वर्ष-2023

माध्यमिक शिक्षा मण्डल, मध्यप्रदेश, भोपाल

32 पृष्ठीय

परीक्षार्थी द्वारा भरा जावे

परीक्षा का विषय	विषय कोड			परीक्षा का माध्यम
MATHEMATICS	1	5	0	ENGLISH

स्टीकर तीर के निशान से मिलाकर लगायें

पुस्तिका का क्रमांक C-23 0159348

परीक्षार्थी का रोल नम्बर

अंकों में

2	3	4	4	3	7	3	6	0	

शब्दों में

TWO	THREE	FOUR	FOUR	THREE	SEVEN	THREE	SIX	ZERO	

नीचे दिये गये उदाहरण अनुसार रोल नम्बर भरें।

परीक्षार्थी द्वारा भरा जावे

प्रश्न पत्र का सेट D

केन्द्राध्यक्ष/सहायक केन्द्राध्यक्ष एवं पर्यवेक्षक द्वारा भरा जावे

क :– परीक्षार्थी का कक्ष क्रमांक 20

ख:– परीक्षा का दिनांक 21 | 03 | 2023

परीक्षा का नाम एवं परीक्षा केन्द्र क्रमांक की मुद्रा

HSSC EXAM C.No.-442199

पर्यवेक्षक का नाम एवं हस्ताक्षर	केन्द्राध्यक्ष/सहायक केन्द्राध्यक्ष के हस्ताक्षर
G. L.	

परीक्षक एवं उपमुख्य परीक्षक द्वारा भरा जावे

प्रमाणित किया जाता है कि होलो क्राफ्ट स्टीकर क्षतिग्रस्त नहीं पाया गया तथा अन्दर के पृष्ठों के अनुरूप मुख्य पृष्ठ पर अंकों की प्रविष्टी एवं अंकों का योग सही है।

निर्धारित मुद्रा : नाम, पदनाम, मोबाईल नम्बर, परीक्षक क्रमांक एवं पदांकित संस्था के नाम की मुद्रा लगाएं।

उप मुख्य परीक्षक के हस्ताक्षर एवं निर्धारित मुद्रा	परीक्षक के हस्ताक्षर एवं निर्धारित मुद्रा
658	M. Jain GHSS Rajoua UMS

केवल परीक्षक द्वारा भरा जावे।

प्रश्न क्रमांक के सम्मुख प्राप्तांकों की प्रविष्टी करें।

प्रश्न क्रमांक	पृष्ठ क्रमांक	प्राप्तांक (अंकों में)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
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20		
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23		
24		
25		
26		
27		
28		

कुल ... में | कुल प्राप्तांक अंकों में

Solution of Question = 6 ~~(ext)~~

Sol Given that:-

Direction Ratio's of line are −18, 12, −4

i.e. $a = -18,\ b = 12,\ c = -4$ —①

Now, According to question

Direction cosines of a line = ? i.e.

$l, m, n = ?$

Now,

$\sqrt{a^2+b^2+c^2} = \sqrt{(-18)^2+(12)^2+(-4)^2}$

$\Rightarrow \sqrt{a^2+b^2+c^2} = \sqrt{324+144+16}$

$\Rightarrow \sqrt{a^2+b^2+c^2} = \sqrt{484}$

$\Rightarrow \sqrt{a^2+b^2+c^2} = 22$ —②

We know:-

$l = \dfrac{a}{\sqrt{a^2+b^2+c^2}},\quad m = \dfrac{b}{\sqrt{a^2+b^2+c^2}},\quad n = \dfrac{c}{\sqrt{a^2+b^2+c^2}}$

$\Rightarrow l = \dfrac{-18}{22},\quad m = \dfrac{12}{22},\quad n = \dfrac{-4}{22}$

[From eq ① & ②]

$\Rightarrow l = \dfrac{-9}{11},\quad m = \dfrac{6}{11},\quad n = \dfrac{-2}{11}$

Hence, Direction cosine of a line is $\left(\dfrac{-9}{11}, \dfrac{6}{11}, \dfrac{-2}{11}\right)$

Ans

Solution of Question = 7 (or)

Sol Given that :-

$f(x) = x^2 - 4x + 6$ —(1)

