

JEE Main 2020 Paper

Date: 7th January 2020 (Shift 1)

Time: 9:30 A.M. to 12:30 P.M.

Subject: Mathematics

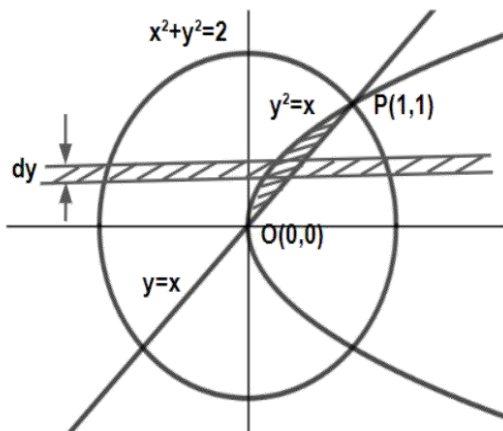
1. The area of the region enclosed by the circle $x^2 + y^2 = 2$ which is not common to the region bounded by the parabola $y^2 = x$ and the straight line $y = x$, is

- a. $\frac{1}{12}(24\pi - 1)$ b. $\frac{1}{6}(12\pi - 1)$
c. $\frac{1}{12}(6\pi - 1)$ d. $\frac{1}{12}(12\pi - 1)$

Answer: (b)

Solution:

Required area = area of the circle – area bounded by given line and parabola



$$\text{Required area} = \pi r^2 - \int_0^1 (y - y^2) dy$$

$$\text{Area} = 2\pi - \left(\frac{y^2}{2} - \frac{y^3}{3} \right)_0^1 = 2\pi - \frac{1}{6} \text{ sq. units}$$

2. If $g(x) = x^2 + x - 1$ and $(g \circ f)(x) = 4x^2 - 10x + 5$, then $f\left(\frac{5}{4}\right)$ is

- a. $\frac{1}{2}$ b. $-\frac{1}{2}$
c. $-\frac{1}{3}$ d. $\frac{1}{3}$

Answer: (b)

Solution:

$$g(x) = x^2 + x - 1$$

$$g \circ f(x) = 4x^2 - 10x + 5$$

$$g(f(x)) = 4x^2 - 10x + 5$$

$$f^2(x) + f(x) - 1 = 4x^2 - 10x + 5$$

$$\text{Putting } x = \frac{5}{4} \text{ \& } f\left(\frac{5}{4}\right) = t$$

$$t^2 + t + \frac{1}{4} = 0$$

$$t = -\frac{1}{2}$$

$$f\left(\frac{5}{4}\right) = -\frac{1}{2}$$

3. If $y = y(x)$ is the solution of the differential equation $e^y \left(\frac{dy}{dx} - 1 \right) = e^x$ such that $y(0) = 0$, then $y(1)$ is equal to

a. $\ln 2$

b. $2 + \ln 2$

c. $1 + \ln 2$

d. $3 + \ln 2$

Answer: (c)

Solution:

$$e^y(y' - 1) = e^x$$

$$\Rightarrow \frac{dy}{dx} = e^{x-y} + 1$$

$$\text{Let } x - y = t$$

$$1 - \frac{dy}{dx} = \frac{dt}{dx}$$

So, we can write

$$\Rightarrow 1 - \frac{dt}{dx} = e^t + 1$$

$$\Rightarrow -e^{-t} dt = dx$$

$$\Rightarrow e^{-t} = x + c$$

$$\Rightarrow e^{y-x} = x + c$$

$$1 = 0 + c$$

$$\Rightarrow e^{y-x} = x + 1$$

$$\text{at } x = 1$$

$$\Rightarrow e^{y-1} = 2$$

$$\Rightarrow y = 1 + \ln 2$$

4. If $y = mx + 4$ is a tangent to both the parabolas, $y^2 = 4x$ and $x^2 = 2by$, then b is equal to

a. -64

b. -32

c. -128

d. 16

Answer: (c)

Solution:

Any tangent to the parabola $y^2 = 4x$ is $y = mx + \frac{a}{m}$

Comparing it with $y = mx + 4$, we get $\frac{1}{m} = 4 \Rightarrow m = \frac{1}{4}$

