APOLLO

FBISE Mathematics Class 12
Topical workbook - Volume 2 of 3

140 questions arranged by official framework topic.
National Curriculum 2022-23; supported examinations from 2027.

APOLLO

Integration-II (Techniques of Integration)

Domain A: Numbers and Algebra

First Annual 2025 | Section B Q2(ix) OR | 4 marks

	Evaluate $\int \sqrt{1-\cos 2x}\,dx$	04

First Annual 2025 | Section B Q2(vi) | 4 marks

(vi)	Evaluate $\int_0^1 \frac{3x}{\sqrt{4-3x}}dx$	04

OR	Evaluate $\int\sqrt{1+\sin x}dx$ *where* $\left(\frac{-\pi}{2}<x<\frac{\pi}{2}\right)$	08

OR	Evaluate	(a) $\int a^{x^2} x\,dx \ (a>0, a\neq 1)$ (b) $\int (a-2x)^{\frac{2}{3}} dx$	**04**

Second Annual 2025 | Section C Q4 OR | 8 marks

OR	Evaluate $\int \frac{x\sin^{-1}x}{\sqrt{1-x^2}}dx$ by parts.	**08**

First Annual 2026 | Section A Q19 | 1 mark

$3x + 4y + 5 = 0$ is:

9. To evaluate $\int 2xe^{x^2}\,dx$, the appropriate substitution is:	$u = x^2$	$u = e^{x^2}$	$u = 2x$	$u = x$
... The	inside the	outside the		

increasing or decreasing at $x = 1$.

Evaluate the integral using substitution $x = 5tan\theta$:

$$\int \frac{1}{\sqrt{x^2+25}}\,dx$$

Transform the linear equation $3x - 4y + 8 = 0$ into

Evaluate using the method of partial fractions and express your answer as a single logarithm:

$$\int \frac{6x^2 + 11x + 3}{(x+1)(x+2)(x+3)}\, dx$$

Find the coordinates of the centre of the circumcircle

08	OR	Using partial fraction, evaluate $\int \frac{6x^2+5x+4}{x(x+1)(x-1)(x+2)}\,dx$

FBISE model paper | Section B Q2(ix) | 4 marks

ix.	Evaluate $\int \frac{dx}{x^2-1}$	4

FBISE model paper | Section B Q2(xi) OR | 4 marks

Evaluate $\int xe^{-x}dx$	4

Q5	Evaluate $\int(\theta^4 + \pi)e^{3\theta}d\theta$	8

APOLLO

Differential Equations

Domain A: Numbers and Algebra

FBISE model paper | Section A Q1(x) | 1 mark

x.	In which real-life scenario would the concept of first order differential equations be most applicable?	Predicting the speed of a moving car	Modeling the cooling of a hot beverage	Designing an electric circuit	Calculating the area of a triangle

FBISE model paper | Section B Q2(i) OR | 4 marks

OR	Solve the separable differential equation: $\frac{dy}{dx} = \frac{y^2 - 1}{x}$ Determine the general solution and express y in terms of x.	4

Q5	Solve the first-order homogeneous differential equation: $(x^2 + y^2)dx = 2xy\,dy$	8

$\frac{2x-1}{x^3-x^2-2x}dx$	08	OR	Solve the homogeneous differential equation $2xy\,dy-(x^2+3y^2)dx=0$	08

	and co-vertices only. (Graph paper is not required)	
OR	Solve the homogeneous differential equation $2xydy-(3x^2+y^2)dx=0$	**08**

Second Annual 2025 | Section B Q2(iii) OR | 4 marks

OR	Find orthogonal trajectory of the family of circles $x^2 + y^2 = a^2$	**04**

Second Annual 2025 | Section B Q2(xi) | 4 marks

(xi)	Solve the separable differential equation $\frac{dy}{dx} = \frac{y}{x+1}$	**04**

Q.5	Solve the homogeneous differential equation $\frac{dy}{dx} = \frac{x+y}{x-y}$	**08**

First Annual 2026 | Section B Q2(i) OR | 4 marks

The population of a city grows at a rate proportional to its current population. In 2020, the population was 50,000. In 2025, it became 60,000. (a) Find the growth constant k. (b) Predict the population in 2030.	04