To find interval in which function is decreasing

On differentiating eq(1) with respect to 'x'

$f'(x) = \frac{d}{dx}(x^2 - 4x + 6)$

$\Rightarrow f'(x) = \frac{d}{dx}x^2 - \frac{d}{dx}4x \pm \frac{d}{dx}6$ $\left[\because \frac{d}{dx}f_1(x) \pm f_2(x) = \frac{d}{dx}f_1(x) \pm \frac{d}{dx}f_2(x)\right]$

$\Rightarrow f'(x) = 2x - 4 + 0$ $\left[\because \frac{d}{dx}x^n = nx^{n-1}, \frac{d}{dx}(\text{constant}) = 0\right]$

$\Rightarrow f'(x) = 2x - 4$

Now, on putting $f'(x) = 0$

$\Rightarrow 0 = 2x - 4$

$\Rightarrow 4 = 2x$

$\Rightarrow 2 = x$

$x = 2$ divides real number in two disjoint interval namely $(-\infty, 2)$ and $(2, \infty)$

Test Table

Interval	Test Value	sign of $f'(x)$	Nature of $f(x)$
$(-\infty, 2)$	1	$(-)$	Decreasing
$(2, \infty)$	3	$(+)$	Increasing

Hence, In interval $(-\infty, 2)$, $f'(x) < 0$, so, $f(x)$ is decreasing in the interval $\boxed{(-\infty, 2)}$ **Ans**

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Solution of Question = 8

Sol

Given that :-

$A = \{1, 2, 3\}$, $B = \{4, 5, 6, 7\}$, $f = \{(1,4), (2,5), (3,6)\}$

To show :-

f is one-one

Showing :-

Here :-

$f(1) = 4$, $f(2) = 5$, $f(3) = 6$

$\because$ Image of all distinct element of A is distinct. So, by definition of one-one

$\therefore$ It is one-one.

Hence Proved :-

f is one-one Ans

Solution of Question = 9 (or)

Sol

To Prove :-

$\sin^{-1}x + \cos^{-1}x = \frac{\pi}{2}$; $x \in [-1, 1]$

Proof :-

Let -

$x = \sin\theta$ — (1)

$\Rightarrow x = \cos\left[\frac{\pi}{2} - \theta\right]$ $\left[\because \sin x = \cos\left(\frac{\pi}{2} - x\right)\right]$

$\Rightarrow \cos^{-1}x = \frac{\pi}{2} - \theta$

$\Rightarrow \cos^{-1}x + \theta = \frac{\pi}{2}$

$\Rightarrow \cos^{-1}x + \sin^{-1}x = \frac{\pi}{2}$ $\left[\because x = \sin\theta \text{ (From eq (1))} \Rightarrow \sin^{-1}x = \theta\right]$

Hence Proved :-

$$\boxed{\sin^{-1}x + \cos^{-1}x = \frac{\pi}{2}}$$ Ans

Solution of Question = 10

Sol. $A = \begin{bmatrix} -2 & 3 \\ 1 & 2 \end{bmatrix}$, $B = \begin{bmatrix} -1 & 0 \\ 1 & 2 \end{bmatrix}$ (given)

According to question :-

$(A+B)' = ?$

Now,

$$A+B = \begin{bmatrix} -2 & 3 \\ 1 & 2 \end{bmatrix} + \begin{bmatrix} -1 & 0 \\ 1 & 2 \end{bmatrix}$$

$$\Rightarrow A+B = \begin{bmatrix} -2+(-1) & 3+0 \\ 1+1 & 2+2 \end{bmatrix}$$

$$\Rightarrow A+B = \begin{bmatrix} -3 & 3 \\ 2 & 4 \end{bmatrix}$$

Now,

$$(A+B)' = \begin{bmatrix} -3 & 3 \\ 2 & 4 \end{bmatrix}'$$

$$\Rightarrow (A+B)' = \begin{bmatrix} -3 & 2 \\ 3 & 4 \end{bmatrix}$$

Hence

$$\boxed{(A+B)' = \begin{bmatrix} -3 & 2 \\ 3 & 4 \end{bmatrix}}$$ Ans

Solution of Question = 11

Sol. Let $y = x^x$

According to question

$\frac{dy}{dx} = ?$

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Now, on taking log both side in $y = x^x$

