JEE-Main-22-01-2026 (Memory Based)
[MORNING SHIFT]
Maths

Question: If sum of first 4 terms of an A.P is 6 and sum of first 6 terms is 4, then sum of first 12 terms of an A.P is

Options:

(a) -22
(b) -21
(c) -23
(d) -24

Answer: (a)

$S_4 = 6$

$S_6 = 4$

Find $S_{12} = ?$

$S_4 = 6 \Rightarrow \frac{4}{2}[2a + 3d] = 6$

$\Rightarrow 2a + 3d = 3$ ....(1)

$S_6 = 4 \Rightarrow \frac{6}{2}[2a + 5d] = 4$

$\Rightarrow 2a + 5d = \frac{4}{3}$ ....(2)

$Eq(2) - Eq(1)$

$2d = -\frac{5}{3}$

$\Rightarrow d = \frac{-5}{6}$

by $(1) \Rightarrow 2a = 3 - 3d$

$2a = 3 - 3\left(\frac{-5}{6}\right)$

$2a = \frac{11}{2}$

$S_{12} = \frac{12}{2}[2a + 11d]$

$= 6\left[\frac{11}{2} + 11\left(\frac{-5}{6}\right)\right]$

$= 6\left[\frac{33-55}{6}\right]$

$= -22$

Question: The coefficient of x^{48} in $1.(1+x) + 2.(1+x)^2 + 3.(1+x)^3 + \ldots\ldots + 100.(1+x)^{100}$ is

Options:

(a) $({}^{101}C_{46})-100$
(b) $100({}^{101}C_{49})-{}^{101}C_{50}$
(c) $100({}^{101}C_{46})-{}^{101}C_{47}$
(d) ${}^{101}C_{47}-{}^{101}C_{46}$

Answer: (b)

$s = y + 2y^2 + 3y^3 + ... + 100y^{100},\ y = 1 + x$
$ys\ =\ y^2 + 2y^3 + ... + 100y^{101}$
$(1-y)s = \left(y + y^2 + y^3 + ... + y^{100}\right) - 100\,y^{101}$
$(1-y)s = \frac{y(1-y^{100})}{1-y}\ -\ 100\,y^{101}$
$S = \frac{y-y^{101}}{(1-y)^2} - \frac{100\,y^{101}}{1-y}\ =\ \frac{(1+x)-(1+x)^{101}}{x^2} + \frac{100(1+x)}{x}^{101}$
$\text{coeff of } x^{48}\ =\ -{}^{101}C_{50}\ +\ 100\,.\ {}^{101}C_{49}$

Question: If $A = \begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix}$, **then the value of $|A^{2025} - 3A^{2024} + A^{2023}|$ is**
Answer: (16)
$A = \begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix}$
$A^2 = \begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix}\begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix} = \begin{bmatrix} 13 & 21 \\ 21 & 34 \end{bmatrix}$
$|A|\ = 1$
$|A^{2025}\ -\ 3\,A^{2024} + A^{2023}|\ =\ |A^{2025}\left(A^2 - 3A + I\right)|$
$= |A^{2025}||A^2\ -\ 3\,A + I|$
$= |A|^{2025}|A^2\ -\ 3\,A + I|$
$= (1)^{2025}\begin{vmatrix} 8 & 12 \\ 12 & 20 \end{vmatrix}$
$= 1(160 - 144)$
$= 16$

Question:If the domain of the function $\frac{1}{\ln(10-x)} + \sin^{-1}\left(\frac{x+2}{2x+3}\right)$ is $(-\infty,-a] \cup (-1, b) \cup (b, c)$, then (b+ c + 3a) is equal
Options:
(a) 22
(b) 24
(c) 23
(d) 21
Answer: (b)
$10 - x > 0,\ 10 - x \neq 1,\ \ -1 \leq \frac{x+2}{2x+3}\ \leq 1$
$x < 10\,,\ x \neq 9,\ \frac{x+2}{2x+3}\ + 1\ \geq 0,\ \frac{x+2}{2x+3}\ - 1 \leq 0$
$\Rightarrow \frac{3x+5}{2x+3}\ \geq 0,\ \frac{-x-1}{2x+3}\ \leq 0$
$\Rightarrow x \in \left(-\infty,\ \frac{-5}{3}\right) \cup \left(-\frac{3}{2}, \infty\right),\ x \in \left(-\infty,\ \frac{-3}{2}\right) \cup \left[-1, \infty\right)$
$\text{Domine}\ =\ \left(-\infty,\ \frac{-5}{3}\right] \cup [-1,\ 9) \cup (9, 10)$
$a = \frac{5}{3},\ \ b = 9,\ \ c = 10$
$b + c + 3a = 19 + 5 = 24$

Question: If $\tan^{-1}(4x) + \tan^{-1}(6x) = \frac{\pi}{6}$ then no of solution in $\left(-\frac{1}{2\sqrt{6}}, \frac{1}{2\sqrt{6}}\right)$
Answer: (1)

