); (SnO, SnO_2) and (GeO, GeO_2) contain amphoteric oxides.
Statement II: $AlCl_3, BH_3, BeH_2$ and NO_2 all have incomplete octet.
In the light of the above statements, choose the correct option.

(A) Both Statement I and Statement II are correct
(B) Both Statement I and Statement II are incorrect
(C) Statement I is correct but Statement II is incorrect
(D) Statement I is incorrect but Statement II is correct

---

35. Which of the following resonating structures is the most stable?



(A) Structure 1
(B) Structure 2
(C) Structure 3
(D) Structure 4

---

36. If O is the vertex of the parabola $x^2 = 4y$, Q is a point on the parabola. If C is the locus of the point which divides OQ in the ratio $2 : 3$, then the equation of the chord of C which is bisected at the point $(1, 2)$ is:

(A) $5x + 4y + 3 = 0$
(B) $5x - 4y - 3 = 0$
(C) $5x - 4y + 3 = 0$
(D) $5x + 4y - 3 = 0$

---

37. The value of

$$\int_{\frac{\pi}{6}}^{\pi} \frac{\pi + 4x^{11}}{1 - \sin\left(|x| + \frac{\pi}{6}\right)}\, dx$$ **is:**

(A) 3π
(B) 4π
(C) 6π
(D) 12π

38. If $f(3) = 18,\ f'(3) = 0$ and $f''(3) = 4$, then the value of

$$\lim_{x \to 1} \ln \left(\frac{f(x+2)}{f(3)} \right)^{\frac{18}{(x-1)^2}} \quad \textbf{is:}$$

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

---

39. A wave propagates whose electric field is given by

$$\vec{E} = 69 \sin(\omega t - kx)\, \hat{j}.$$

Find the direction of the magnetic field.

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

---

40. Two rods of equal length $60\,\text{cm}$ each are joined together end to end. The coefficients of linear expansion of the rods are $24 \times 10^{-6}\,^\circ\text{C}^{-1}$ and $1.2 \times 10^{-5}\,^\circ\text{C}^{-1}$. Their initial temperature is 30°C, which is increased to 100°C. Find the final length of the combination (in cm).

(A) 120.1321
(B) 120.1123
(C) 120.1512
(D) 120.1084

---

41. $1\,\text{g}$ of AB_2 is dissolved in $50\,\text{g}$ of a solvent such that $\Delta T_f = 0.689\,\text{K}$. When $1\,\text{g}$ of AB is dissolved in $50\,\text{g}$ of the same solvent, $\Delta T_f = 1.176\,\text{K}$. Find the molar mass of AB_2. Given $K_f = 5\,\text{K kg mol}^{-1}$. (*Report to nearest integer.*) Both AB_2 and AB are non-electrolytes.

---

42. Out of the following, how many compounds have tetrahedral geometry?

$$NH4^+,\ XeF4,\ [NiCl4]^{2-},\ [PtCl4]^{2-},\ [Cu(NH3)4]^{2+},\ BF3,\ [Ni(CO)4$$

---

43. If the domain of the function

$$\cos^{-1}\left(\frac{2x-5}{11x-7} \right) + \sin^{-1}\left(2x^2 - 3x + 1\right)$$

is

$$[0, a] \cup \left[\frac{12}{13}, b\right],$$

then the value of $\frac{1}{ab}$ **is:**

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

---

44. In the binomial expansion of

$$(ax^2 + bx + c)(1 - 2x)^{26},$$

the coefficients of x, x^2, x^3 **are** $-56, 0$ **and** 0 **respectively. Then the value of** $(a + b + c)$ **is:**

(A) 1500
(B) 1403
(C) 1300
(D) 1483

---

45. Find the change in internal energy of a gas if its temperature changes by $10\,\mathbf{K}$**. Number of moles of gas is** 10**,** C_p **(specific heat at constant pressure) is** $7\,\mathbf{cal\,K^{-1}mol^{-1}}$ **and** R **(gas constant)** $= 2\,\mathbf{cal\,K^{-1}mol^{-1}}$**.**