$\Rightarrow \log y = \log x^x$

$\Rightarrow \log y = x \log x \qquad [\because \log m^n = n \log m]$

On differentiating both side with respect to x

$\Rightarrow \frac{d}{dx} \log y = \frac{d}{dx} x \log x$

$\Rightarrow \frac{1}{y}\frac{dy}{dx} = x \frac{d}{dx} \log x + \log x \frac{dx}{dx}$

$\left[\because \frac{d}{dx} \log x = \frac{1}{x},\ \frac{d}{dx}(f_1(x) \cdot f_2(x)) = f_1(x) \frac{d}{dx} f_2(x) + f_2(x) \frac{d}{dx} f_1(x)\right]$

$\Rightarrow \frac{1}{y}\frac{dy}{dx} = x\left(\frac{1}{x}\right) + \log x (1) \quad \left[\because \frac{d}{dx} \log x = \frac{1}{x},\ \frac{dx}{dx} = 1\right]$

$\Rightarrow \frac{dy}{dx} = [1 + \log x] y$

$\Rightarrow \frac{dy}{dx} = [1 + \log x] x^x \qquad [\because y = x^x]$

Hence :-

$\frac{d}{dx} x^x = \boxed{[1 + \log x] x^x}$ Ans

Solution of Question = 12.

Sol Given that :

$f(x) = 12x - 3$

To show :-

$f(x)$ is increasing on R

Showing :-

Let $x_1, x_2 \in R$ such that

$x_1 < x_2$

$\Rightarrow 12x_1 < 12x_2$ [On multiplying (12) both side]

$\Rightarrow 12x_1 - 3 < 12x_2 - 3$ [On subtracting (3) both side]

$\Rightarrow f(x_1) < f(x_2)$ [$\because f(x) = 12x - 3$]

Here,

$x_1 < x_2 \Rightarrow f(x_1) < f(x_2)$

So, by definition of increasing function

We can conclude that:-

$f(x) = 12x - 3$ is increasing on R Ans

Solution of Question = 13.

Sol Let :-

$$I = \int_{-1}^{1} \sin^5(x) \cos^4 x \, dx \quad -(1)$$

$I = ?$ (According to question)

Here, Let :-

$f(x) = \sin^5 x \cos^4(x)$

Now, consider the value of $f(x)$ at $(-x)$

$\Rightarrow f(-x) = \sin^5(-x) \cos^4(-x)$

$\Rightarrow f(-x) = (-\sin(x))^5 \cos^4(x)$ $\left[\because \begin{array}{l} \sin(-x) = -\sin x, \\ \cos(-x) = \cos x \end{array}\right]$

$\Rightarrow f(-x) = -\sin^5 x \cos^4 x$

$\Rightarrow f(-x) = -f(x)$

Hence, $f(x)$ is an odd function

On taking eq (1)

$I = \int_{-1}^{1} \sin^5(x) \cos^4 x \, dx$

$\Rightarrow I = 0$ [$\because \int_{-a}^{a} f(x)dx = 0$ if $f(x)$ is an odd function]

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Hence,

$$\boxed{\int_{-1}^{1} \sin^5 x \cos^4 x \, dx = 0}$$ Ans

Solution of Question = 14

Sol Given that :-

$\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = 2\hat{i} + \hat{k}$

Now,

Projection of vector $\vec{a}$ on the vector $\vec{b}$ = ?

We know :-

Projection of vector $\vec{a}$ on the vector $\vec{b} = \frac{\vec{a} \cdot \vec{b}}{|\vec{b}|}$

$$= \frac{(\hat{i} + 2\hat{j} + 3\hat{k}) \cdot (2\hat{i} + \hat{k})}{\sqrt{(2)^2 + (1)^2}}$$

[$\because$ $\vec{a}$ & $\vec{b}$ are given $|\vec{r}| = \sqrt{a^2 + b^2 + c^2}$]

$$= \frac{(1)(2) + (2)(0) + (3)(1)}{\sqrt{4+1}}$$

[$\because$ $\vec{a} \cdot \vec{b} = a_1 b_1 + a_2 b_2 + a_3 b_3$]

$$= \frac{2 + 0 + 3}{\sqrt{5}}$$

$$= \frac{5}{\sqrt{5}}$$

$$= \sqrt{5}.$$

Hence,

Projection of $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$ on the vector $\vec{b} = 2\hat{i} + \hat{k}$ is $\boxed{\sqrt{5}}$ Ans

