Register Number :

QP-Code : 20SC01T

Makeup Examination Nov/Dec - 2022

I / II Semester Diploma Examination

ENGINEERING MATHEMATICS (20SC01T)

Time: 3 Hours] **[Max. Marks: 100**

Instruction: i) Answer ONE full question from each section.

ii) One full question carries 20 marks.

SECTION – I

1. (a) Write four type of matrices with one example for each. **(4)**

OR

If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$ then Find $3A + 2B$

(b) If $A = \begin{bmatrix} 3 & 1 & 2 \\ 1 & 2 & 1 \\ 2 & 3 & 1 \end{bmatrix}$ then find adjA **(6)**

OR

Find the characteristic roots of the matrix $A = \begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix}$

(c) Applying Cramer's rule solve the system of linear equations **(5)**

$$3x + y = 4 \; and \; x + 3y = 4$$

OR

The Tata motors company Ltd., has two outlets, one in Bengaluru and one in Belgaum, among other things, it sells Tata Nexon, Tata Tiago, and Tata Punch cars. The monthly sales of these cars at the two stores for two months are Given in the following tables:

October sells

	Bengaluru	**Belgaum**
Tata Nexon	**25**	**35**
Tata Tiago	**15**	**20**
Tata Punch	**18**	**05**

November sells

	Bengaluru	**Belgaum**
Tata Nexon	**35**	**45**
Tata Tiago	**30**	**50**
Tata Punch	**26**	**25**

Use matrix arithmetic to calculate the change in sales of each product in each Store from October to November.

(d) If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$ then find the value of AB and then find $(AB)^T$ **(5)**

OR

For the given matrix $A = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$ verify $A \,.\, adjA = |A|I$, where ' I' is the unit matrix of the order 2.

SECTION – II

2. (a) Find the slope and y-intercept of the line 5x - 3y +9 = 0 **(4)**

OR

Find the equation of straight line of slope 3units and y-intercept 4.

(b) Find the equation of straight line passing through the point (3,4) and perpendicular to 4x+2y+3=0 . **(6)**

OR

Find the equation of straight line passing through the point (2,-5) and (3,7)

(c) Using slope point form of straight line find the equation of line passing through the point (1,2) , inclined at 45^0 to the x - axis **(5)**

OR

Find the equation of straight line whose 'x'- intercept and y-intercept are 5and 6respectively. Write the standard form of it.

(d) Find the equation of straight line passing through the point (2,3) and parallel to 5x - 4y +4 =0 **(5)**

OR

If $\frac{3}{5}$ and $\frac{7}{3}$ are the slopes of two lines, find the angle between the two lines

SECTION – III

3.(a) Convert 30^0 into radians and $\frac{\pi}{12}$ into degree. **(4)**

OR

Prove that $\tan(45^\circ + A) = \frac{1+\tan A}{1-\tan A}$

(b) Prove that $sin\theta \cos(90-\theta) + cos\theta \sin(90-\theta) = 1$ (6)

OR

Prove that $\frac{\sin(A+B)+\sin(A-B)}{\cos(A+B)+\cos(A-B)} = tanA$

(c) Write the formula for $sin(A+B)$ then find the value of $sin75^0$ (5)

OR

Simplify $\frac{\cos(360^0-A)\tan(360^0+A)}{\cot(270^0-A)\sin(90^0+A)}$

(d) Prove that $sin20^0\ sin40^0\ sin80^0 = \frac{\sqrt{3}}{8}$ (5)

OR

Prove that $cos2\theta = 2\cos^2\theta - 1$

SECTION – IV

4. (a) Differentiate $x^3 + x^2 + 3x + 9$ with respect to x. (4)

OR

If $y = (x+1)(x-1)$ then find $\frac{dy}{dx}$.

(b) Find the maximum and minimum value of a function (6)

$y = x^3 - 12x^2 - 27x + 16$

OR

A ball will throw vertically upwards and reaches maximum height s in feet.

The height reached is given by $s = -16t^2 + 64t$. How much time it takes to reach maximum height? Find also the maximum height reached by the ball.

(c) If $y = Ae^{mx} + Be^{-mx}$ then prove that $\frac{d^2y}{dx^2} - m^2y = 0$ **(5)**

OR

Find the derivative of a function $\frac{1+\sin x}{1-\sin x}$ w.r.t.x.

(d) Find the equation of normal to the curve $y = 1 - x^3$ at the point (2, 3) **(5)**

OR

If $y = (1+x^2)\tan^{-1} x$ then find $\frac{dy}{dx}$.

