Sample Question Paper - 6
Mathematics (041)
Class- XII, Session: 2021-22
TERM II

Time Allowed: 2 hours **Maximum Marks: 40**

General Instructions:

1. This question paper contains three sections – A, B and C. Each part is compulsory.
2. Section - A has 6 short answer type (SA1) questions of 2 marks each.
3. Section – B has 4 short answer type (SA2) questions of 3 marks each.
4. Section - C has 4 long answer-type questions (LA) of 4 marks each.
5. There is an internal choice in some of the questions.
6. Q 14 is a case-based problem having 2 sub-parts of 2 marks each.

Section A

1. Evaluate: $\int \frac{dx}{(1-6x-9x^2)}$ **[2]**

OR

Evaluate: $\int_0^{\pi/4} \frac{\sin^2 x \cos^2 x}{\left(\sin^3 x+\cos^3 x\right)^2} dx$

2. At any point (x, y) of a curve the slope of the tangent is twice the slope of the line segment joining the point of contact to the point (- 4, - 3). Find the equation of the curve given that it passes through (-2, 1). **[2]**

3. If A (1, 2, -3) and B (-1, -2, 1) are the two given points in space then find the direction cosines of $\overrightarrow{AB}$. Express $\overrightarrow{AB}$ in terms of $\hat{i}, \hat{j}$ and $\hat{k}$. **[2]**

4. Show that the normal to the pairs of planes are perpendicular to each other: $\vec{r} \cdot (2\hat{i} - \hat{j} + 3\hat{k}) = 5$ and $\vec{r} \cdot (2\hat{i} - 2\hat{j} - 2\hat{k}) = 5$. **[2]**

5. Two cards are drawn without replacement from a pack of 52 cards. Find the probability that the first is a heart and the second is red. **[2]**

6. A die is thrown 6 times. If getting an odd number is a success, what is the probability of appearing at most 5 successes? **[2]**

Section B

7. Evaluate the integral: $\int(2x-5)\sqrt{x^2-4x+3}\,dx$ **[3]**

8. Find the general solution of the differential equation $e^x \tan y dx + (1-e^x)\sec^2 y\, dy = 0$ **[3]**

OR

Find a particular solution of the differential equation $\frac{dy}{dx} + 2y\tan x = \sin x$, given that y = 0, when $x = \frac{\pi}{3}$.

9. Let $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}$, $\vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and $\vec{c} \cdot \vec{d} = 27$ **[3]**

10. Find the coordinates of the point where the line through the points A(3, 4, 1) and B(5, 1, 6) **[3]**

crosses the plane determined by the points P(2, 1, 2), Q(2,1,0) and R(4, -2,1).

OR

Find the value of k for which the following lines are perpendicular to each other:

$\frac{x+3}{k-5}=\frac{y-1}{1}=\frac{5-z}{-2k-1};\frac{x+2}{-1}=\frac{2-y}{-k}=\frac{z}{5}$

Hence find the equation of the plane containing the above lines.

Section C

11. Evaluate: $\int \frac{\sqrt{x^2+1}\left(\log\left|x^2+1\right|-2\log|x|\right)}{x^4} dx.$ **[4]**

12. Find the area enclosed by the parabola $y^2 = 4ax$ and the line y = mx. **[4]**

OR

Using method of integration find the area of the triangle ABC, co-ordinates of whose vertices are A(1, -2), B(3, 5) and C(5,2).