Solution of Question = 15 (Or)

Sol

$x = ?$ when $x(\hat{i}+\hat{j}+\hat{k})$ is a unit vector

Let $\vec{r} = x(\hat{i}+\hat{j}+\hat{k})$

Now,

$|\vec{r}| = \sqrt{(x)^2+(x)^2+(x)^2}$ $\left[\because |\vec{a}| = \sqrt{(a_1)^2+(a_2)^2+(a_3)^2}\right]$

$\Rightarrow 1 = \sqrt{x^2+x^2+x^2}$ $\left[\because \vec{r}\right.$ is a unit vector i.e $\left.|\vec{r}|=1\right]$

$\Rightarrow 1 = \sqrt{3x^2}$

$\Rightarrow 1 = \pm x\sqrt{3}$

$\Rightarrow \frac{\pm 1}{\sqrt{3}} = x$

Hence, $\boxed{x = \frac{\pm 1}{\sqrt{3}}}$ for which $\vec{r}$ is a unit vector

Ans

Solution of Question = 16 (Or)

Sol

Given that :-

$$\frac{dy}{dx} = \frac{1+y^2}{1+x^2} \quad —①$$

To find general solution of differential equation

Now,

On separating variables in eq ①

$$\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$$

$$\Rightarrow \frac{dy}{1+y^2} = \frac{dx}{1+x^2}$$

On integrating both side

$$\Rightarrow \int \frac{1}{1+y^2}\,dy = \int \frac{1}{1+x^2}\,dx$$

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$\Rightarrow \tan^{-1}y = \tan^{-1}x + c \quad [\because \int \frac{dx}{1+x^2} = \tan^{-1}x, \; c \text{ is a constant}]$

$\Rightarrow \tan^{-1}y - \tan^{-1}x = c$

Hence,

General solution of $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$ is

$\tan^{-1}y - \tan^{-1}x = c$ Ans

Solution of Question =18

Sol: Let

E : Event that the number drawn is more than 3

F : Event that the number drawn is even

Now,

$S = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

$\Rightarrow n(S) = 10$

$E = \{4, 5, 6, 7, 8, 9, 10\}$

$\Rightarrow n(E) = 7$

$P(E) = \frac{n(E)}{n(S)}$

$\Rightarrow P(E) = \frac{7}{10}$ — (1)

Now

$F = \{2, 4, 6, 8, 10\}$

$\Rightarrow n(F) = 5$

$P(F) = \frac{n(F)}{n(S)}$

$\Rightarrow P(F) = \frac{5}{10}$

Now,

$E \cap F = \{4, 5, 6, 7, 8, 9, 10\} \cap \{2, 4, 6, 8, 10\}$

$\Rightarrow E \cap F = \{4, 6, 8, 10\}$

$\Rightarrow n(E \cap F) = 4$

$P(E \cap F) = \frac{n(E \cap F)}{n(S)}$

$\Rightarrow P(E \cap F) = \frac{4}{10}$ — (2)

Now, According to question :-

We have to find the Probability of an even number when it is given that number drawn is more than 3 i.e.

$P\left(\frac{F}{E}\right) = ?$

Now, We know :-

$P\left(\frac{F}{E}\right) = \frac{P(E \cap F)}{P(E)}$

$\Rightarrow P\left(\frac{F}{E}\right) = \frac{4/10}{7/10}$ [From eq (1) & (2)]

