Standard - XII

Sample Question Paper - I

MATHEMATICS

(Science Group)

Weightage to score of content

MATHEMATICS (ScienceGroup)

Std: XII

Sl. No.	CO's	Unit	No. of Questions	Score	%
1.	1 - 2	Matrices and Determinants	2	8	10
2.	3 - 5	Boolean Algebra	1	5	6
3.	6 - 7	Probability	1	4	5
4.	8 - 13	Functions, limits and continuity	1	3	4
5.	14 - 17	Differentiation	1	10	13
6.	18 - 23	Application of differentiation	1	7	9
7.	24 - 28	Indefinite Integral	2	9	11
8.	29 - 31*	Definite Integral	1	7	9
9.	32*	Differential Equation	1	5	6
10.	33 - 35	Vector I	1	4	5
11.	36	Vector II	1	7	9
12.	37	3D I	1	5	6
13.	38 - 41	3D II	1	6	7
			15	**80**	**100**

** Internal choices were given to this questions*

Weightage to type of questions

MATHAMATICS

Std: XII

Type of Questions	Scores	%
Objective	18	22.5
Short answer	36	45
Essay	26	32.5
Total	**80**	**100**

Weightage to level of questions

MATHEMATICS

Std: XII

Type of Questions	Scores	%
Essay	15	19
Average	42	52
Difficulty	23	29
Total	**80**	**100**

Blue Print

MATHEMATICS - Paper I (Science Group)

Std: XII

Sl. No.	CO's	Unit	Types of Questions			Total Score
			Objective	Short answer	Essay	
1.	1 - 2	Matrices and Determinants	2	2	4	8
2.	3 - 5	Boolean Algebra	1	1	3	5
3.	6 - 7	Probability	2	2	-	4
4.	8 - 13	Functions, limits and continuity	3	-	-	3
5.	14 - 17	Differentiation	-	8	2	10
6.	18 - 23	Applications of differentiation	2	2	3	7
7.	24 - 28	Indefinite Integral	1	-	8	9
8.	29 - 31	Definite Integral	-	5	2	7
9.	32	Differential Equation	1	2	2	5
10.	33 - 35	Vector I	2	2	-	4
11.	36	Vector II	1	4	2	7
12.	37	3D I	1	4	-	5
13.	38 - 41	3D II	2	4	-	6
		Total	**18**	**36**	**26**	**80**

Part III - MATHEMATICS
(Science Group)

Std - XII | Time: $2\frac{1}{2}$ hrs.
Maximum Score: 80 | Cool off time: 15 mts.

Instructions

- Read the question carefully before answering.
- Maximum time allowed is 2 hours 45 minuts inclding cool off time.
- First 15 minutes is coll-off time, during which the candidate should neither write answers nor have discussion with others.
- All questions are compulsory and only internal choices are allowed.
- In the case of question having internal choice only the sub-questions of the same questions should be answered.
- Calculations, figures and graphs should be shown in the answer sheet itself.

നിർദ്ദേശങ്ങൾ:

$ *ഉത്തരം എഴുതി തുടങ്ങുന്നതിനു മുമ്പ് ശ്രദ്ധാപൂർവം ചോദ്യങ്ങൾ വായിക്കുക.*

$ *'കൂൾ ഓഫ്' സമയം ഉൾപ്പെടെ ചോദ്യങ്ങൾക്ക് അനുവദിക്കപ്പെട്ട സമയം 2 മണിക്കൂർ 45 മിനിറ്റാണ്.*

$ *ആദ്യത്തെ 15 മിനിട്ട് 'കൂൾ ഓഫ്' സമയമാണ്. ഈ സമയത്ത് മറ്റുള്ളവരുമായി ചർച്ച ചെയ്യുകയോ ഉത്തരമെഴുതാനോ പാടില്ല.*

$ *ചോയ്സ് നല്കാത്ത ചോദ്യങ്ങൾക്കെല്ലാം ഉത്തരം എഴുതേണ്ടതാണ്.*

$ *ചോയിസുള്ള ചോദ്യങ്ങൾക്ക് ഉത്തരമെഴുതുമ്പോൾ ആ ചോദ്യത്തിന്റെ ഉപചോദ്യങ്ങൾക്ക് മാത്രം ഉത്തരം എഴുതുക.*

$ *ക്രിയകൾ ചിത്രങ്ങൾ ഗ്രാഫുകൾ ഉത്തരക്കടലാസിൽ തന്നെ എഴുതേണ്ടതാണ്.*

1. (i) Find the graph of the function $f(x) = x + 1$ from the graphs given below. [1]

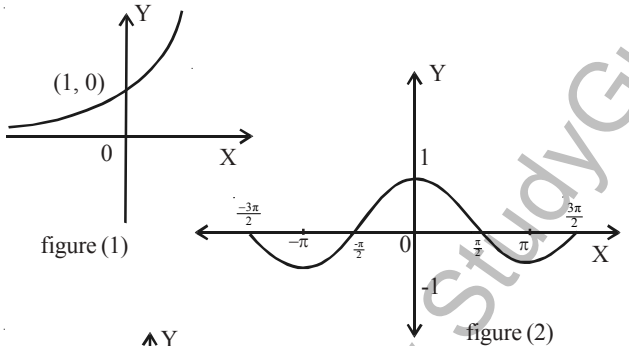


figure (1)

figure (2)

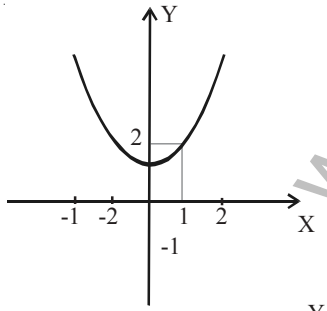


figure (3)

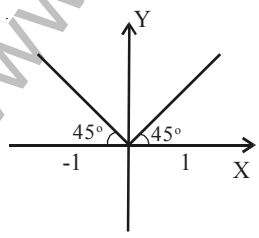


figure (4)

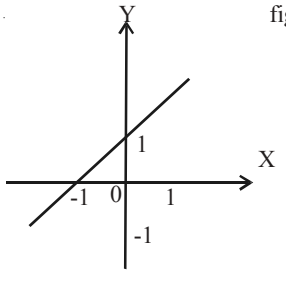
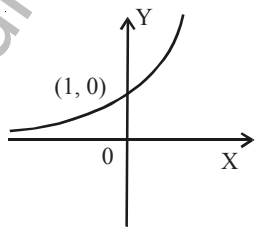
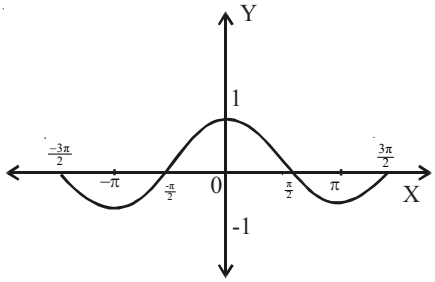


figure (5)

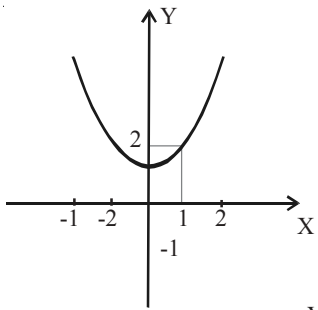
1. (i) ചുവടെ കൊടുത്തിരിക്കുന്ന ഗ്രാഫുകളിൽ നിന്ന് $f(x) = x + 1$ എന്ന ഫംഗ്ഷന്റെ ഗ്രാഫ് കണ്ടെത്തുക. [1]



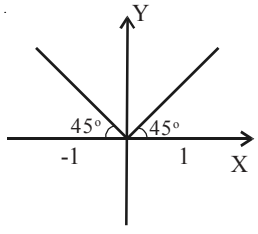
ചിത്രം (1)



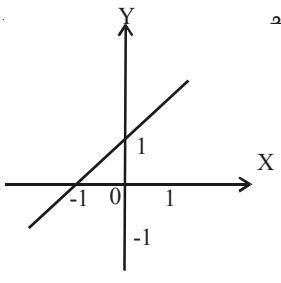
ചിത്രം (2)