SECTION – V

5. a) Integrate $2x^3 - \frac{3}{x} + 4\cos x + \frac{1}{1+x^2}$ w.r.t. x **(4)**

OR

Integrate $(x-2)(x+3)$ w.r.t x.

b) Evaluate $\int \sin^2 x \, dx$ **(6)**

OR

Evaluate $\int_0^{\frac{\pi}{4}} \tan^2 x \, dx$

c) Using definite integrals,find the area bounded by the curve $y = 4x - x^2 - 3$, x-axis and the ordinates $x = 1$ and $x = 3$. **(5)**

OR

The curve $y^2 = x^2 + 5x$ is rotated about x −axis. Find the volume of the solid generated by revolving the curve between the ordinates $x = 1, x = 2$ about x −axis

d) Using integration by parts evaluate the indefinite integral $\int x\ sinx\ dx$. **(5)**

OR

Evaluate $\int_0^1 \frac{(tan^{-1}x)^3}{1+x^2}\ dx$

MAKE UP EXAMINATION NOV/DEC 2022

Course Name: Engineering Mathematics **Course Code : 20SC01T**

SCHEME OF VALUATION

Q No	Particulars	Marks	
	Section - I		
1 (a)	Types Example (each $\frac{1}{2}$ marks)	1 1 1 1	= 4
	OR		
	Finding 3A and 2B Finding 3A+2B	2 2	= 4
1(b)	Finding minors Writing cofactor Writing adjoint	4 1 1	= 6
	OR		
	Writing $\lvert A - \lambda I \rvert = 0$ Finding Characteristic Equation Finding Characteristic roots	1 3 2	= 6
1(c)	Finding $\Delta,\ \Delta_x,\ \Delta_y$ Finding x and y	3 2	= 5
	OR		
	Writing Given Data in Matrix Form Finding difference Answer	2 2 1	= 5
1(d)	Finding AB Finding $(AB)^T$	3 2	= 5
	OR		
	Finding $A.adjA$ Finding $\lvert A \rvert I$ Conclusion	2 2 1	= 5

Q.N	**PARTICULAR**	**MARKS**
	SECTION - II	
2(a)	Finding slope Finding y-intercept	2 2
	OR	
	Writing m=3 and c =4 Formula	1 1

	Substituting values Final equation	1 1
2(b)	Writing 4x+2y+K=0 Getting value of k result	2 2 2
	OR	
	Formula Substituting values Simplification and result	2 2 2
2(c)	Finding m = 1 Formula Substituting values Final equation	2 1 1 1
	OR	
	Writing standard form Substituting values Simplification Final equation	2 1 1 1
2(d)	Writing 5x-4y+K=0 Getting value of k result	2 2 1
	OR	
	Formula Substituting values Simplification Result	2 1 1 1

Q No	Particulars	Marks
	Section - III	
3 (a)	Converting 30^0 to radian Converting $\frac{\pi}{12}$ to degree	2 2 $\Big\}$ $\boxed{= 4}$
	OR	
	$\tan\,(A+B)$ formula substituting 45^0 Result	1 2 1 $\Big\}$ $\boxed{= 4}$
(b)	Allied angle change Substitution Trigonometric identity Result	2 2 1 1 $\Big\}$ $\boxed{= 6}$
	OR	
	$\sin\,(A+B)$ and $\cos\,(A+B)$ (2 mark each) Simplification Proving RHS	4 1 1 $\Big\}$ $\boxed{= 6}$
(c)	$\sin\,(A+B)$ formula each T – value $\frac{1}{2}$ mark result	2 2 1 $\Big\}$ $\boxed{= 5}$
	OR	

	Each allied angle (1 mark each) Simplification and result	4 1 $\boxed{=5}$
1(d)	Simplifying $sin20^0 sin40^0$ Simplifying $cos20^0\ sin80^0$	2 2 1 $\boxed{=5}$
	OR	
	$cos2\theta$ formula $\sin^2\theta$ formula Rest	2 2 1 $\boxed{=5}$

Q.N0	Particular	Marks
SECTION-IV		
4(a)	Differentiation of each term	1+1+1+1 $\boxed{=4}$
	OR	
	Applying algebraic formula or multiplication Differentiation and Answer	1 2+1 $\boxed{=4}$
4(b)	Finding first and second derivative of a function Getting value of x Finding maximum and Minimum value	1+1 2 1+1 $\boxed{=6}$
	OR	
	Finding $\frac{ds}{dt}$ Taking $\frac{ds}{dt}=0$ Getting time value Finding displacement value	2 1 1 2 $\boxed{=6}$
4(c)	Finding $\frac{dy}{dx}$ Finding $\frac{d^2y}{dx^2}$ Simplification and Answer	2 2 1 $\boxed{=5}$
	OR	
	Using Quotient rule Derivative of 1+sinx Derivative of 1-sinx Simplification and answer	2 1 1 1 $\boxed{=5}$
4(d)	Differentiation and getting slope Equation of normal formula Substitution and simplification	2 1 2 $\boxed{=5}$
	OR	
	Using product rule Differentiation each term Answer	2 1+1 1 $\boxed{=5}$