$\frac{4x+6x}{1-14x^2} = \frac{1}{\sqrt{3}}$

$10\sqrt{3}x = 1 - 24x^2$

$24x^2 + 10\sqrt{3}x - 1 = 0 \Rightarrow x = \frac{-10\sqrt{3}\pm\sqrt{300+96}}{48}$

$\Rightarrow x = \frac{-10\sqrt{3}+\sqrt{396}}{48} = \frac{2}{\sqrt{396}+\sqrt{360}}$

No of solutions $= 1$

Question: Let M = {1, 2, 3, ... , 16} and R be a relation on M defined by xRy if and only if 4y = 5x - 3. Then, the number of elements required to added in R to make it symmetric is

Options:

(a) 2

(b) 3

(c) 4

(d) 5

Answer: (a)

$M = \{1, 2, 3, \ldots\ldots., 16\}$

$xRy \Leftrightarrow 4y = 5x - 3$

$\Rightarrow y = \frac{5x-3}{4}$

$\Rightarrow R = \{(3,3), (7,8), (11,13)\}$

To make R symmetric, we need to add $(8,7)$

& $(13,11)$

$\therefore$ 2 elements are required.

Question: The solution of the differential equation xdy - ydx $= \sqrt{x^2+y^2}\,dx$ **is (where c is integration constant)**

Options:

(a) $\sqrt{x^2+y^2} = cx^2 - y$

(b) $\sqrt{x^2+y^2} = cx^2 + y$

(c) $\sqrt{x^2+y^2} = cx - y$

(d) $\sqrt{x^2+y^2} = cx + y$

Answer: (a)

$$\frac{xdy-ydx}{x^2} = \sqrt{x^2+y^2}$$

$$\int \frac{d\frac{y}{x}}{\sqrt{1+\left(\frac{y}{x}\right)^2}} = \int \frac{dx}{x}$$

$$\log\left(\frac{y}{x} + \sqrt{1+\left(\frac{y}{x}\right)^2}\right) = 1nx + \log_c$$

$$xc = \frac{y}{x} + \frac{\sqrt{y^2+x^2}}{x}$$

$$x^2c = y + \sqrt{y^2+x^2}$$

Question:The number of real solution of equation x | x + 4 | + 3 | x + 2 | + 10 = 0 is/are :
Options:
(a) 1
(b) 2
(c) 3
(d) 4
Answer: (a)

$\text{Case I}: x < -4$

$-x(x+4) - 3(x+2) + 10 = 0$

$-x^2 - 7x + 4 = 0 \Rightarrow x^2 + 7x - 4 = 0$

$x = \frac{-7\pm\sqrt{49+16}}{2} = \frac{-7\pm\sqrt{65}}{2}$

$x = \frac{-7-\sqrt{65}}{2}$

$\text{Case II}: -4 \leq x < -2$

$x(x+4) - 3(x+2) + 10 = 0$

$x^2 + x + 4 = 0$

$\text{Case III}: x \geq -2$

$x(x+4) + 3x + 6 + 10 = 0$

$x^2 + 7x + 16 = 0$

$\text{No. of solutions} = 1$

Question: The value of $\dfrac{\cos^2 48^o - \cos^2 12^o}{\sin^2 24^o - \sin^2 6^o}$ is $\dfrac{\alpha + \beta\sqrt{5}}{\gamma}$ **Find** $\alpha+\beta+\gamma$
Answer: ($\alpha+\beta+\gamma$ **=12)**

$\frac{\cos^2 48 - \sin^2 12}{\sin^2 24 - \sin^2 6}$

$= \frac{\cos 60 \cos 36}{\sin 30 \sin 18}$

$= \frac{\cos 36}{\sin 18}$

$= \frac{\frac{1+\sqrt{5}}{4}}{\frac{-1+\sqrt{5}}{4}}$

$= \frac{\sqrt{5}+1}{\sqrt{5}-1} \times \frac{\sqrt{5}+1}{\sqrt{5}+1}$

$= \frac{5+1+2\sqrt{5}}{5-1} = \frac{6+2\sqrt{5}}{4}$

$\cos^2 a - \sin^2 b = \cos(a+b)\cos(a-b)$

$\alpha + \beta + \gamma = 12$

Question: The value of $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{dx}{[x]+4}$ **is Where [.] denotes greatest integer function.**

Options:

(a) $\frac{\pi}{20} + \frac{7}{20}$

(b) $\frac{7\pi}{20} - \frac{7}{60}$

(c) $\frac{7\pi}{20} - \frac{1}{60}$

(d) $\frac{7\pi}{20} + \frac{1}{60}$

Answer: (d)

$$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{dx}{[x]+4} = \int_{-\frac{\pi}{2}}^{-1} \frac{dx}{2} + \int_{-1}^{0} \frac{dx}{3} + \int_{0}^{1} \frac{dx}{4} + \int_{-1}^{\frac{\pi}{2}} \frac{dx}{5}$$