ചിത്രം (3)



ചിത്രം (4)



ചിത്രം (5)

(ii) Match the following using the graph given above. [2]

A - functions	B - Graph
$f(x) = \cos x$	figure (1)
$f(x) = \lvert x \rvert$	figure (2)
$f(x) = e^x$	figure (3)
$f(x) = x^2 + 1$	figure (4)
	figure (5)

(iii) One of the above graphs represents a function which is not differentiable at $x = 0$. Identify that graph. Justify your answer. [2]

2. (i) Match the following

A	B
$\frac{d}{dx}(\sin x)$	$-\cos x$
$\frac{d}{dx}(e^{\cos x})$	$\frac{2}{1+x^2}$
$\frac{d}{dx}\sin^{-1}\left(\frac{2x}{1+x^2}\right)$	$-\sin x \cdot e^{\cos x}$
$\frac{d}{dx}\sin^{-1}(x)$	$\cos x$
	$\frac{1}{\sqrt{1-x^2}}$

[4]

ii) Differentiate $\sin x$ with respect to x using first principle. [2]

iii) If $y = \sin^{-1} x$, prove that

$(1 - x^2)\, y_2 - x y_1 = 0$. [2]

(ii) മുകളിൽ പറഞ്ഞിരിക്കുന്ന ഗ്രാഫുകൾ ഉപയോഗിച്ച് ചേരുംപടി ചേർക്കുക. [2]

A - ഫംഗ്ഷൻസ്	B - ഗ്രാഫ്
$f(x) = \cos x$	ചിത്രം (1)
$f(x) = \lvert x \rvert$	ചിത്രം (2)
$f(x) = e^x$	ചിത്രം (3)
$f(x) = x^2 + 1$	ചിത്രം (4)
	ചിത്രം (5)

(iii) മുകളിൽ കൊടുത്തിരിക്കുന്ന ഫംഗ്ഷനുകളുടെ ഗ്രാഫുകളിൽ ഒന്ന് $x = 0$ ൽ ഡിഫറൻഷിയബിൾ അല്ല. ആ ഗ്രാഫ് ഏത്? എന്തുകൊണ്ട്? [2]

2. (i) ചേരുംപടി ചേർക്കുക.

A	B
$\frac{d}{dx}(\sin x)$	$-\cos x$
$\frac{d}{dx}(e^{\cos x})$	$\frac{2}{1+x^2}$
$\frac{d}{dx}\sin^{-1}\left(\frac{2x}{1+x^2}\right)$	$-\sin x \cdot e^{\cos x}$
$\frac{d}{dx}\sin^{-1}(x)$	$\cos x$
	$\frac{1}{\sqrt{1-x^2}}$

[4]

ii) ഫസ്റ്റ് പ്രിൻസിപ്പിൾ ഉപയോഗിച്ച് $\sin x$ നെ x ആസ്പദമാക്കി ഡിഫറൻഷ്യേറ്റ് ചെയ്യുക. [2]

iii) $y = \sin^{-1} x$ ആയാൽ

$(1 - x^2)\, y_2 - x y_1 = 0$ എന്നു തെളിയിക്കുക. [2]

3. An open box of maximum volume is to be made from a square piece of tin sheet 24 cm on a side by cutting equal squares from the corners and turning of the sides?

i) Complete the following table

Height of the box (x cm)	Width of the box	Volume of the box (v cm^3)
1	$24 - 2 \times 1$	$1 \times (24 - 2 \times 1)^2 = 484$
2	$24 - 2 \times 2$	$2 \times (24 - 2 \times 2)^2 = 800$
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____

[2]

ii) Using the above table, express v as a function of x and determine its domian. [2]

iii) Find height (x cm) of the box when volume (v) is maximum by using differentiation. [3]

4. i) Choose the correct answer from the bracket.

$\int e^x dx = ...$

$(e^{2x} + c, e^x + c, e^{-x} + c, e^{-2x} + c)$ [1]

ii) Evaluate: $\int e^x \sin x \, dx$ [3]

iii) Evaluate $\int_0^2 e^x dx$ as the limit of sum. [2]

3. 24 സെ.മീ വശമുള്ള സമചതുരാകൃതിയിലുള്ള ഒരു ടിൻഷീറ്റിൻരെ മൂലകളിൽ നിന്ന് സമച തുരാകൃതിയിൽ ഒരു ഭാഗം മുറിച്ചുമാറ്റിയ ശേഷം വശങ്ങൾ മുകളിലേക്ക് മടക്കി പരമാ വധി വ്യാപ്തമുള്ള ഒരു തുറന്ന പെട്ടി നിർമി ച്ചിരിക്കുന്നു.

i) ചുവടെ കൊടുത്തിരിക്കുന്ന പട്ടിക പൂരിപ്പി ക്കുക.

പെട്ടിയുടെ ഉയരം (x cm)	പെട്ടിയുടെ വീതി	പെട്ടിയുടെ വ്യാപ്തം (v cm^3)
1	$24 - 2 \times 1$	$1 \times (24 - 2 \times 1)^2 = 484$
2	$24 - 2 \times 2$	$2 \times (24 - 2 \times 2)^2 = 800$
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____

[2]

ii) മുകളിൽ കൊടുത്തിരിക്കുന്ന പട്ടിക ഉപയോ ഗിച്ച് പെട്ടിയുടെ വ്യാപ്തം v യെ x ൽ ഉള്ള ഒരു ഫംഗ്ഷൻ ആയി എഴുതുക. [2]

iii) പെട്ടിയുടെ വ്യാപ്തം പരമാവധി ആകു മ്പോൾ അതിന്റെ ഉയരം എത്രയെന്ന് ഡിഫ റൻസിയേഷൻ ഉപയോഗിച്ച് കണ്ടെത്തുക. [3]

4. i) ബ്രാക്കറ്റിൽ നിന്ന് ശരിയായ ഉത്തരം തെര ഞ്ഞെടുത്തെഴുതുക.

$\int e^x dx = ...$

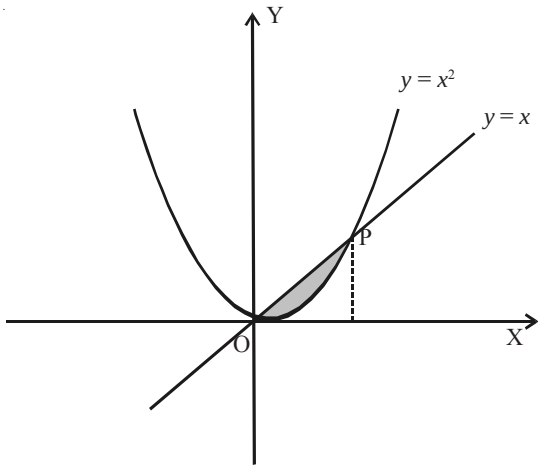
$(e^{2x} + c, e^x + c, e^{-x} + c, e^{-2x} + c)$ [1]

ii) $\int e^x \sin x \, dx$ ന്റെ വില കാണുക. [3]

iii) $\int_0^2 e^x dx$ ന്റെ വില തുകയുടെ ലിമിറ്റ് ഉപയോ ഗിച്ച് കാണുക. [2]

5. *Direction*: Answer any one 5 or 6.