Equation of tangent becomes $y = \frac{x}{4} + 4$

$y = \frac{x}{4} + 4$ is a tangent to $x^2 = 2by$

$$\Rightarrow x^2 = 2b \left(\frac{x}{4} + 4 \right)$$

$$\text{Or } 2x^2 - bx - 16b = 0,$$

$$D = 0$$

$$b^2 + 128b = 0,$$

$$\Rightarrow b = 0 \text{ (not possible),}$$

$$b = -128$$

5. If α and β are two real roots of the equation $(k + 1) \tan^2 x - \sqrt{2} \lambda \tan x = 1 - k$, where $(k \neq 1)$ and λ are real numbers. If $\tan^2(\alpha + \beta) = 50$, then value of λ is

- | | |
|-------|-------|
| a. 10 | b. 5 |
| c. 7 | d. 12 |

Answer: (a)

Solution:

$$(k + 1) \tan^2 x - \sqrt{2} \lambda \tan x = 1 - k$$

$$\tan^2(\alpha + \beta) = 50$$

Now,

$$\tan \alpha + \tan \beta = \frac{\sqrt{2} \lambda}{k + 1}, \quad \tan \alpha \tan \beta = \frac{k - 1}{k + 1}$$

$$\Rightarrow \left(\frac{\frac{\sqrt{2} \lambda}{k + 1}}{1 - \frac{k - 1}{k + 1}} \right)^2 = 50$$

$$\Rightarrow \frac{2\lambda^2}{4} = 50$$

$$\Rightarrow \lambda^2 = 100$$

$$\Rightarrow \lambda = 10$$

6. If the distance between the foci of an ellipse is 6 and the distance between its directrices is 12, then the length of its latus rectum is

- | | |
|------|----------------|
| a. 4 | b. $3\sqrt{2}$ |
| c. 9 | d. $2\sqrt{2}$ |

Answer: (b)

Solution:

Let the equation of ellipse be $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ ($a > b$)

Now $2ae = 6$ & $\frac{2a}{e} = 12$

$\Rightarrow ae = 3$ & $\frac{a}{e} = 6$

$\Rightarrow a^2 = 18$

$\Rightarrow a^2 e^2 = c^2 = a^2 - b^2 = 9$

$\Rightarrow b^2 = 9$

Length of latus rectum = $\frac{2b^2}{a} = \frac{2 \times 9}{\sqrt{18}} = 3\sqrt{2}$

7. The logical statement $(p \rightarrow q) \wedge (q \rightarrow \sim p)$ is equivalent to

a. $\sim p$

b. p

c. $p \wedge q$

d. $p \vee q$

Answer: (a)

Solution:

p	q	$p \rightarrow q$	$\sim p$	$q \rightarrow \sim p$	$(p \rightarrow q) \wedge (q \rightarrow \sim p)$
T	T	T	F	F	F
T	F	F	F	T	F
F	T	T	T	T	T
F	F	T	T	T	T

Clearly $(p \rightarrow q) \wedge (q \rightarrow \sim p)$ is equivalent to $\sim p$

8. If the system of equations

$$2x + 2ay + az = 0$$

$$2x + 3by + bz = 0$$

$$2x + 4cy + cz = 0,$$

where $a, b, c \in \mathbf{R}$ are non-zero and distinct, has non zero solution then

a. $a + b + c = 0$

b. a, b, c are in A.P

c. $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in A.P

d. a, b, c are in G.P

Answer: (c)

Solution:

$$\begin{vmatrix} 2 & 2a & a \\ 2 & 3b & b \\ 2 & 4c & c \end{vmatrix} = 0$$

$$R_2 \rightarrow R_2 - R_1, R_3 \rightarrow R_3 - R_1$$

$$\Rightarrow \begin{vmatrix} 2 & 2a & a \\ 0 & 3b - 2a & b - a \\ 0 & 4c - 2a & c - a \end{vmatrix} = 0$$

$$\Rightarrow (3b - 2a)(c - a) - (4c - 2a)(b - a) = 0$$

$$\Rightarrow 3bc - 2ac - 3ab + 2a^2 - [4bc - 4ac - 2ab + 2a^2] = 0$$

$$\Rightarrow -bc + 2ac - ab = 0$$

$$\Rightarrow ab + bc = 2ac$$

$$\Rightarrow \frac{1}{c} + \frac{1}{a} = \frac{2}{b}$$

9. 5 numbers are in A.P whose sum is 25 and product is 2520. If one of these 5 numbers is $-\frac{1}{2}$, then the greatest number amongst them is

a. $\frac{21}{2}$
c. 27

b. 16
d. 7

Answer: (b)

Solution:

Let 5 numbers be $a - 2d, a - d, a, a + d, a + 2d$

$$5a = 25$$

$$a = 5$$

$$(a - 2d)(a - d)a(a + d)(a + 2d) = 2520$$

$$(25 - 4d^2)(25 - d^2) = 504$$

$$4d^4 - 125d^2 + 121 = 0$$

$$4d^4 - 4d^2 - 121d^2 + 121 = 0$$

$$d^2 = 1 \text{ or } d^2 = \frac{121}{4}$$

$$d = \pm \frac{11}{2}$$

For $d = \frac{11}{2}$, $a + 2d$ is the greatest term, $a + 2d = 5 + 11 = 16$

10. If α is a root of the equation $x^2 + x + 1 = 0$ and $A = \frac{1}{\sqrt{3}} \begin{bmatrix} 1 & 1 & 1 \\ 1 & \alpha & \alpha^2 \\ 1 & \alpha^2 & \alpha \end{bmatrix}$ then A^{31} equal to

a. A
c. A^3

b. A^2
d. A^4

Answer: (c)

Solution:

The roots of equation $x^2 + x + 1 = 0$ are complex cube roots of unity.

$$A = \frac{1}{\sqrt{3}} \begin{bmatrix} 1 & 1 & 1 \\ 1 & \alpha & \alpha^2 \\ 1 & \alpha^2 & \alpha \end{bmatrix}$$

$$A^2 = \frac{1}{3} \begin{bmatrix} 1 & 1 & 1 \\ 1 & \alpha & \alpha^2 \\ 1 & \alpha^2 & \alpha \end{bmatrix} \begin{bmatrix} 1 & 1 & 1 \\ 1 & \alpha & \alpha^2 \\ 1 & \alpha^2 & \alpha \end{bmatrix}$$

$$A^2 = \frac{1}{3} \begin{bmatrix} 3 & 0 & 0 \\ 0 & 0 & 3 \\ 0 & 3 & 0 \end{bmatrix}$$

$$A^2 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

$$A^4 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

$$A^4 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = I$$

$$A^4 = I$$

$$A^{28} = I$$

Therefore, we get

$$A^{31} = A^{28} A^3$$

$$A^{31} = I A^3$$

$$A^{31} = A^3$$

11. Let $x^k + y^k = a^k$ where $a, k > 0$ and $\frac{dy}{dx} + \left(\frac{y}{x}\right)^{\frac{1}{3}} = 0$, then k is

a. $\frac{1}{3}$
c. $\frac{4}{3}$

b. $\frac{2}{3}$
d. 2

Answer: (b)

Solution:

$$x^k + y^k = a^k$$

$$kx^{k-1} + ky^{k-1} \frac{dy}{dx} = 0$$

$$\Rightarrow \frac{dy}{dx} = -\left(\frac{x}{y}\right)^{k-1}$$

$$\Rightarrow \frac{dy}{dx} + \left(\frac{y}{x}\right)^{1-k} = 0$$

$$\Rightarrow 1 - k = \frac{1}{3}$$

$$\Rightarrow k = \frac{2}{3}$$

12. If real part of $\left(\frac{z-1}{2z+i}\right) = 1$ where $z = x + iy$, then the point (x, y) lies on

a. straight line with slope 2

b. straight line with slope $\frac{1}{2}$

c. circle with diameter $\frac{\sqrt{5}}{2}$

d. circle with diameter $\frac{1}{2}$

Answer: (c)

Solution:

$$z = x + iy$$

$$\frac{x + iy - 1}{2x + 2iy + i} = \frac{(x-1) + iy}{2x + i(2y+1)} \left(\frac{2x - i(2y+1)}{2x - i(2y+1)} \right) = 1$$

$$\frac{2x(x-1) + y(2y+1)}{4x^2 + (2y+1)^2} = 1$$

$$2x^2 + 2y^2 - 2x + y = 4x^2 + 4y^2 + 4y + 1$$

$$x^2 + y^2 + x + \frac{3}{2}y + \frac{1}{2} = 0$$

$$\text{Circle's centre will be } \left(-\frac{1}{2}, -\frac{3}{4}\right)$$

$$\text{Radius} = \sqrt{\frac{1}{4} + \frac{9}{16} - \frac{1}{2}} = \frac{\sqrt{5}}{4}$$

$$\text{Diameter} = \frac{\sqrt{5}}{2}$$

13. If $y(\alpha) = \sqrt{\frac{2(\tan \alpha + \cot \alpha)}{1 + \tan^2 \alpha} + \frac{1}{\sin^2 \alpha}}$ where $\alpha \in \left(\frac{3\pi}{4}, \pi\right)$ then find $\frac{dy}{d\alpha}$ at $\alpha = \frac{5\pi}{6}$

a. 4

b. 2

c. 3

d. -4

Answer: (a)