$\Rightarrow P\left(\frac{F}{E}\right) = \frac{4}{7}$

Hence,

Probability of an even number when it is know that drawn card is more than 3 is

$\frac{4}{7}$ Ans

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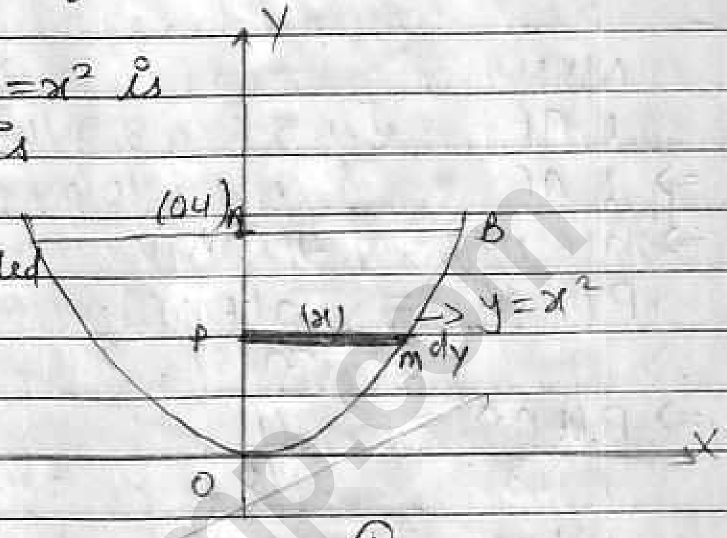
Solution of Question = 19

Sol The given curve $y=x^2$ is parabola which is symmetric about Y-axis and bounded by $y=4$



We have :-

$y = x^2$

$\Rightarrow \sqrt{y} = x$ —(1)

B S E

Now,

Take a small strip PM

Area of a small strip $= |x|\, dy$

Now,

Required area $= 2 \times$ Area of OABO

$= 2 \times \int_0^4 |x|\, dy$

$= 2 \int_0^4 \sqrt{y}\, dy$ [from eq(1)]

$= 2 \cdot 2 \left[\frac{y}{3}\right]^{3/2}\Big|_0^4$ $\left[\because \int x^n dx = \frac{x^{n+1}}{n+1}\right]$

$\cancel{= \frac{4}{3}\left[(4)^{3/2} - (0)^{3/2}\right]}$

$= \frac{4}{3}\left[(4)^{3/2} - (0)^{3/2}\right]$

$\left[\because [F(x)]_a^b = F(b) - F(a)\right]$

$$= \frac{4}{3}[4 \cdot 2 - 0]$$

$$= \frac{4 \cdot 8}{3}$$

$$= \frac{32}{3}$$

$\Rightarrow$ Required Area $= \frac{32}{3}$ sq. unit.

Hence, Area of the region bounded by the ...rve $y = x^2$ and the line $y = 4$ is $\boxed{\frac{32}{3} \text{ sq. unit}}$ Ans

Solution of Question = 20 (Or)

Sol

Given that :-

$\vec{r} = \hat{i} + 2\hat{j} - 4\hat{k} + \lambda(2\hat{i} + 3\hat{j} + 6\hat{k})$ — ①

$\vec{r} = 3\hat{i} + 3\hat{j} - 5\hat{k} + \mu(2\hat{i} + 3\hat{j} + 6\hat{k})$ — ②

$\because$ Both the lines are parallel to $2\hat{i} + 3\hat{j} + 6\hat{k}$

so, both the lines are also parallel

According to question :-

Shortest distance between parallel lines (d) = ?

Now, On comparing eq ① & ② with standard form :-

$\vec{r} = \vec{a}_1 + \lambda(\vec{b})$ and $\vec{r} = \vec{a}_2 + \mu(\vec{b})$

$\vec{a}_1 = \hat{i} + 2\hat{j} - 4\hat{k}$, $\vec{a}_2 = 3\hat{i} + 3\hat{j} - 5\hat{k}$

$\vec{b} = 2\hat{i} + 3\hat{j} + 6\hat{k}$

Now,

$\vec{a}_2 - \vec{a}_1 = (3\hat{i} + 3\hat{j} - 5\hat{k}) - (\hat{i} + 2\hat{j} - 4\hat{k})$