Q.N0	Particular	Marks
SECTION V		
5(a)	Integration of each 1 mark (1+1+1+1)	4M
	OR	
	Simplification Integration	1 M 3M
5(b)	Writing sin^2x formula Substitution Integration	2M 1 M 1M
	OR	
	Writing tan^2x formula Integration Substituting limit values Simplification	2M 1M 1M 2M
5(c)	Writing Area Formula Integration Simplification and Result	1M 2M 2M
	OR	
	Writing Volume Formula Integration Simplification and Result	1M 2M 2M
5(d)	Formula for integration by parts Substitution Calculation and Result	1M 1M 3M
	OR	
	Substitution Differentiation Finding new limits Simplification	1M 1M 1M 2M

MODEL ANSWERS

SECTION I	
1(a)	1. Row matrix $A = [1 \quad 2 \quad 3]$ 2. Column matrix $A = \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix}$ 3. Square matrix $S = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ 4. Diagonal matrix $D = \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$
	OR
	If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$ then Find $3A + 2B$ $3A = 3\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 6 \\ 9 & 12 \end{bmatrix}$ $2B = 2\begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix} = \begin{bmatrix} 6 & 4 \\ 2 & 8 \end{bmatrix}$ $3A + 2B = \begin{bmatrix} 3 & 6 \\ 9 & 12 \end{bmatrix} + \begin{bmatrix} 6 & 4 \\ 2 & 8 \end{bmatrix}$ $= \begin{bmatrix} 9 & 10 \\ 11 & 20 \end{bmatrix}$
1(b)	To find the adjoint we need to find the cofactors first
	$C_3 = +\begin{vmatrix} 2 & 1 \\ 3 & 1 \end{vmatrix}$ $= +(2-3) = -1$ $C_1 = -\begin{vmatrix} 1 & 1 \\ 2 & 1 \end{vmatrix}$ $= -(1-2) = 1$ $C_2 = +\begin{vmatrix} 1 & 2 \\ 2 & 3 \end{vmatrix}$ $= +(3-4) = -1$ $C_1 = -\begin{vmatrix} 1 & 2 \\ 3 & 1 \end{vmatrix}$ $= -(1-6) = 5$ $C_2 = +\begin{vmatrix} 3 & 2 \\ 2 & 1 \end{vmatrix}$ $= +(3-4) = -1$ $C_1 = -\begin{vmatrix} 3 & 1 \\ 2 & 3 \end{vmatrix}$ $= -(9-2) = -7$ $C_2 = +\begin{vmatrix} 1 & 2 \\ 2 & 1 \end{vmatrix}$ $= +(1-4) = -3$ $C_3 = -\begin{vmatrix} 3 & 2 \\ 1 & 1 \end{vmatrix}$ $= -(3-2) = -1$ $C_1 = +\begin{vmatrix} 3 & 1 \\ 1 & 2 \end{vmatrix}$ $= +(6-1) = +5$
	Cofactor matrix C= $\begin{bmatrix} -1 & 1 & -1 \\ 5 & -1 & -7 \\ -3 & -1 & 5 \end{bmatrix}$ AdjA= $[cofactor\ matrix]^T$ $adjA = \begin{bmatrix} -1 & 5 & -3 \\ 1 & -1 & -1 \\ -1 & -7 & 5 \end{bmatrix}$
	OR
	Given $A = \begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix}$ Characteristic equation is 'A' defined as $\lvert A - \lambda I \rvert = 0$ $\Rightarrow \begin{vmatrix} 3-\lambda & 1 \\ 2 & 4-\lambda \end{vmatrix} = 0$ $\Rightarrow (3-\lambda)(4-\lambda) - 2 = 0$ $\Rightarrow 12 - 3\lambda - 4\lambda + \lambda^2 - 2 = 0$