Consider the following figure



i) Find the point of intersection (P) of the paraboloa and the line. [2]

ii) Find the area of the shaded region. [3]

OR

6. i) Ealuate $\int_0^r \sqrt{r^2 - x^2}\, dx$, where r is a fixed positive number. Hence prove the area of the circle of radius r is πr^2. [3]

ii) Find the area of the circle: $x^2 + y^2 = 16$, which is exterior to paraboloa $y^2 = 6x$. [2]

7. Let (B, +, .) be a Boolean algebra. State the following statements are true or false. Justify your answer.

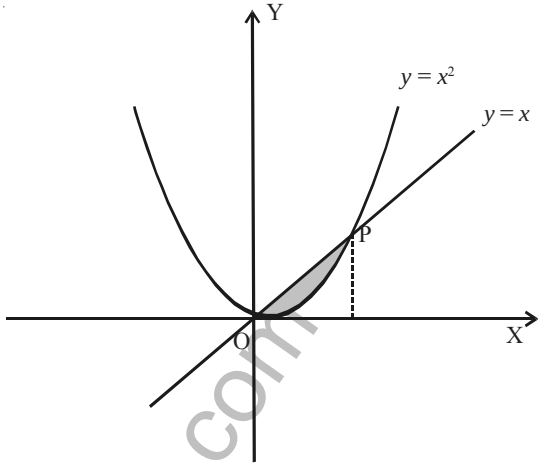
i) $x + y = y + x$ [1]

ii) $x + 1 = 1$, where 1 is the unit element in (B, +, .) [1]

iii) $(x + y) + (x' . y') = 1$, where x' and y' are complements of x and y respectively. [3]

5. *നിർദ്ദേശം*: ചോദ്യം 5, 6 ഇവയിൽ ഒന്നിനു മാത്രം ഉത്തരം എഴുതുക.

ചുവടെ കൊടുത്തിരിക്കുന്ന ചിത്രം പരിഗണിക്കുക.



i) പരബോളയും രേഖയും സംഗമിക്കുന്ന ബിന്ദുവിന്റെ "കോ-ഓർഡിനേറ്റ്സ്" കാണുക? [2]

ii) ഷെയിഡു ചെയ്തിരിക്കുന്ന ഭാഗത്തിന്റെ വിസ്തീർണം കാണുക. [3]

അല്ലെങ്കിൽ

6. i) r ഒരു സ്ഥിരമായ പോസിറ്റീവ് സംഖ്യ ആയാൽ $\int_0^r \sqrt{r^2 - x^2}\, dx$ കാണുക? ഇതിനെ അടിസ്ഥാനമാക്കി ആരം r യൂണിറ്റായ ഒരു വൃത്തത്തിന്റെ വിസ്തീർണം πr^2 ആയിരിക്കും എന്ന് തെളിയിക്കുക. [3]

ii) $y^2 = 6x$ എന്ന പരാബോളയുടെ പുറത്ത് $x^2 + y^2 = 16$ എന്ന വൃത്തഭാഗത്തിന്റെ വിസ്തീർണം എത്ര ആയിരിക്കും? [2]

7. (B, +, .) ഒരു ബൂളിയൻ ആൾബിബ്ര ആയാൽ ചുവടെ കൊടുത്തിരിക്കുന്നവ ശരിയോ തെറ്റോ എന്നു പറയുക? എന്തുകൊണ്ട്?

i) $x + y = y + x$ [1]

ii) $x + 1 = 1$, (B, +, .) ലെ യൂണിറ്റ് എലമെന്റ് 1 ആണ്. [1]

iii) x', y' ഇവ യഥാക്രമം x, y ഇവയുടെ കോമ്പ്ലിമെന്റ്സ് ആയാൽ $(x + y) + (x' . y') = 1$. [3]

8. Consider a random experiment - two dice are thrown simultaneously.

i) Write the sample space of the experiment. [1]

ii) What ist he probability of 'getting a sum 12' from the above experiment. [1]

iii) Write any two event which are mutually exclussive and exhaustive from the above experiment. [2]

9. Given that $A + B = \begin{bmatrix} 2 & 5 \\ 7 & 8 \end{bmatrix}$ and $A - B = \begin{bmatrix} 6 & 8 \\ 4 & 3 \end{bmatrix}$.

i) Find 2A [1]

ii) Find $A^2 - B^2$. Is it equal to $(A + B)(A - B)$. Given reason. [2]

10. Consider a square matrix of order 3 $A = [a_{ij}]$, where $a_{ij} = 2_i + j$.

i) a_{21} = ... [1]

ii) Construct A and thus find A + AT. [2]

iii) Express A as sum of a symmetric and a skew-symmetric matrices. [2]

11. Consider the point (-1, -2, -3).

i) In which octant, the above point lies. [1]

ii) Find the diretion cosines of the line joining (-1, -2, -3) and (3, 4, 5). [2]

iii) If P is any point such that OP = $\sqrt{50}$ and direction cosine of OP are $\frac{3}{\sqrt{50}}, \frac{4}{\sqrt{50}}$ and $\frac{5}{\sqrt{50}}$, then find the co-ordinate of P. [2]

8. രണ്ടു 'ഡൈ' കൾ ഒന്നിച്ച് എറിയുന്നു എന്ന 'റാൻഡം എക്സ്പിരിമെന്റ്' പരിഗണിക്കുക.

i) 'റാൻഡം എക്സ്പിരിമെന്റിന്റെ' 'സാമ്പിൾ സ്പേസ്' ഏത്? [1]

ii) ഈ 'റാൻഡം എക്സ്പിരിമെന്റിന്റെ' തുക 12 വരുന്നതിനുള്ള 'പ്രോബബിലിറ്റി' എത്ര? [1]

ii) മുകളിൽ കൊടുത്തിരിക്കുന്ന ചോദ്യം ഉപയോഗിച്ച് 'മ്യൂച്ചലീ എക്സ്ക്ലൂസി'വും 'എക്സോസ്റ്റീവും' ആയ രണ്ടു ഇവന്റുകൾ എഴുതുക. [2]

9. $A + B = \begin{bmatrix} 2 & 5 \\ 7 & 8 \end{bmatrix}$, $A - B = \begin{bmatrix} 6 & 8 \\ 4 & 3 \end{bmatrix}$ ആയാൽ

i) 2A കാണുക. [1]

ii) $A^2 - B^2$ എത്ര? ഇത് $(A + B)(A - B)$ ക്കു തുല്യമാണോ? കാരണം എന്ത്? [2]

10. $a_{ij} = 2_i + j$ ആകത്തക്കവിധം $A = [a_{ij}]$ എന്ന ഓർഡർ 3 ആയ മെട്രിക്സ് പരിഗണിക്കുക.

i) a_{21} = ... [1]

ii) മെട്രിക്സ് A നിർമിച്ച് A + AT കാണുക. [2]

iii) A എന്ന മെട്രിക്സിനെ ഒരു സിമിട്രിക് മെട്രിക്സിന്റെയും ഒരു സ്ക്യൂസിമട്രികസ് മെട്രിക്സിന്റെയും തുകയായി എഴുതുക. [2]

11. (-1, -2, -3) എന്ന ബിന്ദു പരിഗണിക്കുക.

i) മുകളിൽ പറഞ്ഞിരിക്കുന്ന ബിന്ദു ഏത് ഒക്റ്റന്റിൽ സ്ഥിതി ചെയ്യുന്നു. [1]

ii) (-1, -2, -3), (3, 4, 5) എന്നീ ബിന്ദുക്കൾ യോജിപ്പിച്ചുണ്ടാകുന്ന രേഖയുടെ 'ഡയറക്ഷൻ കൊസൈൻസ്' കാണുക. [2]

iii) OP = $\sqrt{50}$ ആകത്തക്കവിധമുള്ള ഒരു ബിന്ദുവാണ് P. OP യുടെ 'ഡയറക്ഷൻ റേഷ്യോസ്' $\frac{3}{\sqrt{50}}, \frac{4}{\sqrt{50}}, \frac{5}{\sqrt{50}}$, എന്നിവ ആയാൽ P എന്ന ബിന്ദുവിന്റെ കോ-ഓർഡിനേറ്റ്സ് കാണുക. [2]

Direction: Answer 12 or 13.

12. Consider the following spheres

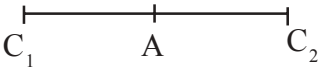
$S_1 = x^2 + y^2 + z^2 - 2x - 2y - 6z + 7 = 0$

$S_2 = x^2 + y^2 + z^2 + 2x - 2z - 7 = 0$

i) Find the centre and radius of circles S_1 and S_2. [2]

ii) Find the distance between the cetnres of S_1 and S_2.

If C_1 and C_2 are centres of S_1 and S_2 and A is the point which S_1 cuts the line $C_1 C_2$. Find the co-ordinate of A. [2]



iii) Find the equation of the smallest sphere which contains spheres S_1 and S_2. [2]

13. Consider the sphere

$S : x^2 + y^2 + z^2 - 2x - 4y + 2z - 3 = 0.$

i) Find ccentre and radius of S. [1]

ii) Find the pependicular distance from the centre of the sphere S to the plane $2x - 2y + z + 12 = 0$.