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$$\Rightarrow \vec{a}_2 - \vec{a}_1 = 3\hat{i} + 3\hat{j} - 5\hat{k} - \hat{i} - 2\hat{j} + 4\hat{k}$$

$$\Rightarrow \vec{a}_2 - \vec{a}_1 = 3\hat{i} - \hat{i} + 3\hat{j} - 2\hat{j} - 5\hat{k} + 4\hat{k}$$

$$\Rightarrow \vec{a}_2 - \vec{a}_1 = 2\hat{i} + \hat{j} - \hat{k}$$

We know :-
Shortest distance between two parallel line (d) $= \left| \dfrac{\vec{b} \times (\vec{a}_2 - \vec{a}_1)}{|\vec{b}|} \right|$

$$\Rightarrow d = \left| \frac{(2\hat{i} + 3\hat{j} + 6\hat{k}) \times (2\hat{i} + \hat{j} - \hat{k})}{\sqrt{(2)^2 + (3)^2 + (6)^2}} \right|$$

$$\left[\because \vec{b} = 2\hat{i} + 3\hat{j} + 6\hat{k},\ \vec{a}_2 - \vec{a}_1 = 2\hat{i} + \hat{j} - \hat{k},\ |\vec{r}| = \sqrt{a^2 + b^2 + c^2} \right]$$

$$\Rightarrow d = \left| \frac{\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & 6 \\ 2 & 1 & -1 \end{vmatrix}}{\sqrt{4 + 9 + 36}} \right| \quad \left[\because \vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix} \right]$$

$$\Rightarrow d = \left| \frac{\hat{i}(-3-6) - \hat{j}(-2-12) + \hat{k}(2-6)}{\sqrt{49}} \right| \quad \cancel{\sqrt{49}}$$

$$\Rightarrow d = \left| \frac{\hat{i}(-9) - \hat{j}(-14) + \hat{k}(-4)}{7} \right|$$

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$$\Rightarrow d = \left| \frac{-9\hat{i} + 14\hat{j} - 4\hat{k}}{7} \right|$$

$$\Rightarrow d = \frac{\sqrt{(9)^2 + (14)^2 + (-4)^2}}{7} \qquad \left[\because |\vec{r}| = \sqrt{a^2+b^2+c^2}\right]$$

$$\Rightarrow d = \frac{\sqrt{81+196+16}}{7}$$

$$\Rightarrow d = \frac{\sqrt{293}}{7}$$

Hence,
shortest distance between parallel lines is $\boxed{\frac{\sqrt{293}}{7} \text{ unit}}$ Ans

BSE

Solution of Question = 21 (Or)

Sol To Prove :-

$$\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$$

Let $\Delta = \begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix}$

On applying $R_1 \rightarrow R_1 + (R_2 + R_3)$

$$\Rightarrow \Delta = \begin{vmatrix} a-b-c+2b+2c & 2a+b-c-a+2c & 2a+2b+c-a-b \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix}$$

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$$\Rightarrow \Delta = \begin{vmatrix} a+b+c & a+b+c & a+b+c \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix}$$

$$\Rightarrow \Delta = (a+b+c)\begin{vmatrix} 1 & 1 & 1 \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix}$$ [On taking common $(a+b+c)$ from R_1]

$$\Rightarrow \Delta = (a+b+c)\begin{vmatrix} 1-1 & 1-1 & 1 \\ 2b-2b & b-c-a-2b & 2b \\ 2c-(c-a-b) & 2c-(c-a-b) & c-a-b \end{vmatrix}$$ [On applying $C_1 \to C_1 - C_3$ & $C_2 \to C_2 - C_3$]

$$\Rightarrow \Delta = (a+b+c)\begin{vmatrix} 0 & 0 & 1 \\ 0 & -(a+b+c) & 2b \\ 2c-c+a+b & 2c-c+a+b & c-a-b \end{vmatrix}$$

$$\Rightarrow \Delta = (a+b+c)\begin{vmatrix} 0 & 0 & 1 \\ 0 & -(a+b+c) & 2b \\ c+a+b & a+b+c & c-a-b \end{vmatrix}$$

On taking common $(a+b+c)$ from C_1 and C_2

$$\Rightarrow \Delta = (a+b+c)(a+b+c)(a+b+c)\begin{vmatrix} 0 & 0 & 1 \\ 0 & -1 & 2b \\ 1 & 1 & c-a-b \end{vmatrix}$$