First Annual 2026 | Section B Q2(iv) | 4 marks

Solve the separable differential equation: $\frac{dy}{dx} = \frac{y+1}{x-2}$	04

Q.6	Find general solution of homogeneous differential equation $$\frac{dy}{dx} = \frac{x^2 + y^2}{xy}$$	**08**

Solve the separable differential equation: $\frac{dy}{dx} = \frac{y-2}{x+6}$	04

Q.6	Find the general solution of the homogeneous differential equation: $\frac{dy}{dx} = \frac{x^2 + 3y^2}{xy}$	08

First Annual 2025 | Section B Q2(i) OR | 4 marks

Solve the differential equation. $\frac{dy}{dx}+\frac{2xy}{2y+1}=x$	04

Second Annual 2025 | Section B Q2(vi) | 4 marks

(vi)	Show that $y=cx-1$ is solution of the differential equation $\frac{xdy}{dx}=1+y$

FBISE model paper | Section A Q1(xviii) | 1 mark

xviii.	What is the solution of the differential equation$xdy - ydx = 0$?	$y = cx$	$y = ce^x$	$x - y = c$	$xy = c$

FBISE model paper | Section B Q2(iv) | 4 marks

iv.	Solve the differential equation $\frac{dy}{dx} = 1 - xy + y - x.$	4

Anwar is driving a car with uniform speed $x + xt$, find: (i) Distance as a function of 't' (ii) Constant when $x(0) = 2$	4

OR	Solve the differential equation $y^2dx + (xy + x^2)dy = 0$	8

APOLLO

Numerical Solution of Non-linear Equations

Domain A: Numbers and Algebra

FBISE model paper | Section A Q1(xi) | 1 mark

xi.	What is the next approximation, correct to two decimal places, for $f(x)=x^3-x^2+4x-4=0$ with an initial guess $x=2$ using the Newton-Raphson Method?	0.67	1.00	1.33	1.50

FBISE model paper | Section B Q2(ii) OR | 4 marks

OR	Use the bisection method to approximate a root of the nonlinear equation: $f(x)=x^3-x-2$ in the interval $[1,2]$. Perform three iterations and find the following: a. The midpoint at each iteration. b. The value of $f(x)$ at the midpoint. c. The approximate root after three iterations.	4

First Annual 2025 | Section B Q2(iii) OR | 4 marks

] $\frac{dy}{du}$	04	OR	Compute two iterations up to 4 decimal places of $f(x)=x^3-5x+1$ by using Newton Raphson's method with initial start $x_o=0.5$	04

First Annual 2025 | Section B Q2(xii) | 4 marks

(xii)	Compute four iterations of the function $f(x)=2x^3-5$ in the interval $[0,2]$ by using Bisection method	04

First Annual 2025 | Section B Q2(iii) OR | 4 marks

04	OR	Compute two iterations up to 4 decimal places of $f(x)=2x^3-5x+1$ by using Newton Raphson's method with initial start $x_o=0.5$	04

First Annual 2025 | Section B Q2(xii) | 4 marks

(xii)	Compute four iterations of the function $f(x)=2x^3-7$ in the interval $[0,2]$ by using Bisection method.	04	OR	Find $\frac{dy}{dx}$, when $3x^3-6x^2y^2-5y^3=0$	04

(4 x 8 = 32)

OR	Use Bisection method to find a real root of $f(x) = x^3 - 3x + 1 = 0$ Take initial interval [0,1], perform four iterations and give approximate root after the 4th iteration.	08

First Annual 2026 | Section B Q2(viii) OR | 4 marks

(viii)	The radius of a sphere is measured as 10 cm with a possible error of 0.05 cm. Use differentials to find the approximate percentage error in the volume.	**04**	**OR**	Use the Bisection Method starting with interval $[2,3]$ for $f(x) = x^3 - 2x - 5$. Perform two iterations and state the new interval after each.	**04**

First Annual 2026 | Section B Q2(viii) OR | 4 marks

		$N(4, 2)$.
04	**OR**	Apply the Regula-Falsi Method to determine a real root of $x^3 - 5x + 1 = 0$ in the interval $[0,1]$, correct to two decimal places.