(A) 500 cal
(B) 1000 cal
(C) 250 cal
(D) 100 cal

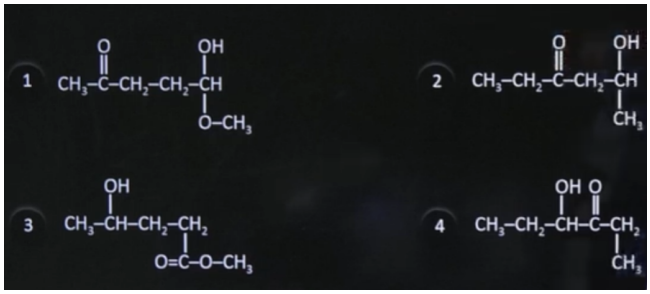
---

46. Two mechanical waves travel on strings of equal length L **and equal tension** T**. The linear mass densities of the strings are in the ratio** $\frac{\mu_1}{\mu_2} = \frac{1}{2}$**. Find the ratio of time taken for a wave pulse to travel from one end to the other in both strings. (Neglect gravity).**

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

---

47. $C_6H_{12}O_3$ **gives positive iodoform test. On hydrolysis with dilute acid, the product formed gives both Tollens' test and iodoform test. Find the correct structure of** $C_6H_{12}O_3$**.**



(A) $CH_3COCH_2CH_2CH(OH)OCH_3$

(B) $CH_3CH_2COCH_2CH(OH)CH_3$

(C) $CH_3CH(OH)CH_2CH_2COOCH_3$

(D) $CH_3CH_2CH(OH)COCH_2CH_3$

---

48. Consider the following statements:

(A) Propanal and propanone are functional isomers

(B) Ethoxyethane and methoxypropane are metamers

(C) But-2-ene shows optical isomerism

(D) But-1-ene and but-2-ene are functional isomers

(E) Pentane and 2,2-dimethylpropane are chain isomers

The correct statements are:

(A) A, B, D only
(B) B, C, D only
(C) A, B, E only
(D) A, B, D, E only

---

49. If $a_1 = 1$ and for all $n \geq 1$,

$$a_{n+1} = \frac{1}{2}a_n + \frac{n^2 - 2n - 1}{n^2(n+1)^2},$$

then the value of

$$\sum_{n=1}^{\infty}\left(a_n - \frac{2}{n^2}\right)$$

is equal to:

---

50. The area enclosed by

$$x^2 + 4y^2 \leq 4, \qquad y \leq |x| - 1, \qquad y \geq 1 - |x|$$

is equal to:

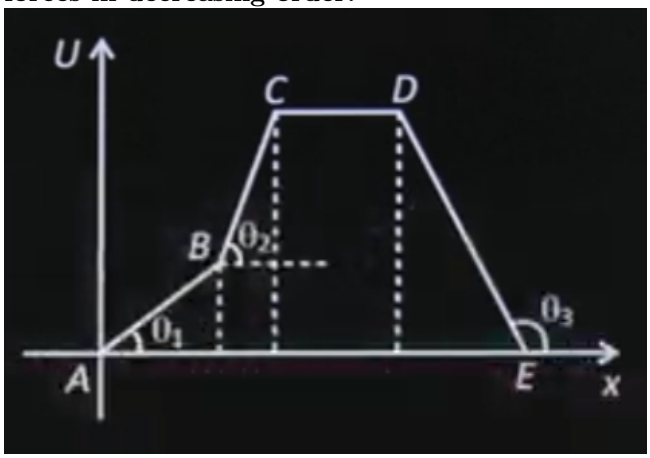
(A) $4\sin^{-1}\left(\frac{3}{5}\right) + \frac{6}{5}$
(B) $\sin^{-1}\left(\frac{3}{5}\right) - \frac{6}{5}$
(C) $4\sin^{-1}\left(\frac{3}{5}\right) + \frac{12}{5}$
(D) $4\sin^{-1}\left(\frac{3}{5}\right) - \frac{6}{5}$

---

51. A curve is given between the potential energy U of a particle and its position on the x-axis as shown. Given:

$$\tan\theta_1 = 1, \qquad \tan\theta_2 = 3, \qquad \tan\theta_3 = -\frac{1}{2}$$

If F_{AB} is the force acting on the particle during motion from A to B, similarly F_{BC}, F_{CD} and F_{DE} are the forces during B to C, C to D and D to E respectively, arrange the magnitudes of these forces in decreasing order.



(A) $F_{BC} > F_{AB} > F_{CD} > F_{DE}$
(B) $F_{BC} > F_{AB} > F_{DE} > F_{CD}$
(C) $F_{AB} > F_{BC} > F_{DE} > F_{CD}$
(D) $F_{BC} > F_{DE} > F_{AB} > F_{CD}$