Solution:

$$y(\alpha) = \sqrt{2 \frac{\tan \alpha + \cot \alpha}{1 + \tan^2 \alpha} + \frac{1}{\sin^2 \alpha}}$$

$$y(\alpha) = \sqrt{2 \frac{1}{\sin \alpha \cos \alpha \times \frac{1}{\cos^2 \alpha}} + \frac{1}{\sin^2 \alpha}}$$

$$y(\alpha) = \sqrt{2 \cot \alpha + \operatorname{cosec}^2 \alpha}$$

$$y(\alpha) = \sqrt{(1 + \cot \alpha)^2}$$

$$y(\alpha) = -1 - \cot \alpha$$

$$\frac{dy}{d\alpha} = 0 + \operatorname{cosec}^2 \alpha \Big|_{\alpha = \frac{5\pi}{6}}$$

$$\frac{dy}{d\alpha} = \operatorname{cosec}^2 \frac{5\pi}{6}$$

$$\frac{dy}{d\alpha} = 4$$

14. Find the greatest integer k for which $49^k + 1$ is a factor of the given sum
 $49^{125} + 49^{124} + \dots + 49^2 + 49 + 1$

a. 63
c. 32

b. 65
d. 60

Answer: (a)

Solution:

$$\begin{aligned} 1 + 49 + 49^2 + \dots + 49^{125} &= \frac{49^{126} - 1}{49 - 1} \\ &= \frac{(49^{63} + 1)(49^{63} - 1)}{48} \\ &= \frac{(49^{63} + 1)((1 + 48)^{63} - 1)}{48} \\ &= \frac{(49^{63} + 1)(1 + 48I - 1)}{48}; \text{ Where } I \text{ is an integer} \\ &= (49^{63} + 1)I \end{aligned}$$

Greatest positive integer is $k = 63$

15. If $A(1,1)$, $B(6,5)$, $C\left(\frac{3}{2}, 2\right)$ are the vertices of ΔABC . A point P is such that area of ΔPAB , ΔPAC and ΔPBC are equal, then find the length of the line the segment PQ , where Q is the point $\left(-\frac{7}{6}, -\frac{1}{3}\right)$

a. 2
c. 4

b. 3
d. 5

Answer: (d)

Solution:

P is the centroid which is $\equiv \left(\frac{1+6+\frac{3}{2}}{3}, \frac{1+5+2}{3} \right)$

$$P = \left(\frac{17}{6}, \frac{8}{3} \right)$$

$$Q = \left(-\frac{7}{6}, -\frac{1}{3} \right)$$

$$PQ = \sqrt{(4)^2 + (3)^2} = 5$$

16. If $\vec{a} = \alpha\hat{i} + 2\hat{j} + \beta\hat{k}$ lies in plane of $\vec{b}$ and $\vec{c}$ where $\vec{b} = \hat{i} + \hat{j}$ and $\vec{c} = \hat{i} - \hat{j} + 4\hat{k}$ and $\vec{a}$ bisects the angle between $\vec{b}$ and $\vec{c}$, then

a. $\vec{a} \cdot \hat{k} + 2 = 0$

b. $\vec{a} \cdot \hat{k} + 4 = 0$

c. $\vec{a} \cdot \hat{k} - 2 = 0$

d. $\vec{a} \cdot \hat{k} + 5 = 0$

Answer:

Solution:

More data needed to solve the question.

17. If $f(x)$ is continuous and differentiable in $x \in [-7, 0]$ and $f'(x) \leq 2 \forall x \in [-7, 0]$, also $f(-7) = -3$ then the range of $f(-1) + f(0)$ is

a. $[-5, -7]$

b. $(-\infty, 6]$

c. $(-\infty, 20]$

d. $[-5, 3]$

Answer: (c)