First Annual 2026 | Section C Q3 OR | 8 marks

		Use Bisection method to find a real root of $f(x) = x^3 - 3x + 1 = 0$ Take initial interval [0,1], perform four iterations and give approximate root after the 4th iteration.
08	OR	

FBISE model paper | Section A Q1(xix) | 1 mark

xix.	The positive root of $3t - cost - 1$ by using the Regula-Falsi method and correct to 3 decimal places are:	0.507	0.670	0.570	0.607

FBISE model paper | Section B Q2(v) | 4 marks

v.	Compute four iterates of the bisection method for the function $f(x) = 2e^{-x} - 5 = 0$ for [0, 1].	4

FBISE model paper | Section B Q2(xii) | 4 marks

xii.	Use the Newton-Raphson iterative method to approximate the actual root $r = 0.438447$ of the non-linear equation $f(x) = x^2 - 5x + 2$ with initial start $x_o = 0.4$ that must be accurate to six decimal places.	4

APOLLO

Analytical Geometry (Concurrency of straight lines)

Domain B: Geometry

FBISE model paper | Section A Q1(xii) | 1 mark

xii.	If $a^2+b^2-c^2+2ab=0$, then family of straight lines $ax+by+c=0$ is concurrent at the points:	$(1,-1)$	$(-1,1)$	$(1,-2)$	$(1,1)$

FBISE model paper | Section A Q1(xiii) | 1 mark

xiii.	The slope of a line perpendicular to a vertical line is:	0	1	-1	undefined

FBISE model paper | Section C Q4 | 8 marks

Q4	Given the vertices of a triangle A (2,3), B (8,7), and C (4,11): a. Find the equation of the altitude from vertex A. b. Find the equation of the right bisector of side BC. c. Verify that the altitude and the right bisector intersect on the circumcircle of the triangle.	8

OR	Find the equation of line passing through the point of intersection of lines $x + y = 3$ and $x - y = 1$ and parallel to line $x - 3y = 2$ and write it into slope intercept form.	**3+1**

	a. $\frac{\partial f}{\partial x}$ **b.** $\frac{\partial f}{\partial y}$
(xii)	Compute four iterations of the function $f(x) = 2x^3 - 5$ in the interval $[0,2]$ by using Bisection method

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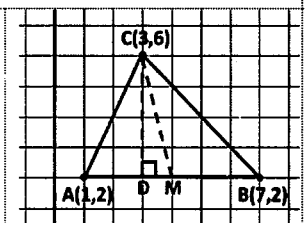
Note: Solve the following Questions.

Q.3 The growth of bacteria is given by the function of time (t) (in hours) $f(t) = 500e^{0.2St}$, then find:

a. Initial number of Bacteria at t=0
b. Number of Bacteria after $t = 4$ hours
c. Number of Bacteria after $t = 8$ hours
d. The time if number of Bacteria is $500e^3$.
e. Is $f(t)$ continuous at $t = 4$ hours and $t = 8$ hours?

Q.4 In the given ΔABC find equation of:

a. Median $\overline{CM}$
b. Altitude $\overline{CD}$
c. Right bisector of $\overline{AB}$ at mid-point, M



OR	Find the equation of line passing through the point of intersection of lines $x+2y=5$ and $x-2y=1$ and parallel to line $x-2y=3$ and write it into slope intercept form.	**04**

	a. $\frac{\partial}{\partial x}$ b. $\frac{\partial}{\partial z}$
(xii)	Compute four iterations of the function $f(x) = 2x^3 - 7$ in the interval $[0,2]$ by using Bisection method.

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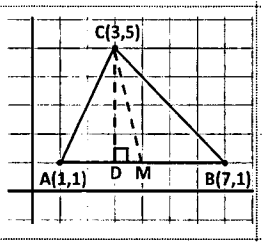
Note: Solve the following Questions.

Q.3 The growth of a virus is the function of time (t) (in hours) $f(t) = 200e^{0.5t}$, then find:

a. Initial number of virus at $t = 0$
b. Number of virus after $t = 2$ hours
c. Number of virus after $t = 4$ hours
d. The time when number of virus is $200e^4$.
e. Is $f(t)$ continuous at $t = 2$ hours and $t = 4$ hours.