	$\Rightarrow 12 - 7\lambda + \lambda^2 - 2 = 0$ $\Rightarrow \lambda^2 - 7\lambda + 10 = 0$ $\Rightarrow \lambda^2 - 5\lambda - 2\lambda + 10 = 0$ $\Rightarrow \lambda(\lambda - 5) - 2(\lambda - 5) = 0$ $\Rightarrow (\lambda - 5)(\lambda - 2) = 0$ $\Rightarrow \lambda - 5 = 0 \ or\ \lambda - 2 = 0$ $\Rightarrow \lambda = 5$ or $\lambda = 2$ Therefore the characteristics roots of the given matrix are $\lambda = 5\ and\ \lambda = 2$
1(c)	Given system of linear equations $3x + y = 4$ $x + 3y = 4$ Consider $\Delta = \begin{vmatrix} 3 & 1 \\ 1 & 3 \end{vmatrix} = 9 - 1 = 8$ $\Delta_x = \begin{vmatrix} 4 & 1 \\ 4 & 3 \end{vmatrix} = 12 - 4 = 8$ $\Delta_y = \begin{vmatrix} 3 & 4 \\ 1 & 4 \end{vmatrix} = 12 - 4 = 8$ $x = \frac{\Delta_x}{\Delta} = \frac{8}{8} = 1 y = \frac{\Delta_y}{\Delta} = \frac{8}{8} = 1$ $x = 1$ and $y = 1$
	OR
	By transforming given data to matrix form Let October sells be Let November sells $O = \begin{bmatrix} 25 & 35 \\ 15 & 20 \\ 18 & 5 \end{bmatrix} N = \begin{bmatrix} 35 & 45 \\ 30 & 50 \\ 26 & 25 \end{bmatrix}$ Change in sells is given by $O - N = \begin{bmatrix} 25 & 35 \\ 15 & 20 \\ 18 & 5 \end{bmatrix} - \begin{bmatrix} 35 & 45 \\ 30 & 50 \\ 26 & 25 \end{bmatrix}$ $= \begin{bmatrix} -10 & -10 \\ -15 & -30 \\ -8 & -20 \end{bmatrix}$ or $\begin{bmatrix} 10 & 10 \\ 15 & 30 \\ 8 & 20 \end{bmatrix}$
1(d)	Given $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$ $AB = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$ $= \begin{bmatrix} (1 \times 3) + (2 \times 1) & (1 \times 2) + (2 \times 4) \\ (3 \times 3) + (4 \times 1) & (3 \times 2) + (4 \times 4) \end{bmatrix}$ $= \begin{bmatrix} 3 + 2 & 2 + 8 \\ 9 + 4 & 6 + 16 \end{bmatrix}$ $= \begin{bmatrix} 5 & 10 \\ 13 & 22 \end{bmatrix}$

	$(AB)^T = \begin{bmatrix} 5 & 13 \\ 10 & 22 \end{bmatrix}$
	OR
	Given ,$A = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$ $\Rightarrow adjA = \begin{bmatrix} 4 & -2 \\ -1 & 3 \end{bmatrix}$ Consider $A.adjA = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}\begin{bmatrix} 4 & -2 \\ -1 & 3 \end{bmatrix}$ $= \begin{bmatrix} (3 \times 4) + (2 \times -1) & (3 \times -2) + (2 \times 3) \\ (1 \times 4) + (4 \times -1) & (1 \times -2) + (4 \times 3) \end{bmatrix}$ $= \begin{bmatrix} 12 - 2 & -6 + 6 \\ 4 - 4 & -2 + 12 \end{bmatrix}$ $= \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$----------------- (1) Consider $\lvert A \rvert I = \begin{vmatrix} 3 & 2 \\ 1 & 4 \end{vmatrix}\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ $= (12 - 2)\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ $= 10\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$---------------(2) From (1) and (2) $A\,.adjA = \lvert A \rvert I$

	SECTION - II
2(a)	Find the slope and y-intercept of the line $5x - 3y + 9 = 0$ Given: $5x - 3y + 9 = 0$ $a = 5 \quad b = -3 \quad c = 9$ $Slope = \frac{-a}{b} = \frac{-5}{-3} = \frac{5}{3}$ $y - intercept = \frac{-c}{b} = \frac{-9}{-3} = \frac{9}{3} = 3$

OR

Find the equation of straight line of slope 3units and y-intercept 4.

Given: $slope\ m = 3 \quad c = 4$

$y = mx + c$

$y = 3x + 4$

$3x - y + 4 = 0$

2(b) Find the equation of straight line passing through the point (3,4) and perpendicular to $4x + 2y + 3 = 0$

Given: $4x + 2y + 3 = 0 \quad 4x + 2y + 3 = 0$

$a = 4 \quad b = 2 \quad c = 3 \quad 2x - 4y + k = 0 \ \ldots\ldots\ldots\ldots.(1)$

$Slope = \frac{-a}{b} = \frac{-4}{2} = -2 \quad 2(3) - 4(4) + k = 0$

$(y - y_1) = \frac{-1}{m}(x - x_1)$ OR $6 - 16 + k = 0$

$(y - 4) = \frac{-1}{-2}(x - 3) \quad -10 + k = 0$

$(y - 4) = \frac{1}{2}(x - 3) \quad k = 10 \quad (substitute\ in\ equ\ -1)$

$2(y - 4) = 1(x - 3) \quad 2x - 4y + 10 = 0$

$2y - 8 = x - 3$

$x - 3 - 2y + 8 = 0$ 0r $x - 2y + 5 = 0$

$x - 2y + 5 = 0$

OR

Find the equation of straight line passing through the point $(2, -5)$ *and* $(3,7)$