Show that this plane touches the sphere S.

[2]

iii) Find the point of contact of sphere S and the plane. [3]

14. Consider $\bar{a} = i + 2\bar{j} - 3\bar{k}$

$\bar{b} = 3i - \bar{j} + 2\bar{k}$, $\bar{c} = 11i + \bar{j}$

i) Find $\bar{a} + \bar{b}$ and $\bar{a} \cdot \bar{b}$. [1]

ii) Find the unit vector in the direction of $\bar{a} + \bar{b}$. [1]

iii) Show that $\bar{a} + \bar{b}$ and $\bar{a} - \bar{b}$ are orthogonal. [2]

iv) Find the value of λ and μ such that $\bar{c} = \lambda\bar{a} + \mu\bar{b}$. [2]

നിർദ്ദേശം: ചോദ്യം 12, 13 ഇവയിൽ ഒന്നിനു മാത്രം ഉത്തരം എഴുതുക.

12. താഴെ കൊടുത്തിരിക്കുന്ന ഗോളങ്ങൾ പരിഗണിക്കുക.

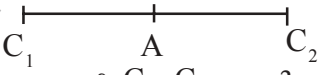
$S_1 = x^2 + y^2 + z^2 - 2x - 2y - 6z + 7 = 0$

$S_2 = x^2 + y^2 + z^2 + 2x - 2z - 7 = 0$

i) S_1, S_2 എന്നീ ഗോളങ്ങളുടെ കേന്ദ്രം, ആരം എന്നിവ കാണുക. [2]

ii) S_1, S_2 എന്നീ ഗോളങ്ങളുടെ കേന്ദ്രങ്ങൾ തമ്മിലുള്ള അകലം കാണുക?

S_1, S_2 എന്നീ ഗോളങ്ങളുടെ കേന്ദ്രങ്ങൾ തമ്മിലുള്ള അകലം കാണുക? C_1, C_2 എന്നിവ യഥാക്രമം S_1, S_2 എന്നീ ഗോളങ്ങളുടെ കേന്ദ്രങ്ങളും A എന്ന ബിന്ദു $C_1 C_2$ എന്ന രേഖയെ S_1 ഖണ്ഡിക്കുന്ന ബിന്ദുവുമായാൽ A എന്ന ബിന്ദുവിന്റെ കോ-ഓർഡിനേറ്റ്സ് കാണുക. [2]



iii) S_1, S_2 എന്നീ ഗോളങ്ങളെ ഉൾക്കൊള്ളാൻ കഴിയുന്ന ഏറ്റവും ചെറിയ ഗോളത്തിന്റെ സമവാക്യം എഴുതുക. [2]

13. $S : x^2 + y^2 + z^2 - 2x - 4y + 2z - 3 = 0.$

എന്ന ഗോളം പരിഗണിക്കുക.

i) S ന്റെ കേന്ദ്രവും ആരവും കാണുക. [1]

ii) ഗോളത്തിന്റെ കേന്ദ്രവും $2x-2y + z + 12 = 0$ എന്ന 'പ്ലെയിനും' തമ്മിലുള്ള ലംബ അകലം എത്ര? ഈ പ്ലെയിൻ ഗോളവുമായി സ്പർശിക്കുന്നവെന്ന് തെളിയിക്കുക. [2]

iii) പ്ലെയിൻ ഗോളവുമായി സ്പർശിക്കുന്ന സ്പർശബിന്ദു കാണുക. [3]

4. $\bar{a} = i + 2\bar{j} - 3\bar{k}$, $\bar{b} = 3i - \bar{j} + 2\bar{k}$, $\bar{c} = 11i + \bar{j}$ എന്നീ വെക്ടറുകൾ പരിഗണിക്കുക.

i) $\bar{a} + \bar{b}$, $\bar{a} \cdot \bar{b}$ ഇവ കാണുക. [1]

ii) $\bar{a} + \bar{b}$ യുടെ ദിശയിലുള്ള യൂണിറ്റ് വെക്ടർ കാണുക. [1]

iii) $\bar{a} + \bar{b}$, $\bar{a} - \bar{b}$ ഇവ ഓർത്തോഗണൽ എന്നു തെളിയിക്കുക. [2]

iv) $\bar{c} = \lambda\bar{a} + \mu\bar{b}$ ആയാൽ λ, μ ഇവയുടെ വിലകൾ കാണുക.. [2]

15. Let $\bar{a} = 2i + 3\bar{j} - 5\bar{k}$

$\bar{b} = 6i - 4\bar{j} + 2\bar{k}$ and

$\bar{c} = 8i + 2\bar{j} + 3\bar{k}$

Consider the product $(\bar{a} . \bar{b}) \times \bar{c}$,

$\bar{a} . (\bar{b} \times \bar{c})$ and $\bar{a} \times (\bar{b} \times \bar{c})$

i) Out of the above three products, which is not possible to find out. [1]

ii) Find the volume of the parallelopiped whose co-terminal edges are $\bar{a}$, $\bar{b}$ and $\bar{c}$. [2]

iii) Show that

$\bar{a} \times (\bar{b} \times \bar{c}) = (\bar{a} . \bar{c})\ \bar{b} - (\bar{a} . \bar{b})\ \bar{c}$

by using above vectors. [2]

Direction: Answer any one of 16 or 17.

16. A horizontal beam of length 21 m carrying a uniform load of wkg/m of length, is freely supported at the both ends satisfying the differential equation. E.I $= \frac{d^2y}{dx^2} - \frac{1}{2} wx^2 - wlx$, y being the diflection at the distance x from one end.

i) What is the order and degree of the above differential equation. [1]

ii) Find $\frac{dy}{dx}$. [2]

iii) If $y = 0, x = 0$ and $\frac{dy}{dx} = 0$ at $x = 1$. Find the deflection at any point. [2]

15. $\bar{a} = 2i + 3\bar{j} - 5\bar{k}$

$\bar{b} = 6i - 4\bar{j} + 2\bar{k}$

$\bar{c} = 8i + 2\bar{j} + 3\bar{k}$ എന്നീ വെക്ടറുകൾ പരിഗണിക്കുക.

കൂടാതെ $(\bar{a} . \bar{b}) \times \bar{c}$, $\bar{a} . (\bar{b} \times \bar{c})$, $\bar{a} \times (\bar{b} \times \bar{c})$ എന്നീ പ്രോഡക്ടുകളും പരിഗണിക്കുക.

i) മുകളിൽ പറഞ്ഞ പ്രോഡക്ടുകളിൽ കണ്ടെത്താൻ കഴിയാത്തതേത്. [1]

ii) $\bar{a}$, $\bar{b}$, $\bar{c}$ ഇവ ഒരു "പാരലലോപിപ്പിഡി"ന്റെ ഒരു മൂലയിലുള്ള വശങ്ങളായാൽ വ്യാപ്തം എത്ര? [2]

iii) $\bar{a} \times (\bar{b} \times \bar{c}) = (\bar{a} . \bar{c})\ \bar{b} - (\bar{a} . \bar{b})\ \bar{c}$ എന്ന് മുകളിൽ പറഞ്ഞ വെക്ടറുകളുടെ സഹായത്താൽ തെളിയിക്കുക. [2]

നിർദ്ദേശം: ചോദ്യം 16, 17 ഇവയിൽ ഒന്നിനു മാത്രം ഉത്തരം എഴുതുക.