Solution:

$$f(-7) = -3 \text{ and } f'(x) \leq 2$$

Applying LMVT in $[-7, 0]$, we get

$$\frac{f(-7) - f(0)}{-7} = f'(c) \leq 2$$

$$\frac{-3 - f(0)}{-7} \leq 2$$

$$f(0) + 3 \leq 14$$

$$f(0) \leq 11$$

Applying LMVT in $[-7, -1]$, we get

$$\frac{f(-7) - f(-1)}{-7 + 1} = f'(c) \leq 2$$

$$\frac{-3 - f(-1)}{-6} \leq 2$$

$$f(-1) + 3 \leq 12$$

$$f(-1) \leq 9$$

$$\text{Therefore, } f(-1) + f(0) \leq 20$$

18. Find the image of the point (2,1,6) in the plane containing the points (2,1,0), (6,3,3) and (5,2,2)

a. (6, 5, -2)

b. (6, -5, 2)

c. (2, -3, 4)

d. (2, -5, 6)

Answer: (a)

Solution:

Points A(2,1,0), B(6,3,3) C(5,2,2)

$$\overrightarrow{AB} = (4, 2, 3)$$

$$\overrightarrow{AC} = (3, 1, 2)$$

$$\vec{n} = \overrightarrow{AB} \times \overrightarrow{AC} = (1, 1, -2)$$

$$\text{Equation of the plane is } x + y - 2z = 3 \dots (1)$$

Let the image of point (2,1,6) is (l, m, n)

$$\frac{l-2}{1} = \frac{m-1}{1} = \frac{n-6}{-2} = \frac{-2(-12)}{6} = 4$$

$$\Rightarrow l = 6, m = 5, n = -2$$

Hence the image of R in the plane P is (6, 5, -2)

19. If sum of all the coefficients of even powers in

$(1 - x + x^2 - x^3 \dots + x^{2n})(1 + x + x^2 + x^3 \dots + x^{2n})$ is 61 then n is equal to

a. 30

b. 32

c. 28

d. 36

Answer: (a)

Solution:

$$\text{Let } (1 + x + x^2 + \dots + x^{2n})(1 - x + x^2 + \dots + x^{2n}) = a_0 + a_1x + a_2x^2 + \dots$$

$$\text{Put } x = 1$$

$$2n + 1 = a_0 + a_1 + a_2 + a_3 + \dots \dots \dots (1)$$

$$\text{Put } x = -1$$

$$2n + 1 = a_0 - a_1 + a_2 - a_3 + \dots \dots \dots (2)$$

Add (1) and (2)

$$2(2n + 1) = 2(a_0 + a_2 + a_4 + \dots \dots \dots$$

$$2n + 1 = 61$$

$$n = 30$$

20. An unbiased coin is tossed 5 times. Suppose that a variable X is assigned the value k when k consecutive heads are obtained for $k = 3, 4, 5$, otherwise X takes the value -1 . The expected value of X is

a. $\frac{1}{8}$

b. $-\frac{1}{8}$

c. $\frac{3}{8}$

d. $-\frac{3}{8}$

Answer: (a)

Solution:

k = no. of consecutive heads

$$P(k = 3) = \frac{5}{32} \text{ (HHHHT, HHHHT, THHHT, HTHHH, TTHHH)}$$

$$P(k = 4) = \frac{2}{32} \text{ (HHHHHT, HHHHHT)}$$

$$P(k = 5) = \frac{1}{32} \text{ (HHHHHH)}$$

$$P(\bar{3} \cap \bar{4} \cap \bar{5}) = 1 - \left(\frac{5}{32} + \frac{2}{32} + \frac{1}{32} \right) = \frac{24}{32}$$

$$\sum XP(X) = \left(-1 \times \frac{24}{32} \right) + \left(3 \times \frac{5}{32} \right) + \left(4 \times \frac{2}{32} \right) + \left(5 \times \frac{1}{32} \right) = \frac{1}{8}$$

21. Given $f(a + b + 1 - x) = f(x) \forall x \in \mathbf{R}$ then the value of $\frac{1}{(a+b)} \int_a^b x(f(x) + f(x+1)) dx$ is equal to

a. $\int_{a+1}^{b+1} f(x) dx$

b. $\int_{a+1}^{b+1} f(x+1) dx$

c. $\int_{a-1}^{b-1} f(x) dx$

d. $\int_{a-1}^{b-1} f(x+1) dx$

Answer: (d)