Given: $(x_1, y_1) = (2, -5)$

$(x_2, y_2) = (3,7)$

$(y - y_1) = \frac{(y_2 - y_1)}{(x_2 - x_1)}(x - x_1)$

$(y + 5) = \frac{(7 + 5)}{(3 - 2)}(x - 2)$

$(y + 5) = \frac{12}{1}(x - 2)$

$1(y + 5) = 12(x - 2)$

$y + 5 = 12x - 24$

$12x - y - 29 = 0$

2(c) Using slope point form of straight line find the equation of line passing through the point (1,2) , inclined at 45^0 to the x – axis

Given: $(x_1, y_1) = (1, 2)$

$\theta = 45^0$

$m = tan\,\theta$

$m = tan\,45$

$m = 1$

$(y - y_1) = m(x - x_1)$

$(y - 2) = 1(x - 1)$

$y - 2 = x - 1$

$x - y + 1 = 0$

OR

Find the equation of straight line whose ‘x’- intercept and y-intercept are 5and 6 respectively. Write the standard form of it.

Given: $a = 5$

$b = 6$

Standard form of equation is $\frac{x}{a} + \frac{y}{b} = 1$

$\frac{x}{a} + \frac{y}{b} = 1$

$\frac{x}{5} + \frac{y}{6} = 1$

$\frac{(6x+5y)}{30} = 1$

$6x + 5y = 30$

$6x + 5y - 30 = 0$

2(d)

(d) Find the equation of straight line passing through the point (2,3) and parallel to $5x - 4y + 4 = 0$

Given: $5x - 4y + 4 = 0$

$a = 5 \quad b = -4 \quad c = 4$

$Slope = \frac{-a}{b} = \frac{-5}{-4} = \frac{5}{4}$

$(y - y_1) = m\,(x - x_1)$

$(y - 3) = \frac{5}{4}\,(x - 2)$

$4\,(y - 3) = 5\,(x - 2)$

$4y - 12 = 5x - 10$

$5x - 10 - 4y + 12 = 0$

$5x - 4y + 2 = 0$

Alternative method

$5x - 4y + 4 = 0$

$5x - 4y + k = 0 \;\ldots\ldots\ldots\ldots(1)$

$5(2) - 4(3) + k = 0$

$10 - 12 + k = 0$

$-2 + k = 0$

$k = 2$

(substitute in equ -1)

$5x - 4y + 2 = 0$

OR

If $\frac{3}{5}$ and $\frac{7}{3}$ are the slopes of two lines, find the angle between the two lines

Given: $m_1 = \frac{3}{5}$ $\tan\theta = \left|\frac{m_1 - m_2}{1 + m_1 m_2}\right|$ $\tan\theta = \left|\frac{\frac{3}{5} - \frac{7}{3}}{1 + \frac{37}{53}}\right|$

$m_2 = \frac{7}{3}$ $\tan\theta = \left|\frac{\frac{9-35}{15}}{1 + \frac{21}{15}}\right|$ $\tan\theta = \left|\frac{\frac{-26}{15}}{\frac{15+21}{15}}\right|$

$\tan\theta = \left|\frac{-26}{36}\right|$ $\tan\theta = \left|\frac{-13}{18}\right|$

$\tan\theta = \frac{13}{18}$ $\theta = \tan^{-1}\left(\frac{13}{18}\right)$

SECTION III

3(a)

Consider ,$30^0 = 30^0 \times \frac{\pi}{180^0}$

$= \frac{\pi}{6}\ radians$

Consider

$\frac{\pi}{12} radians = \frac{\pi}{12} \times \frac{180^0}{\pi} = \frac{180^0}{12}$