16. 21 മീറ്റർ നീളമുള്ളതും തിരശ്ചീനവുമായ ഒരു ബീം wkg/m ലോഡു താങ്ങുന്നതും ഇതിന്റെ ഒരഗ്രത്തിൽ നിന്നും x യൂണിറ്റ് അകലെയുള്ള ബിന്ദുവിലെ വളവ് y യും ആയാൽ ഇത് E.I $= \frac{d^2y}{dx^2} = \frac{1}{2} wx^2 - wlx$ എന്ന ഡിഫറൻഷ്യൽ ഇക്വേഷന് അനുസൃതമാണ്.

i) മുകളിൽ പറഞ്ഞ ഡിഫറൻഷ്യൽ ഇക്വേഷന്റെ ഓർഡർ, ഡിഗ്രി എന്നിവ കാണുക. [1]

ii) $\frac{dy}{dx}$ കാണുക. [2]

iii) If $y = 0$ യിൽ $y = 0$ യും $x = 1$ ൽ $\frac{dy}{dx} = 0$ ഉം ആയാൽ ഏതൊരു ബിന്ദുവിന്റെയും ഡിഫ്ളക്ഷൻ കാണുക. [2]

17. Consider the differential equation.

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

i) Find $\frac{dy}{dx}$ degree and order of the differential equation. [2]

ii) Find the integrating factor of the above differential equaiton. [1]

iii) Solve the differential equation. [2]

18. Find $\int \sqrt{\tan x}\, dx$. [5]

17. $(x^2 - 1)\frac{dy}{dx} + 2(x + 2)y = 2(x + 1)$ എന്ന ഡിഫറൻഷ്യൽ ഇക്വേഷൻ പരിഗണിക്കുക.

i) $\frac{dy}{dx}$, ഡിഗ്രി, ഓർഡർ എന്നിവ കാണുക. [2]

ii) മുകളിൽ പറഞ്ഞ ഡിഫറൻഷ്യൽ ഇക്വേഷന്റെ ഇന്റഗ്രേറ്റിംഗ് ഫാക്ടർ കാണുക. [1]

iii) മുകളിൽ പറഞ്ഞ ഡിഫറൻഷ്യൽ ഇക്വേഷന്റെ മൂല്യം കാണുക. [2]

18. $\int \sqrt{\tan x}\, dx$ കണ്ടുപിടിക്കുക. [5]

Questionwise Analysis

Q.	CO No.	M.P	Content	Type	Level	Score	Time in Min
1.i)	8	4, 5	Limit & Continuity	O	E	1	2
ii)	8	4, 5, 7	Limit & Continuity	O	A	2	4
iii)	14	2, 4, 7, 10	Differentiation	SA	D	2	4
2. i)	14, 16	2, 5, 7	Differentiation	SA	A	4	7
ii)	14	3, 5, 7	Differentiation	SA	A	2	4
iii)	17	2, 3, 5, 7, 10	Differentiation	Essay	D	2	4
3. i)	20	2, 5	Application of differentiation	O	A	2	4
ii)	20	2, 5, 7	Application of differentiation	SA	A	2	4
iii)	20	2, 5, 7, 10	Application of differentiation	Essay	D	3	5
4. i)	24, 25	2, 5	Indefinite integral	O	E	1	2
ii)	24, 25	2, 5, 7	Indefinite integral	Essay	A	3	5
iii)	24, 25	2, 5, 7, 10	Definite integral	Essay	D	2	4
5. i)	31	2, 5, 7	Definite integral	SA	A	2	4
ii)	31	2, 5, 7, 10	Definite integral	SA	A	3	5
6* i)	31	2, 5, 7, 10	Definite integral	Essay	A	3	5
ii)	31	2, 5, 7, 10	Definite integral	Essay	D	2	4
7. i)	3	2, 5	Boolean Algebra	O	E	1	2
ii)	3	2, 5, 7	Boolean Algebra	SA	A	1	2
iii)	3	2, 5, 7, 10	Boolean Algebra	Essay	D	3	5
8. i)	6	2, 5	Probability	O	E	1	2
ii)	6	2, 5, 7	Probability	O	A	1	2
iii)	6	2, 5, 7	Probability	SA	A	2	4
9. i)	1	2, 5	Matrices and determinants	O	E	1	2
ii)	1	2, 5, 7	Matrices and determinants	Essay	A	2	4
10. i)	1	2	Matrices and determinants	O	E	1	2
ii)	1	2, 5	Matrices and determinants	SA	A	2	4
iii)	1	2, 5, 7	Matrices and determinants	Essay	A	2	4
11. i)	37	2, 5	3D - I	O	E	1	2
ii)	37	2, 5	3D - I	SA	A	2	4
iii)	37	2, 5, 7	3D - I	SA	A	2	4

Q.	CO No.	M.P	Content	Type	Level	Score	Time in Min
12.i)	41	2, 5	3D - II	O	E	2	3
ii)	41	2, 5, 7	3D - II	SA	D	2	4
iii)	41	2, 5, 7	3D - II	SA	D	2	4
13* i)	41	2, 5, 6	3D - II	O	E	1	2
ii)	41	2, 5, 6, 7	3D - II	SA	A	2	4
iii)	41	2, 5, 6, 7, 10	3D - II	Essay	D	3	5
14. i)	34	2, 5	Vector I	O	E	1	2
ii)	33	2, 5	Vector I	P	E	1	2
iii)	36	2, 5, 6	Vector II	SA	A	2	4
iv)	35	2, 5, 6, 7	Vector I	SA	A	2	4
15. i)	36	2, 5, 6	Vector II	O	E	1	2
ii)	36	2, 5, 6, 7	Vector II	SA	A	2	4
iii)	36	2, 5, 6, 7, 10	Vector II	Essay	D	2	4
16. i)	32	2, 5	Differential equaiton	O	E	1	1
ii)	32	2, 5, 6, 7	Differential equaiton	SA	A	2	4
iii)	32	2, 5, 6, 7, 10	Differential equaiton	Essay	D	2	4
17*. i)	32	2, 5	Differential equaiton	SA	E	2	4
ii)	32	2, 5, 6	Differential equaiton	SA	A	1	2
iii)	32	2, 5, 6, 7, 10	Differential equaiton	Essay	D	2	4
18.	25	2, 5, 6, 7, 10	Indefinite integral	Essay	D	5	8

O - Objective, SA - Short Answer, A - Average, D - Difficult, E - Easy

Std - XII

Sample Question Paper
MATHEMATICS
(Science Group)
Scoring Key

Total Score: 80

Time : 2 $\frac{1}{2}$ hours

Cool off Time: 15 mts.

Qn.No.	Scoring indicators	Score: Stage score	Score: Total
1. i)	Figure 5	1	
ii)	$f(x) = \cos x$ - figure 2	1	
	$f(x) = \lvert x \rvert$ - figure 4		
	$f(x) = e^x$ - figure 1		
	$f(x) = x^2 + 2$ - figure 3	1	
iii)	Figure 4.	1	
	In the figure, there is a shap edge at $x = 0$. So it is not differentiable at $x = 01$ 1	5	
2. i)	$\frac{d}{dx}(\sin x) \rightarrow \cos x.$	1	
	$\frac{d}{dx}(e^{\cos x}) \rightarrow -\sin x\, e^{\cos x}$	1	
	$\frac{d}{dx} \sin^{-1}\left(\frac{2x}{1+x^2}\right) \rightarrow \frac{2x}{1+x^2}$	1	
	$\frac{d}{dx} \sin^{-1}(x) \rightarrow \frac{1}{\sqrt{1-x^2}}$	1	
ii)	$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$		
	$= \lim_{h \to 0} \frac{\sin(x+h) - \sin(x)}{h}$	1	
	$= \lim_{h \to 0} \frac{2\cos(x + h/2) - \sin(h/2)}{2}$	1	
	$= \cos x.$		
iii)	$y_1 = \frac{1}{\sqrt{1-x^2}}$	1	
	$\sqrt{1-x^2}\ y_1 = 1$		
	Differentiate again with respect to x.		
	$(1 - x^2)\, y_2 - x y_1 = 0$	1	8