13. Find the distance of the point (-1,-5,-10) from the point of intersection of the line $\vec{r}=(2\hat{i}-\hat{j}+2\hat{k})+\lambda(3\hat{i}+4\hat{j}+2\hat{k})$ and the plane $\vec{r}\cdot\left(\hat{i}-\hat{j}+\hat{k}\right)=5.$ **[4]**

CASE-BASED/DATA-BASED

14. To teach the application of probability a maths teacher arranged a surprise game for 5 of his students namely Govind, Girish, Vinod, Abhishek and Ankit. He took a bowl containing tickets numbered 1 to 50 and told the students go one by one and draw two tickets simultaneously from the bowl and replace it after noting the numbers. **[4]**

Based on the above information, answer the following questions.

i. Teacher ask Govind, what is the probability that tickets are drawn by Abhishek, shows a prime number on one ticket and a multiple of 4 on other ticket?
ii. Teacher ask Girish, what is the probability that tickets drawn by Ankit, shows an even number on first ticket and an odd number on second ticket?

Solution

MATHEMATICS 041

Class 12 - Mathematics

Section A

1. Let I = $\int \frac{dx}{(1-6x-9x^2)}$, then we have

$I = -\int \frac{dx}{(9x^2+6x-1)}$

$= -\frac{1}{9}\int \frac{dx}{\left(x^2+\frac{2}{3}x-\frac{1}{9}\right)}$

$= -\frac{1}{9}\cdot\int \frac{dx}{\left\{\left(x^2+\frac{2}{3}x+\frac{1}{9}\right)-\frac{2}{9}\right\}}$

$= -\frac{1}{9}\cdot\int \frac{dx}{\left\{\left(x+\frac{1}{3}\right)^2-\left(\frac{\sqrt{2}}{3}\right)^2\right\}} = \frac{1}{9}\cdot\int \frac{dx}{\left\{\left(\frac{\sqrt{2}}{3}\right)^2-\left(x+\frac{1}{3}\right)^2\right\}}$

$= \frac{1}{9}\cdot\int \frac{dx}{\left\{\left(\frac{\sqrt{2}}{3}\right)^2-t^2\right\}}$, where $\left(x+\frac{1}{3}\right)=t$

$= \frac{1}{9}\cdot\frac{1}{2\cdot\frac{\sqrt{2}}{3}}\log\left|\frac{\frac{\sqrt{2}}{3}+t}{\frac{\sqrt{2}}{3}-t}\right| + C = \frac{1}{6\sqrt{2}}\log\left|\frac{\sqrt{2}+3t}{\sqrt{2}-3t}\right| + C$

$= \frac{1}{6\sqrt{2}}\log\left|\frac{\sqrt{2}+3\left(x+\frac{1}{3}\right)}{\sqrt{2}-3\left(x+\frac{1}{3}\right)}\right| + C$

$= \frac{1}{6\sqrt{2}}\log\left|\frac{\sqrt{2}+1+3x}{\sqrt{2}-1-3x}\right| + C$

OR

Let I = $\int_0^{\pi/4} \frac{\sin^2 x\cos^2 x}{\left(\sin^3 x+\cos^3 x\right)^2}dx$, then we have

$I = \int \sec^2 x\frac{\tan^2 x}{\tan^6 x+2\tan^3 x+1}dx$

Let $u = \tan x \Rightarrow \frac{du}{dx} = \sec^2 x$

$I = \int \frac{u^2}{u^6+2u^3+1}du$

Again let $v = u^3 \Rightarrow \frac{dv}{du} = 3u^2$

$I = \frac{1}{3}\int \frac{1}{v^2+2v+1}dv$

$= \frac{1}{3}\int \frac{1}{(v+1)^2}dv$

$= -\frac{1}{3(v+1)}$

$= -\frac{1}{3(u^3+1)}$

$= -\frac{1}{3(\tan^3 x+1)}$

$= \left\{-\frac{1}{3(\tan^3 x+1)}\right\}_0^{\frac{\pi}{4}}$

$= \left\{-\frac{1}{6}+\frac{1}{3}\right\} = \frac{1}{6}$

2. The slope of the tangent at any point P (x,y) is given by $\frac{dy}{dx}$. The slope of the line segment joining P (x, y) and A (-4, -3) is $\frac{y+3}{x+4}$

According to the given condition, we have

$\frac{dy}{dx} = 2\left(\frac{y+3}{x+4}\right)$ ...equation(i)

$\Rightarrow \frac{1}{y+3}dy = \frac{2}{x+4}dx$

On integrating both sides, we get

$\int \frac{1}{y+3}dy = 2\int \frac{1}{x+4}dx$

$\Rightarrow$ log (y + 3) = 2 log (x + 4) + log C

$\Rightarrow$ (y + 3) = C (x + 4)^2 ...equation(ii)

This represents the family of solutions of differential equation (i). We have to find a particular member of this family which passes through (- 2, 1).

