MILITARY COLLEGE SUI BALOCHISTAN

IMPORTANT QUESTIONS - MATHEMATICS

CLASS - 2nd YEAR

Chapter No. 1	**Introduction to Symbolic Package: MAPLE**
Exercise	**Questions**
	MAPLE Environment and Command Practice (COMPUTER BASED)
Chapter No. 2	**Functions and Limits**
Exercise	**Questions**
1.	Find the domain and range of $f(x) = \sqrt{3x+7}$
2.	Let $f(x) = x + 5 \ and \ g(x) = \sqrt{x^2 - 1} \ (gof)(x)$
3.	If f(x)=$\sqrt{x+3} \ then \ find \ f^{-1}(3)$
4.	Find f(x) given that $f(2x) = \frac{x}{x^3-1}$
5.	If $f(x) = x^2$-1, then find f(a+h) – f(a)
6.	Define f(1) in a way that extends $f(x) = \frac{x^3-1}{x^2-1}$ to be continuous function
7.	Evaluate $\lim_{x \to \pi} \frac{\tan(sinx)}{sinx}$
8.	Evaluate $\lim_{y \to 4} \frac{2-\sqrt{y}}{4-y}$
9.	If $f(x) = ax + b$ and $g(x) = x + 3$. If$(fog)(x) = (gof)(x)$and$(f+g)(1) = 7$, find values of a and b
10.	Evaluate $\lim_{x \to +\infty} (\sqrt{x^2 + 3x} - x)$
11.	Evaluate $\lim_{x \to 0} \frac{1-cox2x}{1-cos4x}$
12.	Discuss the continuity at $x = \frac{\pi}{3}$ of the function defined by $f(x) = \begin{cases} \sqrt{1 + \sin(\pi cosx)} if \ \ x \neq \frac{\pi}{3} \\ \sqrt{2} \, if \ \ x = \frac{\pi}{3} \end{cases}$
13.	Find the value of 'a' of the function defined by $f(x) = \begin{cases} \frac{sin3x}{sin2x} if & x \neq 0 \\ \frac{2}{3} \ a & if \ \ x = 0 \end{cases}$
14.	If $y = \frac{x^2}{2}$ find the instantaneous rate of change of y w.r.t x at the point x=4
15.	If $g(x) = \frac{x-1}{x^2+1} then \ find \ (gog)(x)$
16.	Evaluate $\lim_{x \to -1} \frac{x^2+6x+5}{x^2-3x-4}$
17.	If $f(x)$=$\frac{24}{ax+b}$ with$f(1) = 6 \ and \ f(-1) = -12$, then find the values of a and b.
Chapter No. 3	**Differentiation**
Exercise	**Questions**
1.	Differentiate $y = (3 + \sqrt{x})x^5 \ w.r.t.x$
2.	Differentiate $y = \frac{x}{x^2+5} \ w.r.t.x$
3.	Find $\frac{dy}{dx}$ if $y = Cos^2 3x$
4.	Find the derivative of $\ln(3x^2 + 5x + 7) \ w.r.t.x$
5.	Differentiate $y = (x+3)^{\frac{1}{3}}$ by definition method
6.	Find $\frac{dy}{dx}$ if $y = 3tan^4 2x$