3.	i)	$24 - 2 \times 3$ $\quad 3 \times 18^2 = 972$	1	
		$24 - 2 \times 4$ $\quad 4 \times 16^2 = 1024$		
		$24 - 2 \times 5$ $\quad 5 \times 14^2 = 980$		
		$24 - 2 \times 6$ $\quad 6 \times 12^2 = 864$	1	
	ii)	$V = x(24 - 2x)^2$	1	
		Domain $0 < x < 12$		
	iii)	$\frac{dv}{dx} = -4x(24 - 2x) + (24 - 2x)^2 = 0$	1	
		$\Rightarrow x = 12, 4$	1	
		$\frac{d^2v}{dx^2} = -4x \times -2 + -4(24 - 2x) + -2(24 - 2x)$	1	
		$\Rightarrow x = 4, \frac{d^2v}{dx^2} < 0.$		
		Volume is maximum when $x = 4$ cm.	1	7
4.	i)	$e^x + c$	1	
	ii)	$I = \int e^x \sin x \, dx$	1	
		$= \sin x \, . \, e^x - \int \cos x . e^x \, dx$		
		$= \sin x \, . \, ex - \left(\cos x e^x - \int -\sin x e^x \, dx\right)$	1	
		$2I = e^x (\sin x - \cos x)$	1	
		$I = \frac{1}{2} e^x (\sin x - \cos x)$		
	iii)	$\int_0^2 e^x dx = 2 \lim_{n\to\infty} \frac{1}{n} \left[e^0 + e^{2/n} + e^{4/n} + e\frac{2n-2}{n}\right]$	1	
		$= 2 \lim_{n\to\infty} \frac{1}{n} \left[\frac{e^{\frac{2n}{n}} - 1}{e^{\frac{2}{n}} - 1}\right]$		
		$= \frac{2(e^2 - 1)}{2}$	1	
		$= e^2 - 1$	1	6

5. i) $x = x^2$ — 1

$x^2 - x = 0$

$x(x - 1) = 0$

$x = 0, 1$ — 1

When $x = 0$, $y = 0$

When $x = 0$, $y = 1$

Points of intersection (0, 0) and (1, 1)

ii) $\int_0^1 x\,dx - \int_0^1 x^2\,dx = \left(\frac{x^2}{2}\right)_0^1 - \left(\frac{x^3}{3}\right)_0^1$ — 1 + 1

$= \frac{1}{2} - \frac{1}{3} = \frac{1}{6}$ sq.units. — 1 — 5

6. i) $\int_0^r (r^2 - x^2)\,dx = \left[\frac{x}{2}\sqrt{r^2 - x^2} + \frac{r^2}{2}\sin^{-1}\frac{x}{r}\right]_0^r$

$= \frac{r^2}{2}\sin^{-1} 1$ — 1

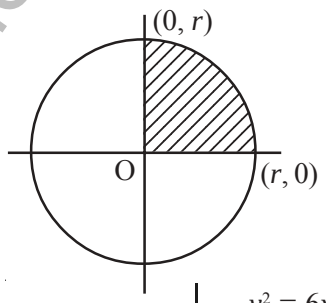
$= \frac{\pi r^2}{4}$

$y = \sqrt{r^2 - x^2}$ — 1

Area $= 4\int_0^r y\,dx$

$= 4 \cdot \int_0^r \sqrt{r^2 - x^2}\,dx$ — 1

$= 4 \cdot \frac{\pi r^2}{4} = \pi r^2$



ii) Area = Area of the circle - Interior area of the parabola — 1+1*

$= 16\pi - 2\int_0^2 y\,dx - 2\int_2^4 y\,dx$

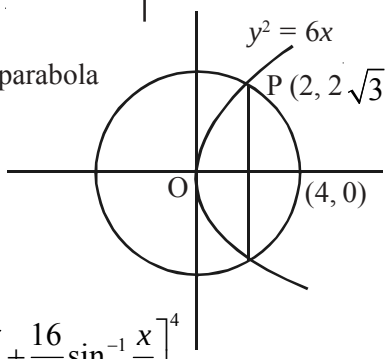
$= 16\pi - 2\int_0^2 \sqrt{6}\,x^{1/2}\,dx - 2\int_2^4 \sqrt{16 - x^2}\,dx$

$= 16\pi - 2\sqrt{6}\left[\frac{2}{3}x^{3/2}\right]_0^2 - 2\left[\frac{x}{2}\sqrt{16 - x^2} + \frac{16}{2}\sin^{-1}\frac{x}{4}\right]_2^4$ — 1

$= 16\pi - \frac{16}{\sqrt{3}} - 16 \cdot \frac{\pi}{2} + 4\sqrt{3} + \frac{8\pi}{3}$

$= \frac{-4}{\sqrt{3}} + \frac{32\pi}{3}$

$= \frac{4}{3}(8\pi - \sqrt{3})$ — 1 — 7

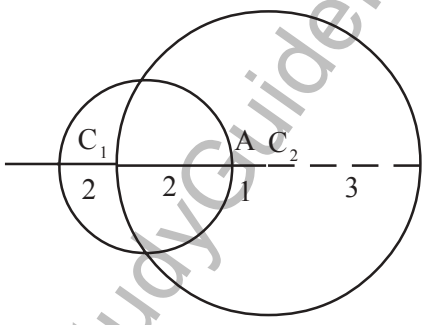


*Picture

7.	i)	True, operation + is commutative in Boolean Algebra.	1	
	ii)	True $1 = x + x'$		
		$= x + (x' \cdot 1)$	1	
		$= (x + x') \cdot (x + 1)$		
		$= 1 \cdot (x + 1)$		
		$= (x + 1) \cdot 1 = x + 1$		
	iii)	True		
		$(x + y) + (x' \cdot y') = (y + x) + (x' \cdot y')$	1	
		$= y + [x + (x' \cdot y')]$		
		$= y + [(x + x') \cdot (x' + y')]$	1	
		$= y + [1 \cdot (x + y')]$		
		$= y + [(x + y') \cdot 1]$		
		$= y + (x + y')$		
		$= (y + x) + y'$		
		$= (x + y) + y'$		
		$= x + (y + y')$	1	5
8.	i)	S = { (1, 1), (1, 2) ..... (1, 6)		
		(2, 1), (2, 2) ..... (2, 6)		
		(3, 1), (2, 2) ..... (3, 6)		
		(4, 1) ..... (4, 6)	1	
		(5, 1) ..... (5, 6)		
		(6, 1) ..... (6, 6) }		
	ii)	$1/36$	1	
	iii)	A = Getting of a number whose sum is less than 6.	1	
		B = Getting a number whose sum is greater than or equal to 6.		
		(Hint: Two events whose union is sample space and their intersection is null set)	1	4
9.	i)	$2A = \begin{bmatrix} 8 & 13 \\ 11 & 11 \end{bmatrix}$	1	

*Picture

ii)	$A = \begin{bmatrix} 4 & 13/2 \\ 11/2 & 11/2 \end{bmatrix}$, $B = \begin{bmatrix} -2 & -3/2 \\ 3/2 & 5/2 \end{bmatrix}$	1	
	$A^2 - B^2 = \begin{bmatrix} \frac{207}{4} & \frac{247}{4} \\ \frac{209}{4} & \frac{264}{4} \end{bmatrix} - \begin{bmatrix} \frac{7}{4} & \frac{-9}{2} \\ \frac{3}{4} & 4 \end{bmatrix}$		
	$= \begin{bmatrix} \frac{200}{4} & \frac{265}{2} \\ \frac{206}{4} & \frac{248}{4} \end{bmatrix}$		
	$(A + B)(A - B) = \begin{bmatrix} 32 & 31 \\ 74 & 80 \end{bmatrix}$		
	$A^2 B^2 \neq (A + B)(A - B)$	1	
	This is because $AB \neq BA$.		3
10. i)	$a_{21} = 5$	1	
ii)	$A = \begin{bmatrix} 3 & 4 & 5 \\ 5 & 6 & 7 \\ 7 & 8 & 9 \end{bmatrix}$		
	$A + A^T = \begin{bmatrix} 3 & 4 & 5 \\ 5 & 6 & 7 \\ 7 & 8 & 9 \end{bmatrix} + \begin{bmatrix} 3 & 5 & 7 \\ 4 & 6 & 8 \\ 5 & 7 & 9 \end{bmatrix}$	1	
	$= \begin{bmatrix} 6 & 9 & 12 \\ 9 & 12 & 15 \\ 12 & 15 & 18 \end{bmatrix}$	1	
iii)	$\begin{bmatrix} 3 & 9/2 & 6 \\ 9/2 & 6 & 15/2 \\ 6 & 15/2 & 9 \end{bmatrix} + \begin{bmatrix} 0 & -1/2 & -1 \\ 1/2 & 0 & -1/2 \\ 1 & 1/2 & 0 \end{bmatrix}$	1 + 1	5
11 i)	7^{th} octant	1	
ii)	Direction ratio 2, 6, 8	1	
	Direction csines are $\frac{1}{\sqrt{26}}, \frac{3}{\sqrt{26}}, \frac{4}{\sqrt{26}}$	1	