Substituting x - 2 , y =1 in equation(ii), we get: 4 = C (- 2 + 4)^2 $\Rightarrow$ C = 1

Putting C = 1 in equation(ii), we get y + 3 = (x + 4)^2 as the required equation of the curve.

3. $|\overrightarrow{AB}| = \sqrt{(-2)^2 + (-4)^2 + 4^2} = \sqrt{36} = 6$

   $\therefore$ the direction cosines of $\overrightarrow{AB}$ are $\frac{-2}{6}, \frac{-4}{6}, \frac{4}{6}$, i.e., $\frac{-1}{3}, \frac{-2}{3}, \frac{2}{3}$

   Therefore, $\overrightarrow{AB}$ = $-\frac{1}{3}\hat{i} - \frac{2}{3}\hat{j} + \frac{2}{3}\hat{k}$.

4. Let $\overrightarrow{n_1}$ and $\overrightarrow{n_2}$ be the vectors which are normals to the planes given by
   $\vec{r} \cdot (2\hat{i} - \hat{j} + 3\hat{k}) = 5$ and $\vec{r} \cdot (2\hat{i} - 2\hat{j} - 2\hat{k}) = 5$
   The given equations of the planes are
   $\vec{r} \cdot (2\hat{i} - \hat{j} + 3\hat{k}) = 5; \vec{r} \cdot (2\hat{i} - 2\hat{j} - 2\hat{k}) = 5$
   $\Rightarrow \vec{n}_1 = (2\hat{i} - \hat{j} + 3\hat{k}); \vec{n}_2 = (2\hat{i} - 2\hat{j} - 2\hat{k})$
   Now we have, $\vec{n}_1 \cdot \vec{n}_2 = (2\hat{i} - \hat{j} + 3\hat{k}) \cdot (2\hat{i} - 2\hat{j} - 2\hat{k})$ = 4 + 2 - 6 = 0
5. Total number of all favourable cases is n(S) = 52
   Let A be the event that the first card drawn is a heart. There are 13 hearts in the pack. Hence, the probability of the first card is a heart is
   $P(A) = \frac{13}{52}$
   Let B be the event that the second card is red without replacement. Therefore, there are 26 red cards in the pack but as the cards are not replaced now there are 25 red cards as one heart which is red in color is already drawn out. Therefore, the probability of the second card is red is
   $P(B|A) = \frac{25}{51}$
   Hence, the probability of getting first card as a heart and the second card as a red without replacement is given by,
   $P(A \cap B)$
   $= \mathrm{P(A)P(B|A)}$
   $= \frac{13}{52} \times \frac{25}{51}$
   $= \frac{25}{204}$
   The probability that first is a heart and the second is a red card without replacement is $\frac{25}{204}$
6. We know that the repeated tosses of a dice are known as Bernouli trials.
   Let x = number of times getting an odd number in an experiment of 6 trials.
   P(getting an odd number in a single throw) = $\frac{\text{number of odd numbers on a dice}}{\text{total number of numbers on a dice}} = \frac{3}{6} = \frac{1}{2}$
   Thus, q = 1 - p = $\frac{1}{2}$
   Here x follows Binomial Distribution.
   Thus, P(X = x) = $^nC_x\, q^{n-x}p^x$, where x = 0, 1, 2, ...n
   = $^6C_x\, (\frac{1}{2})^{6-x}(\frac{1}{2})^x$
   = $^6C_x\, (\frac{1}{2})^6$
   Probability of getting at most 5 successes = P(X $\leq$ 5)
   Where P(X $\leq$ 5) = 1 – P(X > 5)
   = 1 - P(X = 6)
   = 1 - $^6C_6\, (\frac{1}{2})^6$
   = $1 - \frac{1}{64}$
   = $\frac{63}{64}$