7.	Find y_2 of $\ln(1+x)$ $w.r.t.x$
8.	Find the equation of tangent line to the curve $y = 5x^2 - 2x + 3$ at a point (1,6)
9.	If $x = sin3t$ and $y = cos2t$ then find $\frac{dy}{dx}$ by chain rule
10.	If $y = 3x - x^3$ then find the stationary points on the curve
11.	Find $\frac{dy}{dx}$ of $3x^2 + xy + y^2 = 7$
12.	Find the derivative of $tanh^{-1}(tanx^3)$ w.r.t.x.
13.	Find $\frac{dy}{dx}$ of $log_7(sinx)$.
14.	If $y = x^5 + 7x^4 - 3x^2 - 5x + 9$ then find y_1.
15.	Expand $Cosx$ by using Maclaurin's series
16.	Find derivative of $x\sqrt{x^2 - a^2}$ using logarithmic differentiation
17.	Find $\frac{dy}{dx}$ if $3x^2 - 2xy + y^2 + y + 8 = 0$
Chapter No. 4,5	**Higher Order Derivatives and Vector Differentiation with Applications**
Exercise	**Questions**
1.	If $y = 2x^5 - 4x^3 + 8x^2 - 16$ then find y_3
2.	Discuss the extreme values of the function $f(x) = x^3 + 6x^2 - 15x + 5$
3.	Show that the function $f(x) = \frac{x-2}{x-1}$ is increasing in *R.*
4.	Expand $Sinx$ by using Maclaurin's series.
5.	Expand Cos$x$ by using Maclaurin's series.
6.	Apply Taylor's expansion to expand a^x at x=2.
7.	Find y_2 of $\ln(1+x)$ $w.r.t.x$
8.	If $y = (Sin^{-1}x)^2$ then show that $(1-x^2)y_2 - xy_1 = 2$.
9.	Show that the function $f(x) = \frac{x-2}{x-1}$ is increasing in *R.*
10.	Discuss the extreme values of the function by second derivative test $f(x) = 9x^3 - 45x^2 + 48x + 11.$
11.	Find the equation of tangent line to the curve $y = 5x^2 - 2x + 3$ at a point (1,6).
12.	If $x = -3Sin3t$ and $y = -cos2t$ then find $\frac{dy}{dx}$ by chain rule
13.	If $y = 3x - x^3$ then find the stationary points on the curve.
14.	If $y = x^4 + 7x^3 - 3x^6 - 5x + 9$ then find y_2.
15.	If $y = 2x^5 - 4x^3 + 8x^2 - 16$ then find y_3.
16.	Discuss the extreme values of the function $f(x) = x^3 + 6x^2 - 15x + 5$
17.	If $a = 2i + 3j - 4k$ and $b = 5i - j + 2k$, find $\|3a + b\|$.
18.	Find the velocity of the position vector at time t $\underline{r}(t) = (1-5t)\,\hat{\imath} - t^2\hat{\jmath} + (e^t - 1)\,\hat{k}$ at $t = 2.$
Chapter No. 6	**Integration**
Exercise	**Questions**
1.	Integrate $\int \frac{Sinx}{1+Cos^2x}dx.$.
2.	Evaluate $\int \frac{\sqrt{tan^{-1}x}}{1+x^2}\,dx$
3.	Find the area under the curve $y^2 = 9x, x = 3,\ x = 5$ and *x-axis* in the first quadrant.

4.	Find the value of definite integral $\int_{-3}^{4}(x^2+3x)dx$
5.	Evaluate $\int_{1}^{3}\frac{x-x^2}{x^2}\,dx$
6.	Evaluate $\int\frac{x+1}{x^3-x^2-2x}$ dx.
7.	Evaluate $\int x\ln(x+\sqrt{1+x^2})\ dx.$
8.	Evaluate the integral by parts $\int x\ tan^{-1}x\ dx.$
9.	Integrate the given function by partial fraction $\frac{2x}{(x-1)(x^2+4)}$
10.	Evaluate $\int x\ln x\ dx.$
11.	Evaluate $\int\sqrt{a^2-x^2}\ dx$
12.	Find the value of k if $\int_{1}^{3}(3x^2+2x+k)dx=11$
13.	Find the integral of $Sin^3x\ Cosx$
14.	Integrate $\int\frac{Cos}{1+Sin^2x}dx.$
15.	Evaluate $\int 2\ \frac{\sqrt{tan^{-1}x}}{1+x^2}\ dx.$
16.	Find the value of definite integral $\int_{-3}^{4}(2y^2+3y)dy.$
17.	Evaluate the integral by parts $\int x\ tan^{-1}x\ dx.$
18.	Integrate the given function by partial fraction $\frac{2x}{(x^2-1)(x^2+4)}.$
19.	Evaluate $\int\sqrt{a^2-x^2}\ dx.$
20.	Find the value of definite integral $\int_{-3}^{4}(3x^2+3x-2)dx.$
21.	Integrate by partial fraction $\int\frac{2x+1}{(x+1)(x-1)}\ dx.$
Chapter No. 7	**Plane Analytic Geometry-Straight Line**
Exercise	**Questions**
1.	Find the distance between the following two points. A(-8,6) , B(3, -5) P(8, -5) , Q(-2, -7)
2.	Find a point on the x-axis which is equidistance from the points (-6, 4) and (8, 9).
3.	Show that the points (1,0) , (0, l) and (-3,4) lie on a straight line.
4.	Find the coordinates of the point which divides the line joining (2, -5) and (5, 7) internally and externally in the ratio 2:3.
5.	For what value of *m* the line joining P (2,-3), Q(7,m) and the line joining R(-4,7), S(-7,13) are parallel.
6.	Find the equation of straight-line using slope intercept form if it has Gradient 7 and y-intercept -8.
7.	Find the equation of straight line using point slope form if it has slope $\frac{-1}{2}$ and passing through (-4, -7).
8.	Find the equation of the line whose x-intercept is three times its y-intercept and passing through the point (2, -3).
9.	Find the value of k for which the (k-3) x – (4 - k ^{2}) y+ k ^{2}—7k +6=0 is Parallel to x-axis.
10.	Determine whether the point (1, 3) lies below or above the line 5x + 3x -9 = 0
11.	Find the distance of the point (-2,3) from the line 5x- 4y+ 2 = 0.