$= \frac{1}{2}\left(-1 + \frac{\pi}{2}\right) + \frac{1}{3}(0+1) + \frac{1}{4} + \frac{1}{5}\left(\frac{\pi}{2} - 1\right)$

$= -\frac{1}{2} + \frac{\pi}{4} + \frac{1}{3} + \frac{1}{4} + \frac{\pi}{10} - \frac{1}{5}$

$= \frac{7}{12} - \frac{1}{2} - \frac{1}{5} + \frac{\pi}{4} + \frac{\pi}{10}$

$= \frac{35-30-6}{60} + \frac{5\pi+2\pi}{20} = -\frac{1}{60} + \frac{7\pi}{20}$

Question: If a line ax + y =1 does not intersect the hyperbola x2 - 9y2 = 9 then α **possible value of** α **is :**

Options:

(a) 0.2

(b) 0.3
(c) 0.4
(d) 0.5
Answer: (d)

$$x^2 - 9(1-\alpha x)^2 = 9$$

$$x^2 - 9\left(1+\alpha^2 x^2 - 2\alpha x\right) = 9$$

$$\left(1-9\alpha^2\right)x^2 + 18\alpha x - 18 = 0$$

$$D < 0$$

$$(18\,\alpha)^2 + 4 \times 18\left(1-9\alpha^2\right) < 0$$

$$\Rightarrow 18\alpha^2 + 4 - 36\alpha^2 < 0 \Rightarrow 4 < 18\alpha^2$$

$$\Rightarrow \alpha^2 > \frac{2}{9} = 0.222$$

Correct ans (4)

Question: If

$$\int (\cos\, x)^{-5/2}(\sin\, x)^{-11/2}dx = \frac{p_1}{q_1}(\cot\, x)^{9/2} + \frac{p_2}{q_2}(\cot\, x)^{1/2} - \frac{p_4}{q_4}(\cot\, x)^{-3/2} + c$$

(where c is constant of integration), then value of $\frac{15p_1p_2p_3p_4}{q_1q_2q_3q_4}$ **is**

Options:
(a) 14
(b) 16
(c) 10
(d) 9
Answer: (b)

$$\int (\cos\, x)^{\frac{-5}{2}}(\sin\, x)^{\frac{-1}{2}}dx$$

$$I = \int \frac{1}{\cos^{\frac{5}{2}}x \sin^{\frac{1}{2}}x}\, dx$$

$$I = \int \frac{\text{cosec}^8 x}{\cos^{\frac{5}{2}}x} dx$$

let $\cot\, x = t$

$$-\cos\text{ec}^2 x\, dx = dt$$

$$\therefore I = -\int \frac{\left(1+t^2\right)^3}{t^{\frac{5}{2}}} dt$$

$$= -\int \frac{\left(1+t^6+3t^2+3t^4\right)dt}{t^{\frac{5}{2}}}$$

$$= -\int\left(t^{-\frac{5}{2}} + 3t^{+\frac{3}{2}} + 3t^{-\frac{1}{2}} + t^{\frac{7}{2}}\right)dt$$

$$= -\left[\frac{t^{\frac{9}{2}}}{\frac{9}{2}} + \frac{3t^{\frac{5}{2}}}{\frac{5}{2}} + \frac{3t^{\frac{1}{2}}}{\frac{1}{2}} + \frac{t^{\frac{-3}{2}}}{\frac{-3}{2}}\right]$$

$$= -\frac{2}{9}\cot^{\frac{9}{2}} x - \frac{6}{5}\cot^{\frac{5}{2}} x - 6\, \cot^{\frac{1}{2}} x + \frac{2}{3}\cot^{-\frac{3}{2}}\, x + c$$

$$\therefore \frac{p_1}{q_1} = \frac{-2}{9}, \frac{p_2}{q_2} = \frac{-6}{5}, \frac{p_3}{q_3} = -6, \frac{p_4}{q_4} = -\frac{2}{3}$$

$$\therefore \frac{15p_1p_2p_3p_4}{q_1q_2q_3q_4} = 16$$

Question: Let $6\int_1^x f(t)dt = 3xf(x) - x^3 + 4,$ **then find f(2) - f(3)**
Answer: (-3)

$x = 1$

$0 = 3f(1) + 3$

$f(1) = -1$

$6f(x) = 3f(x) + 3xf\prime(x) - 3x^2$

$\Rightarrow 3xf\prime(x) - 3f(x) - 3x^2 = 0$

$\Rightarrow x\frac{dy}{dx} - y = x^2, \; y = f(x)$

$\Rightarrow \frac{x\,dy - ydx}{x^2} = 1$

$\Rightarrow \frac{y}{x} = x + c \Rightarrow f(x) = x^2 + cx$

$f(1) = 1 + c \Rightarrow c = -2$

$f(x) = x^2 - 2x$

$f(2) - f(3) = (4 - 4) - (9 - 6)$

$= -3$