Section B

7. Let the given integral be,I = $\int (2x + 3)\sqrt{x^2 + 4x + 3}\, dx$
   Also, 2x + 3 = $\lambda \frac{d}{dx}\left(x^2 + 4x + 3\right) + \mu$
   $\Rightarrow$ 2x + 3 = λ(2x + 4) + μ

$\Rightarrow$ 2x + 3 = (2λ)x + $4\lambda + \mu$
Equating coefficient of like terms.
$2\lambda = 2$
$\Rightarrow \lambda = 1$
And
$4\lambda + \mu = 3$
$\Rightarrow 4 + \mu = 3$
$\Rightarrow \mu = -1$
$\therefore$ I = $\int(2x+4-1)\sqrt{x^2+4x+3}\,dx$
= $\int(2x+4)\sqrt{x^2+4x+3}\,dx$ - $\int\sqrt{x^2+4x+3}\,dx$
= $\int(2x+4)\sqrt{x^2+4x+3}\,dx$ - $\int\sqrt{x^2+4x+4-1}\,dx$
= $\int(2x+4)\sqrt{x^2+4x+3dx}$ - $\int\sqrt{(x+2)^2-1^2}\,dx$
Let $x^2 + 4x + 3 = t$
$\Rightarrow$ (2x + 4) dx = dt
then,
I = $\int\sqrt{t}$dt - $\int\sqrt{(x+2)^2-1^2}\,dx$
= $\frac{2}{3}t^{\frac{3}{2}}$ - $\left[\frac{x+2}{2}\sqrt{(x+2)^2-1}\right.$ - $\frac{1^2}{2}\log|(x+2)+\sqrt{(x+2)^2-1}|$ + C
= $\frac{2}{3}\left(x^2+4x+3\right)^{\frac{3}{2}}$ - $\frac{1}{2}[(x+2)\sqrt{x^2+4x+3}$ - log $|(x+2)+\sqrt{x^2+4x+3}|]$ + C

8. $e^x\tan y dx + (1-e^x)\sec^2 y\,dy = 0$
$\Rightarrow e^x\tan y dx = -(1-e^x)\sec^2 y\,dy$
$\Rightarrow\int\frac{e^x}{1-e^x}dx = -\int\frac{\sec^2 y}{\tan y}dy$
$\Rightarrow -\log(1-e^x) = -\log\tan y + \log c$
$\Rightarrow \log\left(\frac{\tan y}{1-e^x}\right) = \log c$
$\Rightarrow \frac{\tan y}{1-e^x} = c$
$\Rightarrow \tan y = c(1-e^x)$

OR

We have,
$\frac{dy}{dx} + 2y\tan x = \sin x$
which is a linear differential equation of the form $\frac{dy}{dx} + Py = Q$.
Here, P = 2 tanx and Q =sin x
$\therefore \quad \text{IF} = e^{\int Pdx} = e^{2\int\tan x dx} = e^{2\log|\sec x|}$
$= e^{\log\sec^2 x} \quad [\because m\log n = \log n^m\mathbf{1}$
= $\sec^2$x [$\because e^{\log x}$ = x]
The general solution is given by
$y\times IF = \int(Q\times IF)dx + C$ ...(i)
$\Rightarrow \quad y\sec^2 x = \int\left(\sin x\cdot\sec^2 x\right)dx + C$
$\Rightarrow \quad y\sec^2 x = \int\sin x\cdot\frac{1}{\cos^2 x}dx + C$
$\Rightarrow \quad y\sec^2 x = \int\tan x\sec x dx + C$
$\Rightarrow \quad y\sec^2 x = \sec x + C$.............(ii)
Also, given that y = 0, when $x = \frac{\pi}{3}$.
On putting y = 0 and $x = \frac{\pi}{3}$ in Eq. (ii), we get
$0\times\sec^2\frac{\pi}{3} = \sec\frac{\pi}{3} + C$
$\Rightarrow \quad 0 = 2 + C \Rightarrow C = -2$
On putting the value of C in Eq. (ii), we get
$y\sec^2 x = \sec x - 2$
$\therefore \quad y = \cos x - 2\cos^2 x$
which is the required particular solution of the given differential equation