12.	Find the perpendicular distance from the point (5,6) to the line 7x-3y +12 = 0.
13.	What is the equation of the line passes through (2, -2) and the point of intersection of 2x+3y-5=0 and 7x-5y-2=0?
14.	Find *m* so that the lines; x - 2y + 1 = 0, 2x - 5y + 3 = 0 and 5x + 9y + m = 0 are concurrent.
15.	Find the equation of a line through (7,11) and perpendicular to a line through (-1,5) and (7,6)
16.	Find the equation of a line passing through two points (-1, 5) and (2,8)
17.	Find the equation of straight line passing through a point (-2, 3) with slope $\frac{1}{2}$
18.	Find the slope of the line joining the points (-9,-11) and (6,8).
19.	Find the equation of a line passing through two points (-1, 5) and (2,8).
20.	Show that the points (1,0), (01) and (-3,4) lie on a straight line
21.	Find the equation of tangent and normal to the curve $y = x^4 - 6x^3 + 13x^2 - 10x + 5$ at a point (0, 5).
22.	Find the equation of a line through (8,3) and also through the midpoint of line segment between (3,5) and (8,10).
23.	Find equation of the line through the point of intersection of the lines $3x + 2y + 5 = 0$ and $11x + 2y - 9 = 0$ with inclination 60^0.
Chapter No. 8	**Conics-I**
Exercise	**Questions**
1.	Find an equation of a circle, whose centre and radius are (-3,-1), r=2
2.	Find the centre and radius of the circle $3x^2 + 3y^2+6x-3y-7=0$.
3.	Find equation of a circle which passes through the three points A(4,5), B (-4,-3), C (8, -3).
4.	Find equation of a circle which passes through the points (0,0) ,(0,4) and the line 5x- 4y = 0 is tangent at (0,0).
5.	Find the co-ordinate of the points if the line x—2y+3=0 cuts the circle $x^2 + Y^2 = 9$. Also find the length of the chord intercepted.
6.	Find the condition that the line lx+ my + n = 0 may touch the circle $x^2 + Y^2 = r^2$
7.	Find equations of the tangents drawn of from (5, 7) to $x^2 + y^2$ —8x+ 6y +3 = 0.
8.	If A(-1,1) and B (2,4) are the end points of the chord AB of the circle $x^2 + y^2$ - 4x-2y- 4=0 then show that the line from the centre of the circle is perpendicular to chord AB .
9.	If A(-3,0), B(3,0) are end points of diameter of circle. A point C(0,-3) is on the circle whose centre is at origin. Show that m*L*ACB = 90^0
10.	Two chords AB and CD having vertices A(-2,1), B(2,—3), C(2,5), D(6,1) respectively with equation of circle $x^2 + y^2$ - 4x- 2y - 11=0. Show that the distance from centre of circle to the chords AB and CD are equal.
Chapter No. 9	**Conics-II**
Exercise	**Questions**