iii)	Let P (x, y, z) be the point Direction ratios of OP = x, y, z Direction cosines of OP are $\frac{x}{\sqrt{x^2+y^2+z^2}}, \frac{y}{\sqrt{x^2+y^2+z^2}}, \frac{z}{\sqrt{x^2+y^2+z^2}}$ $= \frac{3}{\sqrt{50}}, \frac{4}{\sqrt{50}}, \frac{5}{\sqrt{50}}$ $\Rightarrow$ $x, 3, y = 4, z = 5$ Since $\sqrt{x^2+y^2+z^2} = \sqrt{50}$ Therefore the point is (3, 4, 5)	1 1	5
12. i)	S_1: centre (1, 1, 3); Radius = 2 S_2: centre (-1, 0, 1); Radius = 3	1 1	
ii)	$C_1 C_2 = \sqrt{4+1+4} = 3$ Centre of the smallest sphere which contiains the S_1 and S_2 is A. (From fig.)	1	
		1	
	A divides $C_1 C_2$ in the ratio 2 : 1 Co-ordinate of A = $\left(\frac{-1}{3}, \frac{1}{3}, \frac{5}{3}\right)$		
iii)	Radius 4 units. Equation of the sphere is $\left(x+\frac{1}{3}\right)^2 + \left(y-\frac{1}{3}\right)^2 + \left(z-\frac{5}{3}\right)^2 = 0$	1 1	6

13*	i)	Centre (1, 2, -1), Radius 3	1	
	ii)	Perpendicular distance = $\frac{2\times1-2\times2-1+12}{\sqrt{4+4+1}} = 3$	1	
		Since radius and perpendicular distance are equal, the plane touches the sphere.	1	
	iii)	Equation to the line from the centre (1, 2, -1) perpendicular to plane is	1	
		$\frac{x-1}{2} = \frac{y-2}{-2} = \frac{z+1}{1} = k.$		
		Any point on the line is $(2k + 1, -2k + 2, k - 1)$	1	
		Point of contact is (-1, 4, -2)	1	6
14.	i)	$\bar{a} + \bar{b} = 4i + \bar{j} - \bar{k}$	1	
		$\bar{a} \cdot \bar{b} = -5$		
	ii)	$\bar{a} + \bar{b} = \frac{4i+\bar{j}-\bar{k}}{3\sqrt{2}}$	1	
	iii)	$\bar{a} - \bar{b} = -2\bar{j} + 3\bar{j} - 5\bar{k}$	1	
		$(\bar{a} + \bar{b}) \cdot (\bar{a} - \bar{b}) = -8 + 3 + 5$		
		$= 0$		
		$\bar{a} + \bar{b}$ and $\bar{a} - \bar{b}$ are orthogonal.	1	4
	iv)	$\lambda = 2, \mu = 3.$		
15.	i)	$(\bar{a} \cdot \bar{b}) \times \bar{c}$	1	
	ii)	$\bar{a} \cdot (\bar{b} \times \bar{c}) = \begin{bmatrix} 2 & 3 & -5 \\ 6 & -4 & 2 \\ 8 & 2 & 3 \end{bmatrix}$ = 258 cub units.	1 + 1	
	ii)	$\bar{b} \times \bar{c} = \begin{bmatrix} i & j & \bar{k} \\ 6 & -4 & 2 \\ 8 & 2 & 3 \end{bmatrix} = 16\bar{i} - 2\bar{j} - 44\bar{k}$	1 + 1	
		$\bar{a} \times (\bar{b} \times \bar{c}) = \begin{bmatrix} i & j & \bar{k} \\ 2 & 3 & -5 \\ -16 & -2 & -44 \end{bmatrix}$ $122\bar{i} - 2\bar{j} - 44\bar{k}$	1	
		$(\bar{a} \cdot \bar{c})\,\bar{b} - (\bar{a} \cdot \bar{b})\,\bar{c} = 122\bar{i} - 2\bar{j} - 44\bar{k}$.	1	7
		Thus the results follows.		

16	i)	order 2, degree 1	1	
	ii)	$\frac{d^2y}{dx^2} = \frac{1}{EI}\left(\frac{1}{2}wx^2 - wlx\right)$		
		$\frac{dy}{dx} = \frac{w}{2EI}.\frac{x^3}{3} - \frac{wl}{EI}\frac{x^2}{2} + c$	1 + 1	
	iii)	$\frac{dy}{dx} = 0$, when $x = 1$		
		Then $c = \frac{wl^3}{3EI}$	1	
		$y = \frac{1}{EI}\left(\frac{1}{24}wx^4 - \frac{wlx^3}{6}\right) + \frac{wl^3}{3EI} + c$		
		$y = 0$ where $x = 0 \Rightarrow c_1 = 0$ Therefore deflection at any point is	1	5
		$y = \frac{w}{24EI}(x^4 - 41x^3 + 81^3x)$		
17.	i)	$\frac{dy}{dx} = \frac{-2(x+2)}{x^2-1}y + \frac{2(x+1)}{x^2-1}$	1	
		degree 1, order 1.	1	
	ii)	$\int pdx = \int \frac{-2(x+2)}{x^2-1}dx$	1	
		$= \int\left(\frac{-3}{x-1} + \frac{1}{x+1}\right)dx = \log\int\frac{x+1}{(x-1)^3}$		
		$\int e^{pdx} = \frac{x+1}{(x-1)^3}$		
		I.F $= \frac{x+1}{(x-1)^3}$	1	
	iii)	Solution is		
		$y.\frac{x+1}{(x-1)^3} = c + \int\frac{2(x+1)}{x^2-1}.\frac{x+1}{(x-1)^3}dx$	1	5

18 i) $I = \int \sqrt{\tan x}\, dx$ — 1

put $\tan x = t$, $\sec^2 x\, dx = 2t\, dt$

$$dx = \frac{2t\, dt}{1+t^4}$$

$$I = \int \frac{2t^2\, dt}{1+t^4} = \int \frac{t^2+1 dt}{t^4+1} + \int \frac{t^2-1}{t^4+1} dt = I_1 + I_2$$

$$I_1 = \int \frac{t^2+1}{t^4+1} dt = \int \frac{(1+\frac{1}{t^2})}{(t+\frac{1}{t})^2 + (\sqrt{2})^2}$$ — 1

$$= \frac{1}{\sqrt{2}} \tan^{-1}\left(\frac{u}{\sqrt{2}}\right) + c_1$$ — 1

$$= \frac{1}{\sqrt{2}} \tan^{-1}\left(\frac{\tan x - 1}{\sqrt{2 \tan x}}\right) + c_1$$

$$I_2 = \int \frac{t^2-1}{t^4+1} dt = \int \frac{\left(1-\frac{1}{t^2}\right) dt}{\left(t+\frac{1}{t}\right)^2 - (\sqrt{2})^2}$$ — 1

$$= \int \frac{du}{u^2 - (\sqrt{2})^2} \text{ where } u = t + \frac{1}{t}$$

$$= \frac{1}{2\sqrt{2}} \log\left|\frac{u-\sqrt{2}}{u+\sqrt{2}}\right| + c_2$$ — 1

$$= \frac{1}{2\sqrt{2}} \log\left|\frac{t^2-\sqrt{2}t+1}{t^2+\sqrt{2}t+1}\right| + c_2$$ — 5

$\int \sqrt{\tan x}\, dx = I_1 + I_2$

APPENDIX

Curriculum Objectives

Unit - 1- Matrices and Determinants

1. Understand the concept of matrices, familiarise different types of matrices, matrix operations and the algebra of matrices by discussion, assignment, project etc.
2. Develop the concept of determinant of a square matrix and its properties, inverse of a square matrix, consistency of linear equations and their solutions by discussion, assignment, seminar etc.