9. Here we have, $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}$, $\vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$.

Now, $\vec{d} = d_1\hat{i} + d_2\hat{j} + d_,\hat{k}$

Since $\vec{d}$ is perpendicular to both $\vec{a}$ and $\vec{b}$

$\vec{d} \cdot \vec{a} = 0$

$\Rightarrow d_1 + 4d_2 + 2d_3 = 0$ ....(i)

And,

$\vec{d} \cdot \vec{b} = 0$

$\Rightarrow 3d_1 - 2d_2 + 7d_3 = 0$ ....(ii)

Also, it is given that:

$\vec{c} \cdot \vec{d} = 15$

$\Rightarrow 2d_1 - d_2 + 4d_3 = 15$ ....(iii)

On solving (i), (ii), and (iii), we get:

$d_1 = \frac{160}{3}, d_2 = -\frac{5}{3}$ *and* $d_3 = -\frac{70}{3}$

$\therefore \vec{d} = \frac{160}{3}\hat{i} - \frac{5}{3}j - \frac{70}{3}\hat{k} = \frac{1}{3}(160\hat{i} - 5\hat{j} - 70\hat{k})$

Hence, the required vector is $\frac{1}{3}(160\hat{i} - 5\hat{j} - 70\hat{k})$

10. Here, we are given points A(3, 4, 1) and B(5, 1, 6)

So, direction ratio of line A B=(2,-3,5)

So, equation of line becomes, $\frac{x-3}{2} = \frac{y-4}{-3} = \frac{z-1}{5} = k$

$\Rightarrow \frac{z-1}{5} = k$

As the line is crossing XY-plane, z-coordinate will be 0. So, $\frac{0-1}{5} = k \Rightarrow k = -\frac{1}{5}$

$\therefore \frac{x-3}{2} = -\frac{1}{5}$

$\Rightarrow x = 3 - \frac{2}{5} = \frac{13}{5}$

$\frac{y-4}{-3} = -\frac{1}{5}$

$\Rightarrow y = 4 + \frac{3}{5} = \frac{23}{5}$

So, the required coordinates will be $\left(\frac{13}{5}, \frac{23}{5}, 0\right)$

OR

Here the equation of the given lines are:

$\frac{x+3}{k-5} = \frac{y-1}{1} = \frac{5-z}{2k-1}$

$\Rightarrow \frac{x-(-3)}{k-5} = \frac{y-1}{1} = \frac{z-5}{1-2k}$ .... (i)

and $\frac{x+2}{-1} = \frac{2-y}{-k} = \frac{z}{5}$

$\Rightarrow \frac{x-(-2)}{-1} = \frac{y-2}{k} = \frac{z}{5}$ .... (ii)

Comparing (i) and (ii) with standard equations, we get

$\frac{x-x_1}{a_1} = \frac{y-y_1}{b_1} = \frac{z-z_1}{c_1}$ and $\frac{x-x_2}{a_2} = \frac{y-y_2}{b_2} = \frac{z-z_2}{c_2}$

We get:

$< a_1, b_1, c_1 > \equiv < (k-5), 1, (1-2k) >$

$< a_2, b_2, c_2 > \equiv < -1, k, 5 >$

Since the lines (i) and (ii) are $\perp$ to each other, so

$a_1a_2 + b_1b_2 + c_1c_2 = 0$

$\Rightarrow -1(k-5) + 1 \times k + 5(1-2k) = 0$

$\Rightarrow$ -k + 5 + k + 5 - 10k = 0

$\Rightarrow$ -10k + 10 = 0

$\Rightarrow$ -10k = -10

$\Rightarrow$ k = 1

Section C

11. According to the question , $I = \int \frac{\sqrt{x^2+1}\left[\log|x^2+1| - 2\log|x|\right]}{x^4} dx$

$= \int \frac{\sqrt{x^2+1}\left[\log|x^2+1| - \log|(x)^2|\right]}{x^4} dx [\because m\log a = \log a^m]$

$= \int \frac{\sqrt{x^2+1}\log\left|\frac{x^2+1}{x^2}\right|}{x^4} dx \left[\because \log m - \log n = \log \frac{m}{n}\right]$

$= \int \frac{x\sqrt{1+\frac{1}{x^2}}\log\left|1+\frac{1}{x^2}\right|}{x^4} dx$

$= \int \frac{\sqrt{1+\frac{1}{x^2}}\log\left|1+\frac{1}{x^2}\right|}{x^3} dx$

Put , $1 + \frac{1}{x^2} = t$

$\Rightarrow \frac{-2}{x^3} dx = dt$

$\Rightarrow \frac{dx}{x^3} = -\frac{dt}{2}$

$\therefore \quad I = -\frac{1}{2} \int \sqrt{t} \log|t| dt$

By using integration by parts ,we get

$= -\frac{1}{2}\left[\log|t| \int t^{1/2} dt - \int \left\{\frac{d}{dt}(\log|t|) \int t^{1/2} dt\right\} dt\right]$

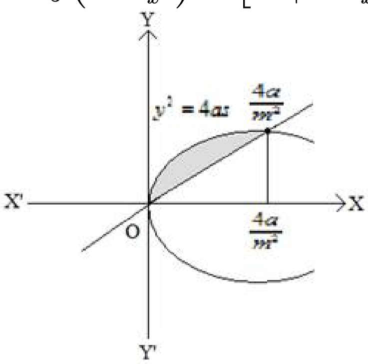
$= -\frac{1}{2}\left[\log|t| \times \frac{t^{3/2}}{3/2} - \int \frac{t^{3/2}}{3/2} \times \frac{1}{t} dt\right]$

$= -\frac{1}{3}\left[t^{3/2} \log|t| - \int \sqrt{t} dt\right]$

$= -\frac{1}{3}\left[t^{3/2} \log|t| - \frac{t^{3/2}}{3/2}\right] + C$

$= -\frac{1}{3} t^{3/2} \left[\log|t| - \frac{2}{3}\right] + C$

$= -\frac{1}{3}\left(1 + \frac{1}{x^2}\right)^{3/2} \left[\log\left|1 + \frac{1}{x^2}\right| - \frac{2}{3}\right] + C \left[\because t = 1 + \frac{1}{x^2}\right]$

12. 

$y^2 = 4ax$ ....(1)

$y = mx$........(2)

Using (2) in (1), we get,

$(mx)^2 = 4ax$

$\Rightarrow m^2x^2 = 4ax$

$x(m^2x - 4a) = 0$

$\Rightarrow x = 0, \frac{4a}{m^2}$

From (2),

When x = 0, y = m(0) = 0

When $x = \frac{4a}{m^2}, y = m \times \frac{4a}{m^2} = \frac{4a}{m}$

$\therefore$ points of intersection are (0, 0) and $\left(\frac{4a}{m^2}, \frac{4a}{m}\right)$

Area $= \int_0^{4a/m^2} \sqrt{4ax} dx - \int_0^{\frac{4a}{m^2}} mx \, dx$

$= \sqrt{4a} \int_0^{\frac{4a}{m^2}} \sqrt{x} dx - m \int_0^{\frac{4a}{m^2}} x dx$