1.	Find the focus, vertex, directrix and co-ordinates of focal chord. Also sketch the graph $y^2 = 6x$.
2.	Find the equation of parabola with the given elements as Focus (0, -5) , Vertex (0, 0)
3.	Find the equation of parabola with the given elements Focus (5, 7) and directrix 4x+3Y+8=0
4.	For what values of a will the parabola $x^2 = 4ay$ passes through the point (3,2).
5.	For what value of c, the line 3x+2y—c = 0 will touch the parabola $x^2 = 6y$?
6.	Find the equation of tangent to a parabola $y^2 = 9x$ which is perpendicular to the line 4x+y+l = 0.
7.	Find the centre, foci, vertices, co-vertices, eccentricity and directrices of the ellipse $x^2 + 9y^2 = 36$.
8.	Find the centre, foci, vertices, co-vertices, eccentricity and directrices of the following ellipse $x^2 + 4y^2 - 16x + 16y + 76 = 0$.
9.	Find an equation of ellipse with the given elements as centre at (3, —l) , major axis on x-axis and the points E (-2, -1) and F (3, 2).
10.	Find an equation of ellipse with the given elements as Foci (4, 1) and (0, l) , Vertices (-1,1), (5,1)
11.	Find the centre, foci, vertices, co-vertices, eccentricity and directrices of the following hyperbola $16y^2 - 25x^2 = 400$
12.	Find the centre, foci, vertices, co-vertices, eccentricity and directrices of the following hyperbola $81x^2 - 16y^2 - 64y - 1360 = 0$
13.	Find the equation of hyperbola with the given elements as the points (—3, 5) and (2, —4) lie on hyperbola and transverse axis is along x-axis
14.	Find the equation of hyperbola with the given elements as Focus: (—2, 3), Centre (l, 3) and directrix x =±1.
15.	For what value of c; the line $y = 5x + c$ will touch the hyperbola $\frac{x^2}{25} - \frac{y^2}{4} = 1$.
Chapter No. 10	**Differential Equations**
Exercise	**Questions**
1.	Determine the order and degree of the ordinary differential equation $\frac{dy}{dx} = x^3 + 2y$
2.	Determine the order and degree of the ordinary differential equation $x^2 \frac{d^2y}{dx^2} + y \frac{dy}{dx} + 5 = 0$
3.	Show that the given function is a solution of the differential equation $x^2 = x\,(2 - x)$, $\frac{dy}{dx} = \frac{1-x}{y}$
4.	find the particular solution where the general solution of differential equations $3y^2 = ln\,(1 + x^3)^2 + c$, y(0) = 2
5.	Find the general solution of the following differential equations $\frac{dy}{dx} = 1 + x + y^2 + xy^2$
6.	Find the general solution of the following differential equations $\frac{dy}{dx} = \frac{x^2}{y^2}$

7.	Solve the following homogeneous differential equations $\frac{dy}{dx} = \frac{x^3 - x^3}{x^2y - xy^2}$
8.	Reduce the following differential equations in homogeneous form and then solve $(2x + y + 1)dx - (6x + 3y - 1)dy = 0$

Chapter No. 11 Partial Differential

Exercise	Questions
1.	If $f(x, y) = xy\,e^{2x} + (2x - 3y)^2$, then evaluate the following (i) $f(0,0)$ (ii) $f(2,3)$ (iii) $f(y, 3)$
2.	Given W = $x^2 \sin xy$, then find $\frac{\partial w}{\partial x}$ at $(\frac{1}{2}, \pi)$
3.	Find the degree of the following homogeneous functions. (i) $V = f(x, y) = ax^2 + 2bxy + cy^2$ (ii) $V = f(x, y) = \frac{x^3 + y^3}{x + y}$
4.	If $V = f(x, y) = f(\frac{y}{x})$, show that $x\frac{\partial V}{\partial x} + y\frac{\partial V}{\partial y} = 0$
5.	Verify Eulers theorem for the following homogeneous functions. $V = f(x, y) = (x^2 - xy + y^2)^{-1}$

Chapter No. 12 Introduction to Numerical Methods

Exercise	Questions
1.	Using bisection method, find the root correct to 3 decimal places of the following functions with indicated interval. $f(x) = Sinx - e^x$ [0.5, 0.7], x is in radian.
2.	Using bisection method, find the root correct to 3 decimal places of the following functions with indicated interval $f(x) = x^3 - 9x + 1$, [2, 4]
3.	Using Regula-Falsi method, find the root correct to 3 decimal places of the following functions with indicated interval. $f(x) = x^6 - x - 1$, [1, 1.2]
4.	Using Newton-Raphson method, find the root correct to 3 decimal places of the following functions with indicated initial value. (i) $f(x) = x^2 - 5x + 2$, $x_0 = 0.5$ (ii) $f(x) = Sinx - 5x + 2$, $x_0 = 0.4$ x is in radian
5.	Use the trapezoidal rule to approximate the value of definite integral. Round the answer upto 3 decimal places and compare results with the actual value of the definite integral: (i) $\int_1^2 x^2\,dx$, $n = 3$ (ii) $\int_0^1 \left(\frac{x^2}{2} - 1\right) dx$, n=4.
6.	Use Simpson's rule to approximate the value of each definite integral. Round the answer upto 3 decimal places and compare your results with the actual value of definite integral (i) $\int_2^4 x^3\,dx$, $n = 4$

	(ii) $\int_{1}^{3}\left(\frac{x^2}{3}+1\right)dx$, n=4.
7.	Evaluate the following definite integrals by Simpsons rule $\int_{-1}^{1} e^{x^2}\ dx\ \ , x=2$