Unit - 2 - Boolean Algebra

3. Develop the concepts of Boolean algebra as an algebraic structure, understand the principle of duality and prove the related basic theorems through discussion, seminar, project etc.
4. Develop the concepts of Boolean function, basic gates, combinatorial circuits and their applications in switching circuits through discussion, lab work, project, assignment etc.
5. Develop the concepts of conditional statements, biconditional statements, arguments and validity of arguments through discussion, assignment etc.

Unit - 3 - Probabiltiy

6. Understand the concepts of random experiment, sample space, events, types of events, equally-likely outcomes, mutually exclusive events, exhaustive events, algebra of events, probability of an event, addition rule, conditional probability, independent events, independent experiments and multiplication rule through discussion, lab work, seminar, assignment etc.
7. Develop the concept of random variables and probability distribution through discussion, seminar etc.

Unit - 4 - Functions, Limit and Continuity

8. Develop the concepts of real functions, domain and range, composite functions, inverse of a function, familiarize the functions - modulus function, greatest integer function, signum function, trigonometric function, inverse trigonometric function and draw the graphs of above functions by discussion, assignment, seminar etc.
9. Develop the concept of limit of a function, left hand limit, right hand limit, familiarize the related notations and the fundamental theorems on limits by drawing graphs, assignment, discussion etc.
10. Derive the standard results i) $\lim_{x\to a} \frac{x^n - a^n}{x - a} = na^{n-1}$, n is a positive integer.

    ii) $\lim_{x\to 0} \frac{\sin x}{x} = 1$ and familiarize the results (i) $\lim_{x\to 0} \frac{e^x - 1}{x} = 1$ and (ii) $\lim_{x\to 0} \frac{\log(1+x)}{x} = 1$

    by seminar, assignment etc.
11. Develop the concepts of limit at infinity, infinite limits and familiarise theorems on limits by drawing graphs, assignment, discussion etc.
12. Develop the concept of continuity of a function (i)at a point, (ii) over an open/closed interval, familiarize the concept of continuity of sum, difference, product and quotient of continuous functions by drawing graphs, assignments, discussion etc.

13. Develop the concept of continuity of special functions - trigonometric functions, logarithmic functions, exponential functions, inverse trigonometric functions and polynomial functions by drawing graphs, discussion, assignment etc.

Unit -5- Differntiation

14. Develop the concept of derivative of a function, understand its physical and geometrical significance, derive the derivatives of algebraic, trigonometric, exponential and logarithmic functions using first principle through discussion, assignment, seminar etc.

15. Develop the ideas of derivative of sum, difference, product, quotient of functions and chain rule through discussion.

16. Familiarize the methods of logarithmic differentiation, derivative of a function expressed in parametric forms, implicit functions and differentiation by substitution through discussion, seminar etc.

17. Develop the concept of second order derivative by discussion, assignment etc.

Unit - 6- Application of Derivatives

18. Develop the concepts of rate of change of quantities, applying in different situations by discussion, assignment etc.

19. Deriving the equations of tangents and normals using derivatives by discussion, lab work etc.

20. Application of the derivatives in increasing and decreasing functions, maxima and minima, greatest and least values of functions by discussion, drawing graphs, assignments etc.

21. Familiarize and apply the ideas of Rolle's theorem and Mean Value theorem, by model preparations, seminars etc.

22. Applies differentiation to find approximate values of certain quantities by discussion, assignment etc.

23. Applies differentiation to sketch simple curves by lab work, assignment etc.

Unit - 7 - Indefinite Integrals

24. Develop the concept of indefinite integrals as antiderviatives and comprehence the properties of indefinite integrals through discussion, seminar etc.

25. Develop the idea of integration of functions involving algebraic, trigonometric, exponential and logarithmic functions using suitable substitutions and trigonometric identities through discussion, seminar, etc.

26. Derive the integrals of the form $\int \frac{dx}{x^2 \pm a^2}$, $\int \frac{dx}{a^2 - x^2}$, $\int \frac{dx}{\sqrt{x^2 \pm a^2}}$, $\int \frac{dx}{\sqrt{a^2 - x^2}}$ and apply them in integrating function such as $\frac{1}{ax^2+bx+c}$, $\frac{1}{\sqrt{ax^2+bx+c}}$, $\frac{px+q}{ax^2+bx+c}$, $\frac{px+q}{\sqrt{ax^2+bx+c}}$, $\frac{1}{a+b\sin x}$, $\frac{1}{a+b\cos x}$ through discussion, assignment etc.

27. Familiarize the methods of partial fractions and their use in integration of rational expressions through discussion, seminar etc.

28. Familiarize the method of integration by parts and apply it in the evaluation of integrals of the type $\int \sqrt{x^2 \pm a^2}\, dx$, $\int \sqrt{a^2 - x^2}\, dx$, $\int \sqrt{ax^2 + bx + c}\, dx$, $\int (px + q)\sqrt{ax^2 + bx + c}\, dx$ through discussion, assignment etc.

Unit -8 - Definite Integral

29. Develop the concept of definite integral as the limit of a sum and familiarise the fundamental theorems of integral calculus through discussion, project etc.

30. Familiarise the methods of evaluating definite integral by the method of subtitution and using properties of definite integrals through discussion, seminar etc.

31. Develop the method to find the area bounded by a curve and the co-ordinate axes, by a curve, a straight line and between two curves by discussion, seminar, project etc.

Unit - 9- Differential Equations

32. Familiarize the concept of differential equations, its order, degree, the general and particular solutions and formation of a differential equation whose general solution is given and finding the solutions of different types of differential equations by discussion, assignment, seminar etc.

Unit - 10- Vectors - I (Part - B)

33. Develop the concept of vectors and differentiate different types of vectors such as equal vectors, unit vectors, zero vector, localised vector, collinear vectors, coplanar vectors, negative of a vector by group work, assignment etc.

34. Develop the idea of addition of vectors, multiplication of vectors by a scalar and its algebra through assignment, discussion etc.

35. Familiarize the concept of position vector and finding the position vector of a point dividing the line segment in the given ratio by discussion, assignment etc.

Unit -11 - Vectors - II

36. Develop and familiarize the concept of product of two vectors, dot product, cross product, area of triangle and parallelogram, solving problem in geometry and trigonometry using vector, scalar and vector tripple product of three vectors by lab work, seminar, discussion, assignment, model preparation etc.

Unit - I2 - Three Dimensional Geometry - I

37. Develop the concept of co-ordinate planes in three dimensional space, co-ordinate of a point in a space, derive the formula of distance between two points and section formulae and also develop the concept of direction cosines and direction ratios of a line joining two points, projection of the join of two points on a given line, angle between two lines whose direction ratios are given through discussion, seminar, assignment, model preparation etc.

Unit - I3 - Three Dimensional Geometry - II

38. Familiarize the concepts of cartesian and vector equation of a line through (i) a point and parallel to a given vector (ii) two points and collinearity of three points by discussion, assignment, seminar etc.

39. Develop the idea of coplanar, skew lines, derive the method to find the shortest distance between two lines and find the condition for intersection of two lines through discussion, assignment etc.

40. Comprehence the vector and Cartesian equation of a plane and derives the formulae for the angle between (i) two lines (ii) two planes (iii) a line and a plane, the condition of coplanarity of two lines in vector and cartesian form, perpendicular distance of a point from a plane by both vectors and cartesian methods using discussion, seminar, assignment etc.

41. Derive the vector and Cartesian equation of a sphere using its centre and radius, diameter form of equation of the sphere using discussion, assignment, seminar etc.

Mental Process

1 Retrieves/ Recalls/ Retells information

2 Readily makes connection to new information based on past experience and formulate initial ideas.

3 Detects similarities and differences

4 Classifies/ Categorises/ Organises information appropriately

5 Translates/ Transfers knowledge or understanding and apply them in new situations

6 Establishes cause and effect relationship

7 Makes connection/ relates prior knowledge to new information. Apply reasoning and draw inferences

8 Communicates knowledge/ understands different media

9 Imagines/ Fantasises/ designs/ predicts based on received information

10 Judges/ appraises/ evaluates the merits or demerits of idea, develops own solution to problems.