$\frac{\pi}{12} = 15^0$

	OR
	We know that $\tan(A+B)=\dfrac{tanA+tanB}{1-tanA\ tanB}$ Consider LHS = $\tan(45^0+A)$ $\tan(45^0+A)=\dfrac{tan45^0+tanA}{1-tan45^0\ tanA}$ $\tan(45^0+\ A)=\frac{1+tanA}{1-tanA}=$ RHS
3(b)	Consider $\cos(90-\theta)=sin\theta$ $\sin(90-\theta)=cos\theta$ LHS= $sin\theta\cos(90-\theta)+cos\theta\sin(90-\theta)$ $=\ sin\theta\sin\theta+cos\theta\cos\theta$ $=\sin^2\theta+\cos^2\theta=1=RHS$ [acccording to first trigonometric identity]
	OR
	LHS= $\frac{\mathrm{Sin}(A+B)+\sin(A-B)}{\cos(A+B)+\cos(A-B)}$ $=\dfrac{(sinA\ cosB+cosA\ sinB)+(sinA\ cosB-cosA\ sinB)}{(cosA\ cosB-sin\ sinB)+(cosA\ cosB+sinA\ sinB)}$ $=\dfrac{2\ sinA\cos B}{2\cos A\ cosB}$ $=\dfrac{sinA}{cosA}$ $=tanA$ =RHS
3(c)	Consider $\sin(A+B)=sinAcosB+cosA\sin B$ $\sin75^0=\sin\ (30^0+45^0)$ $\sin(30^0+45^0)=sin30^0\ cos45^0+cos30^0 sin45^0$ $=\left(\dfrac{1}{2}\right)\left(\dfrac{1}{\sqrt{2}}\right)+\left(\dfrac{\sqrt{3}}{2}\right)\left(\dfrac{1}{\sqrt{2}}\right)$ $=\dfrac{1}{2\sqrt{2}}+\dfrac{\sqrt{3}}{2\sqrt{2}}$ $sin75^0=\dfrac{\sqrt{3}+1}{2\sqrt{2}}$
	OR
	Consider $\cos(360^0-A)=\cos\ (A)$ $\tan(360^0+A)=\tan\ (A)$ $\cot(270^0-A)=\tan\ (A)$ $\sin(90^0+A)\ =\cos\ (A)$ Consider $\frac{\cos(360^0-A)\tan(360^0+A)}{\cot(270^0-A)\sin(90^0+A)}$ $=\dfrac{cosA\ tanA}{tanAcosA}=\frac{1}{1}=1$
3(d)	LHS = $sin20^0\ sin40^0 sin80^0$ $=sin80^0 sin40^0 sin20^0$

	$= -\frac{1}{2}(\cos(120^0) - cos40^0)sin20^0$ $= -\frac{1}{2}\left(-\frac{1}{2} - cos40^0\right)sin20^0$ $= -\frac{1}{2}\left(-\frac{1}{2}sin20^0 - cos40^0 sin20^0\right)$ $= -\frac{1}{2}(-\frac{1}{2}sin20^0 - \frac{1}{2}(\sin(60^0) - sin20^0)$ $= -\frac{1}{2}\left(-\frac{1}{2}sin20^0 - \frac{1}{2}sin60^0 + \frac{1}{2}sin20^0\right)$ $= -\frac{1}{2}\left(-\frac{1}{2}sin60^0\right)$ $= -\frac{1}{2}\left(-\frac{1}{2} \times \frac{\sqrt{3}}{2}\right)$ $= \frac{\sqrt{3}}{8}$ =RHS
	OR
	We know that $cos2\theta = \cos^2\theta - \sin^2\theta$ $cos2\theta = \cos^2\theta - (1 - \cos^2\theta)$ $cos2\theta = \cos^2\theta - 1 + \cos^2\theta$ $cos2\theta = 2\cos^2\theta - 1$

SECTION-IV	
4 (a)	$\frac{d}{dx}(x^3 + x^2 + 3x + 9) = 3x^2 + 2x + 3 + 0$ $= 3x^2 + 2x + 3$
	OR

	$y=(x+1)(x-1)$ $y=x^2-1$ Diff w.r.t.x $\frac{dy}{dx}=\frac{d}{dx}(x^2-1)=2x-0=2x$
4 (b)	$y=x^3-12x^2-27x+16$ *Differentiate w.r.t.x* $\frac{dy}{dx}=\frac{d}{dx}(x^3-12x^2-27x+16)$ $\frac{dy}{dx}=3x^2-12\times 2x-27+0$ $\frac{dy}{dx}=3x^2-24x-27$ For function to be maxima or minima put $\frac{dy}{dx}=0$ $0=3x^2-24x-27 \quad \Rightarrow \quad 3x^2-24x-27=0$ Divide both side by 3 $x^2-8x-9=0$ Solve the above quadratice quation by factorizat ion method $x^2-8x-9=0 \qquad -9x^2=-9x+x$ $x^2-9x+x-9=0$ $x(x-9)+1(x-9)=0$ $(x-9)(x+1)=0$ $x-9=0 \quad or \quad x+1=0$ $x=9 \quad or \quad x=-1$ $x=9,-1$ are the stationary points $\frac{dy}{dx}=3x^2-24x-27$ Again diff w.r.t.x $\frac{d^2y}{dx^2}=3\times 2x-24+0$ $\frac{d^2y}{dx^2}=6x-24$