Solution:

$$f(a + b + 1 - x) = f(x) \quad (1)$$

$$x \rightarrow x + 1$$

$$f(a + b - x) = f(x + 1) \quad (2)$$

$$I = \frac{1}{a+b} \int_a^b x(f(x) + f(x+1)) dx \quad (3)$$

From (1) and (2)

$$I = \frac{1}{a+b} \int_a^b (a + b - x)(f(x+1) + f(x)) dx \quad (4)$$

Adding (3) and (4)

$$2I = \int_a^b (f(x) + f(x+1)) dx$$

$$2I = \int_a^b f(x+1) dx + \int_a^b f(x) dx$$

$$2I = \int_a^b f(a+b-x+1)dx + \int_a^b f(x)dx$$

$$2I = 2 \int_a^b f(x)dx$$

$$I = \int_a^b f(x)dx \quad ; \quad x = t+1, dx = dt$$

$$I = \int_{a-1}^{b-1} f(t+1)dt$$

$$I = \int_{a-1}^{b-1} f(x+1)dx$$

22. Total number of six-digit numbers in which only and all the five digits 1,3,5,7 and 9 appear, is _____.

Answer: (1800)

Solution:

Selecting all 5 digits = ${}^5C_5 = 1$ way

Now, we need to select one more digit to make it a 6 digit number = ${}^5C_1 = 5$ ways

Total number of permutations = $\frac{6!}{2!}$

Total numbers = ${}^5C_5 \times {}^5C_1 \times \frac{6!}{2!} = 1800$

23. Evaluate $\lim_{x \rightarrow 2} \frac{3^x + 3^{x-1} - 12}{\frac{-x}{3^{\frac{x}{2}} - 3^{1-x}}}$

Answer: (72)

Solution:

$$\lim_{x \rightarrow 2} \frac{3^x + \frac{3^x}{3} - 12}{\frac{\frac{1}{x}}{\frac{1}{3^{\frac{x}{2}}} + \frac{3}{3^x}}}$$

$$\lim_{x \rightarrow 2} \frac{\frac{4}{3}3^x - 12}{\frac{\frac{1}{x}}{\frac{1}{3^{\frac{x}{2}}} + \frac{3}{3^x}}}$$

Put $3^{\frac{x}{2}} = t$

$$\lim_{t \rightarrow 3} \frac{\frac{4t^2}{3} - 12}{-\frac{3}{t^2} + \frac{1}{t}} = \lim_{t \rightarrow 3} \frac{4(t^2 - 9)t^2}{3(-3 + t)} = \lim_{t \rightarrow 3} \frac{4t^2(3+t)}{3} = \frac{4 \times 9 \times 6}{3} = 72$$

24. If variance of first N natural numbers is 10 and variance of first M even natural numbers is 16 then the value of $M + N$ is _____.

Answer: (18)

Solution:

For N Natural number variance

$$\sigma^2 = \frac{\sum x_i^2}{N} - \left(\frac{\sum x_i}{N} \right)^2$$

$$\frac{\sum x_i^2}{N} = \frac{1^2 + 2^2 + 3^2 + \dots + N \text{ term}}{N} = \frac{N(N+1)(2N+1)}{6N}$$

$$\frac{\sum x_i}{N} = \frac{1+2+3+\dots+N \text{ terms}}{N} = \frac{N(N+1)}{2N}$$

$$\sigma^2 = \frac{N^2 - 1}{12} = 10 \text{ (given)}$$

$$\Rightarrow N = 11$$

$$\text{Variance of } (2, 4, 6 \dots) = 4 \times \text{variance of } (1, 2, 3, 4 \dots) = 4 \times \frac{M^2 - 1}{12} = \frac{M^2 - 1}{3} = 16 \text{ (given)}$$

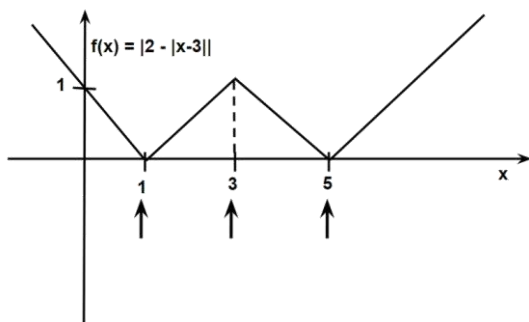
$$\Rightarrow M = 7$$

$$\text{Therefore, } N + M = 11 + 7 = 18$$

25. If $f(x) = |2 - |x - 3||$ is non-differentiable in $x \in S$. Then, the value of $\sum_{x \in S} (f(f(x)))$ is _____.

Answer: (3)

Solution:



There will be three points $x = 1, 3, 5$ at which $f(x)$ is non-differentiable.

$$\text{So } f(f(1)) + f(f(3)) + f(f(5))$$

$$= f(0) + f(2) + f(0)$$

$$= 1 + 1 + 1$$

$$= 3$$