On expanding along R_1

$$\Rightarrow \Delta = (a+b+c)^3 \left\{0\begin{vmatrix} -1 & 2b \\ 1 & c-a-b \end{vmatrix} - 0\begin{vmatrix} 0 & 2b \\ 1 & c-a-b \end{vmatrix} + 1\begin{vmatrix} 0 & -1 \\ 1 & 1 \end{vmatrix}\right\}$$

$$\Rightarrow \Delta = (a+b+c)^3\left(0 - 0 + 1\left(0(1) - (-1)(1)\right)\right)$$

$$\Rightarrow \Delta = (a+b+c)^3\left(1(1)\right)$$

$\Rightarrow \Delta = (a+b+c)^3$

Hence Proved :-

$$\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$$

Ans

Solution of Question = 22 (Or)

Sol Let $y = \sin x^2$, $w = x^2$

~~On differentiating both side with respect x^2~~

According to question :-

Differentiation of $\sin(x^2)$ with respect to (x^2)

= ? i.e.

$\frac{dy}{dw} = ?$

On differentiating y with respect to 'x'

$\frac{dy}{dx} = \frac{d}{dx}\sin x^2$

$\Rightarrow \frac{dy}{dx} = \cos x^2 \frac{d}{dx} x^2$ $\left[\because \frac{d}{dx}\sin x = \cos x\right]$

$\Rightarrow \frac{dy}{dx} = \cos x^2 \cdot 2x$ $\left[\because \frac{d}{dx} x^n = n x^{n-1}\right]$

$\Rightarrow \frac{dy}{dx} = 2x \cos x^2$ —— (1)

Now,

On differentiating 'w' with respect to 'x'

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$$\frac{dw}{dx} = \frac{d}{dx} x^2$$

$$\Rightarrow \frac{dw}{dx} = 2x \quad \text{—②} \quad \left[\because \frac{d}{dx} x^n = nx^{n-1}\right]$$

Now, dividing eq ① by eq ②

$$\frac{\frac{dy}{dx}}{\frac{dw}{dx}} = \frac{2x\cos(x^2)}{2x}$$

$$\Rightarrow \frac{dy}{dw} = \cos(x^2)$$

Hence,
Differentiation of $\sin(x^2)$ with respect to x^2 is $\boxed{\cos(x^2)}$

Ans

Solution of Question = 23 ~~(b)~~

Sol Let :-

$$\cancel{I = \int_0^{\pi/2} \cos^5 x}$$

$$I = \int_0^{\pi} \frac{x \sin x}{1+\cos^2 x}\, dx \quad \text{—①}$$

Now,
According to question :-
$I = ?$

$$I = \int_0^{\pi} \frac{x \sin x}{1+\cos^2 x}\, dx$$

$$\Rightarrow I = \int_0^{\pi} \frac{(\pi - x)\sin(\pi - x)}{1+\cos^2(\pi - x)}\, dx \quad \left[\because \int_0^a f(x)dx = \int_0^a f(a-x)\,dx\right]$$

$$\Rightarrow I = \int_0^{\pi} \frac{(\pi - x)\sin x}{1+\cos^2(-x)}\, dx \quad \left[\because \begin{array}{l} \sin(\pi - x) = \sin x, \\ \cos(\pi - x) = -\cos x \end{array}\right]$$

$$\Rightarrow I = \int_0^{\pi} \frac{(\pi - x)\sin x}{1+\cos^2 x}\, dx \quad \text{—(2)}$$

On adding eq (1) & (2)

$$\Rightarrow I + I = \int_0^{\pi} \frac{(\pi - x)\sin x}{1+\cos^2 x}\, dx + \int_0^{\pi} \frac{x \sin x}{1+\cos^2 x}\, dx$$

$$\Rightarrow 2I = \int_0^{\pi} \frac{\pi \sin x - x\sin x + x \sin x}{1+\cos^2 x}\, dx \quad \left[\because \int f_1(x)dx + \int f_2(x)dx = \int [f_1(x) + f_2(x)]dx\right]$$

$$\Rightarrow 2I = \int_0^{\pi} \frac{\pi \sin x}{1+\cos^2 x} \quad \text{—(3)}$$