$When\ \ x = -1$

$$\left(\frac{d^2y}{dx^2}\right)_{x=-1} = 6(-1) - 24 = -6 - 24 = -30 \prec 0$$

Therfore the function is maxima at x = -1 and its maximum value is given

$y = x^3 - 12x^2 - 27x + 16$

$put\ x = -1$

$y_{\max} = (-1)^3 - 12(-1)^2 - 27(-1) + 16$

$y_{\max} = -1 - 12 \times 1 + 27 + 16$

$y_{\max} = -1 - 12 + 27 + 16$

$y_{\max} = 43 - 13 = 30$

$When\ \ x = 9$

$$\left(\frac{d^2y}{dx^2}\right)_{x=9} = 6(9) - 24 = 54 - 24 = 30 \succ 0$$

Therfore the function is minima at x = 9 and its minimum value is given

$y = x^3 - 12x^2 - 27x + 16$

$put\ x = 9$

$y_{\min} = (9)^3 - 12(9)^2 - 27(9) + 16$

$y_{\min} = 729 - 12(81) - 243 + 16$

$y_{\min} = 729 - 972 - 243 + 16$

$y_{\min} = 745 - 1215 = -470$

OR

$s = -16t^2 + 64t. ------------------ (1)$

$Differentiate\ w.r.t.x$

$$\frac{ds}{dt} = \frac{d}{dt}\left(-16t^2 + 64t\right) \Rightarrow \qquad \frac{ds}{dt} = -16 \times 2t + 64$$

$$\frac{ds}{dt} = -32t + 64$$

when ball reaches maximum height at that time velocity v = 0

$0 = -32t + 64$

$32t = 64$

$$t = \frac{64}{32} = 2$$

$t = 2\sec$

Therfore the ball taken time to raech maximum height is 2sec.

Now find maximum height put t = 2sec in (1)

$s = -16t^2 + 64t$

$s = -16(2)^2 + 64(2)$

$s = -16 \times 4 + 128 = -64 + 128 = 64\ feet$

4 (c)	$y = Ae^{mx} + Be^{-mx} ----------------(1)$ *Differentiate w.r.t.x* $\frac{dy}{dx} = \frac{d}{dx}\left(Ae^{mx} + Be^{-mx}\right)$ $\frac{dy}{dx} = A \times e^{mx} \times m + B \times e^{-mx} \times -m$ $\frac{dy}{dx} = Ame^{mx} - Bme^{-mx}$ Again differenti ate w.r.t.x $\frac{d}{dx}\left(\frac{dy}{dx}\right) = \frac{d}{dx}\left(Ame^{mx} - Bme^{-mx}\right)$ $\frac{d^2y}{dx^2} = Am \times e^{mx} \times m - Bm \times e^{-mx} \times -m$ $\frac{d^2y}{dx^2} = Am^2e^{mx} + Bm^2e^{-mx} = m^2\left(Ae^{mx} + Be^{-mx}\right)$ $\frac{d^2y}{dx^2} = m^2y$ from equation (1) $\frac{d^2y}{dx^2} - m^2y = 0$
	OR
	Let $y = \frac{1+\sin x}{1-\sin x}$ *Differentiate w.r.t.x* $\frac{dy}{dx} = \frac{d}{dx}\left(\frac{1+\sin x}{1-\sin x}\right)$ $w.k.t\ \frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$ $\frac{dy}{dx} = \left(\frac{(1-\sin x)\frac{d}{dx}(1+\sin x) - (1+\sin x)\frac{d}{dx}(1-\sin x)}{(1-\sin x)^2}\right)$ $\frac{dy}{dx} = \frac{(1-\sin x)(0+\cos x) - (1+\sin x)(0-\cos x)}{(1-\sin x)^2}$ $\frac{dy}{dx} = \frac{(1-\sin x)(\cos x) - (1+\sin x)(-\cos x)}{(1-\sin x)^2}$ $\frac{dy}{dx} = \frac{\cos x - \sin x\cos x + \cos x + \sin x\cos x}{(1-\sin x)^2}$ $\frac{dy}{dx} = \frac{2\cos x}{(1-\sin x)^2}$
4 (d)	$y = 1 - x^3$ Differenti ate w.r.t.x $\frac{dy}{dx} = \frac{d}{dx}\left(1-x^3\right) \Rightarrow \quad \frac{dy}{dx} = 0 - 3x^2$ $\frac{dy}{dx} = -3x^2$ $\left(\frac{dy}{dx}\right)_{at\ A(2,3)} = -3(2)^2 = -12$