$= \sqrt{4a}[\frac{2}{3} x^{\frac{3}{2}}]_0^{\frac{4a}{m^2}} - m[\frac{x^2}{2}]_0^{\frac{4a}{m^2}}$

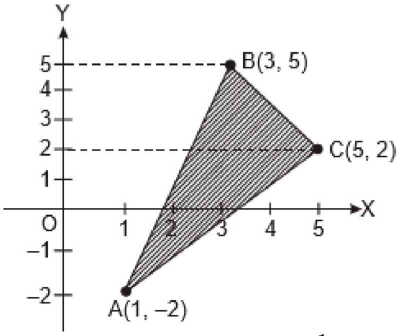
$= \sqrt{4a}[\frac{2}{3}(\frac{4a}{m^2})^{\frac{3}{2}} - 0] - \frac{m}{2}[(\frac{4a}{m^2})^2 - 0]$

$= \frac{2}{3m^3}(4a)^2 - \frac{1}{2m^3}(4a)^2$

$= \frac{(4a)^2}{m^3}\left[\frac{2}{3} - \frac{1}{2}\right]$
$= \frac{8a^2}{3m^3} sq unit.$

OR

Let ABC, be a triangle with given vertices as shown below.



Now Equation of AB: x = $\frac{1}{7}(2y + 11)$
Equation of BC: x = $\frac{1}{3}(19 - 2y)$
Equation of AC: x = y + 3
Required area = $\int_{-2}^{2}(y+3)dy$ + $\frac{1}{3}\int_{2}^{5}(19-2y)dy$ - $\frac{1}{7}\int_{-2}^{5}(2y+11)dy$

$\Rightarrow$ A = $\left.\frac{(y+3)^2}{2}\right]_{-2}^{2} + \frac{1}{3}\left.\frac{(19-2y)^2}{-4}\right]_{2}^{5} - \frac{1}{7}\left.\frac{(2y+11)^2}{4}\right]_{-2}^{5}$

= $\frac{1}{2}$(25 - 1) - $\frac{1}{12}$(81 - 225) - $\frac{1}{28}$(441 - 49) = 10 sq. units

13. $\vec{r} = (2i - j + 2k) + \lambda(3i + 4j + 2k)$
Then, in Cartesian form,we have
$\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{2} = \lambda$ ..... (i)
coordinates of any point on (i) is ,
$3\lambda + 2, 4\lambda - 1, 2\lambda + 2$
The equation of plane is
$\overrightarrow{r}.\left(\hat{i} - \hat{j} + \hat{k}\right) = 5$
$\left(x\hat{i} + y\hat{j} + z\hat{k}\right) \cdot \left(\hat{i} - \hat{j} + \hat{k}\right) = 5$
x - y + z = 5 .... (ii)
If the point $(3\lambda + 2, 4\lambda - 1, 2\lambda + 2)$lies on (ii),then
$(3\lambda + 2) - (4\lambda - 1) + (2\lambda + 2) = 5$
$\lambda + 5 = 5$
$\lambda = 0$
we get (2, -1, 2) as the coordinate of the point of intersection of the given line and the plane.
Now distance between the points (-1, -5, -10) and (2, -1, 2)
$= \sqrt{(2+1)^2 + (-1-5)^2 + (2+10)^2}$
= 13

CASE-BASED/DATA-BASED

14. i. Required probability = P(one ticket with prime number and other ticket with a multiple of 4)
$= 2\left(\frac{15}{50} \times \frac{12}{49}\right) = \frac{36}{245}$
ii. Let the event A = First ticket shows even number and B = Second ticket shows odd number
Now, P(First ticket shows an even number and second ticket shows an odd number) = P(A) · P(B|A)
$= \frac{25}{50} \times \frac{25}{49} = \frac{25}{98}$