Now,

Let $\cos x = t$

$\Rightarrow -\sin x\, dx = dt$

$\Rightarrow \sin x\, dx = -dt$

If $x = \pi$, then

$\cos \pi = t$

$\Rightarrow -1 = t \quad [\because \cos \pi = -1]$

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And if $x = 0$

then, $\cos(0) = t$

$\Rightarrow \quad 1 = t \qquad [\because \cos 0 = 1]$

On using $\sin x\, dx = -dt$, $t = -1$ and $t = 1$ in eq (3)

$$\Rightarrow 2I = \pi \int_{1}^{-1} \frac{-dt}{1+t^2}$$

$$\Rightarrow 2I = -\pi \int_{1}^{-1} \frac{dt}{1+t^2}$$

$$\Rightarrow 2I = -\pi \left[\tan^{-1}(t)\right]_{1}^{-1} \qquad \left[\because \int \frac{dx}{1+x^2} = \tan^{-1}x\right]$$

$$\Rightarrow 2I = -\pi\left[\tan^{-1}(-1) - \tan^{-1}(1)\right] \qquad \left[\because [F(x)]_a^b = F(b) - F(a)\right]$$

$$\Rightarrow 2I = -\pi\left[-\tan^{-1}(1) - \tan^{-1}(1)\right] \qquad \left[\because \tan^{-1}(-x) = -\tan^{-1}x\right]$$

$$\Rightarrow 2I = -\pi\left[-\frac{\pi}{4} - \frac{\pi}{4}\right] \qquad \left[\because \tan^{-1}(1) = \frac{\pi}{4}\right]$$

$$\Rightarrow 2I = -\pi\left[-\frac{\pi}{2}\right]$$

$$\Rightarrow 2I = \frac{\pi^2}{2}$$

$$\Rightarrow 2I = \frac{\pi^2}{2}$$

$$\Rightarrow I = \frac{\pi^2}{4}$$

Hence,

$$\boxed{\int_0^{\pi} \frac{x \sin x}{1+\cos^2 x}\, dx = \frac{\pi^2}{4}}$$ Ans

Answer of Question = 1
Choose the correct Option

(i) (b) $25|A|$

(ii) (c) Not Defined

(iii) (b) ± 6

(iv) (a) f is one-one onto

(v) (b) $-\frac{\pi}{3}$

(vi) (b) $\frac{\pi}{3}$

Answer of Question = 2
Fill in the Blanks

(i) $\frac{\pi}{2}x + c$

(ii) 0

$\frac{e^{\sqrt{x}}}{2\sqrt{e^{\sqrt{x}}}} \cdot \frac{1}{2\sqrt{x}}$

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(iii) 0

(iv) 1,0,0 , 0,1,0 , 0,0,1

~~(v) $\frac{e^{\sqrt{x}}}{4\sqrt{x}e^{\sqrt{x}}}$ $\frac{\sqrt{e^{\sqrt{x}}}}{4\sqrt{x}}$~~

~~(vi)~~

(v) $e^x f(x)$

(vi) $\frac{e^{\sqrt{x}}}{4\sqrt{x e^{\sqrt{x}}}}$

(vii) $10\pi\ cm^2/cm$

Answer of Question = 3

Match the correct pairs

'A'	'B'
(i) Derivative of $\sin 2x$ with respect to x	(e) $2\cos 2x$
(ii) $\int \tan x\, dx$	(a) $-\log\lvert\cos x\rvert + c$
(iii) $\int \cot x\, dx$	(b) $\log\lvert\sin x\rvert + c$

(iv) $\int \sec x \, dx$ (g) $\log|\sec x + \tan x| + c$

(v) $\int \text{cosec}\, x \, dx$ (f) $\log|\text{cosec}\, x - \cot x| + c$

(vi) $\begin{vmatrix} \cos x & \sin x \\ \sin x & \cos x \end{vmatrix}$ (c) $\cos 2x$

Answer of Question = 4
Answer in one word / sentence

(i) $\sqrt{3}$

(ii) 0.4

(iii) 0

(iv) 126

(v) Universal and Empty relation are sometime called Trivial Relation

(vi) $\frac{\pi}{4}$

(vii) Column matrix is a matrix which has only 1 column i.e $A = [a_{ij}]_{m \times 1}$

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Answer of Question = 5
True / False

(i) True

(ii) True

(iii) False

(iv) True

(v) True

(vi) False

Question No. = 17
is On the
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