	$m=-12$ The equation of normal to the curve at the point (2, 3) with slope m=-12 is $y-y_1=\frac{-1}{m}(x-x_1) \quad \Rightarrow \quad y-3=\frac{-1}{-12}(x-2)$ $y-3=\frac{1}{12}(x-2) \quad \Rightarrow \quad 12(y-3)=1(x-2)$ $12y-36=x-2 \quad \Rightarrow \quad x-2-12y+36=0$ $x-12y+34=0$
	OR
	$y=(1+x^2)\tan^{-1}x$ *Differentiate w.r.t.x* $\frac{dy}{dx}=\frac{d}{dx}\left[(1+x^2)\tan^{-1}x\right]$ $w.k.t \frac{d}{dx}(uv)=u\frac{dv}{dx}+v\frac{du}{dx}$ $\frac{dy}{dx}=(1+x^2)\frac{d}{dx}(\tan^{-1}x)+\tan^{-1}x\frac{d}{dx}(1+x^2)$ $\frac{dy}{dx}=(1+x^2)\times\frac{1}{(1+x^2)}+\tan^{-1}x\times(0+2x)$ $\frac{dy}{dx}=1+2x\tan^{-1}x$

	SECTION V
5 a)	Integrate $2x^3-\frac{3}{x}+4cosx+\frac{1}{1+x^2}$ w.r.t. x Let $I=\int 2x^3dx-\int\frac{3}{x}\,\mathrm{dx}+\int 4cosxdx+\int\frac{1}{1+x^2}\,\mathrm{dx}$ $I=\int 2x^3-\frac{3}{x}+4cosx+\frac{1}{1+x^2}\,\mathrm{dx}$ $I=\frac{x^4}{2}-3logx+4sinx+tan^{-1}x+c$
	OR
	Let $I=\int(x-2)(x+3)\,\mathrm{dx}$ $I=\int x^2+x-6\,dx$ $I=\frac{x^3}{3}+\frac{x^2}{2}-6x+c$

b)	Using $sin^2x = \frac{1-cos2x}{2}$ Then$I = \int sin^2x\, dx$ $I = \int \frac{1-cos2x}{2} dx$ $I = \int \frac{1}{2} - \frac{cos2x}{2} dx$ $I = \frac{1}{2}x - \frac{sin2x}{4} + c$
	OR
	Using $tan^2x = sec^2x - 1$ $I = \int_0^{\frac{\pi}{4}} tan^2xdx$ $I = \int_0^{\frac{\pi}{4}} sec^2x - 1\ dx$ $I = [tanx - x]_0^{\frac{\pi}{4}}$ $I = \left(tan\frac{\pi}{4} - \frac{\pi}{4}\right) - (\tan 0 - 0)$ $I = 1 - \frac{\pi}{4}$
c)	Required Area $A = \int_a^b y\, dx$ $A = \int_1^3 4x - x^2 - 3\, dx$ $A = \frac{4x^2}{2} - \frac{x^3}{3} - 3x$ $A = \left[\frac{4x^2}{2} - \frac{x^3}{3} - 3x\right]_1^3$ $A = \left[2(3)^2 - \frac{3^3}{3} - 3(3)\right] - \left[2(1)^2 - \frac{1^3}{3} - 3(1)\right]$ $A = [18 - 9 - 9] - \left[2 - \frac{1}{3} - 3\right] = \frac{4}{3}$ sq.units
	OR
	Required Volume, $V = \int_a^b y^2\, dx$ $V = \int_1^2 x^2 + 5x\ \mathrm{dx}$ $V = \left[\frac{x^3}{3} + \frac{5x^2}{2}\right]_1^2$ $V = \left[\frac{(2)^3}{3} + \frac{5(2)^2}{2}\right] - \left[\frac{(1)^3}{3} + \frac{5(1)^2}{2}\right]$ $V = \frac{59}{6}$ cubic.units
d)	Let $I = \int x\ sinx\ dx$ Integrating by parts using $\int uv\ \ dx = u\int v\ \ dx - \int\left[\frac{du}{dx}.\int v\ dx\right] dx$, we get $I = x\int sinx\ dx - \int(-cosx)\ 1dx$ $I = x(-cosx) + \int cosx\ dx$

	$I = -x\, cosx + sinx + c$
	OR
	Let $I = \int_0^1 \frac{(tan^{-1}x)^3}{1+x^2} dx$ Substituting $tan^{-1}x = t$ Differentiating w.r.t t, $\frac{1}{1+x^2} = \frac{dt}{dx} \Rightarrow \frac{dx}{1+x^2} = dt$ Lower limit $x = 0$, $t = 0$; Upper limit $x = 1$, $t = \frac{\pi}{4}$ $I = \int_0^{\frac{\pi}{4}} t^3 dt = \left[\frac{t^4}{4}\right]_0^{\frac{\pi}{4}} = \frac{\pi^4}{1024}$