Q.4 In the given ΔABC find equation of:

a. Median $\overline{CM}$
b. Altitude $\overline{CD}$
c. Right bisector of $\overline{AB}$ at mid-point M



(viii)	Reduce the equation $6x + 8y - 48 = 0$ to slope intercept form, two intercepts form and normal form.	04

Q.6	Find equations of **medians** of a triangle whose vertices are A (2,3), B (6,7) and C (4,1).	**08**

Find the equation of the median drawn from vertex $A(2, 4)$to the side joining $B(6, 2)$and $C(4, -2)$.	04

Q.5	For the triangle with vertices $A(0,0)$, $B(4,0)$, $C(0,6)$, verify that the three medians are concurrent. Find the point of concurrency (centroid).	**08**

Find the equation of the perpendicular (right) bisector of the side joining the points $M(-2, 6)$ and $N(4, 2)$.	04

Q.5	For the triangle with vertices $A(1,1), B(9,1), C(1,9)$, verify that the three right bisectors are concurrent. Find the point of concurrency (circumcenter).	08

First Annual 2025 | Section B Q2(vii) OR | 4 marks

Show that the lines $3x-4y-3=0$, $5x+12y+1=0$, $32x+4y-17=0$ are concurrent.		04

First Annual 2026 | Section A Q4 | 1 mark

In a triangle with vertices $A(1,2), B(3,4), C(5,0)$, the median from vertex A passes through:	$(4,3)$	$(2,3)$	$(3,2)$	$(4,2)$
The system of linear equations		infinite	a unique	

$(x+1)(x+2)(x+3)$

Find the coordinates of the centre of the circumcircle of a triangle with vertices $A(2,3)$, $B(6,7)$, and $C(8,3)$.

First Annual 2026 | Section C Q6 | 8 marks

Find equations of medians of a triangle whose vertices are A (2,3), B (6,7) and C (4,1).	08

FBISE model paper | Section A Q1(xii) | 1 mark

xii.	The three lines defined by the equations $x + 2y = 0, 2x + y = 0, 3x + 5y = 0$ are:	sides of a triangle	Perpendicular	concurrent	parallel

Q4	(a) $A(5,1)$, $B(3,-5)$ and $C(-3,7)$ are the vertices of triangle ABC. Find equations of medians of triangle ABC. (b) Show that medians of triangle ABC are concurrent.	8

APOLLO

Area of a Triangular Region

Domain B: Geometry

First Annual 2025 | Section B Q2(viii) | 4 marks

(viii)	Find the area of a triangle if its vertices are $A(5,4), B(2,1)$ and $C(7,3)$	**04**

First Annual 2025 | Section B Q2(viii) | 4 marks

(viii)	Find the area of a triangle if its vertices are $A(4,5), B(5,2)$ and $C(6,7)$.	**04**

Second Annual 2025 | Section B Q2(iii) | 4 marks

(iii)	Find area of a triangle having vertices A(1,2), B(4,6) and C(5,2).	04

Second Annual 2025 | Section B Q2(xi) OR | 4 marks

OR	Find area of the triangle with vertices $A(1,4)$, $B(2,-3)$ and $C(3,-10)$	04

APOLLO

Homogeneous Equations

Domain B: Geometry

OR	A surveillance drone is flying along a straight path defined by the equation $3x + 4y - 12 = 0$, while a stationary communication tower is located at (2,3). a. Find the shortest distance between the drone's path and the communication tower. b. Interpret the result in the context of the real-world scenario.	4

FBISE model paper | Section B Q2(iv) OR | 4 marks

OR	The second-degree homogeneous equation $4x^2 + 6xy + y^2 = 0$ represents a pair of straight lines passing through origin. Find an acute angle θ between the two lines.	4

First Annual 2025 | Section B Q2(vii) OR | 4 marks

OR	If $3x^2 - 2xy - 8y^2 = 0$ is 2nd degree homogeneous equation then find: a. Pair of straight lines b. Angle between these lines

First Annual 2025 | Section B Q2(vii) OR | 4 marks

OR	If $8x^2 - 2xy - 3y^2 = 0$ is 2nd degree homogeneous equation then find: **a.** Pair of straight lines **b.** Angle between these lines	**04**

First Annual 2026 | Section B Q2(v) | 4 marks

For the homogeneous equation $3x^2 - 5xy + 2y^2 = 0$: (a) State whether it represents a pair of lines through the origin. (b) Find the individual line equations.	**04**

For the homogeneous equation: $x^2 - 7xy + 12y^2 = 0$ **(a)** State whether it represents a pair of lines through the origin. **(b)** Find the individual line equations.	**04**

OR	Find the lines represented by the equation $6x^2 - 19xy + 15y^2 = 0$. Also find measure of angle between them.	**08**

APOLLO

Vector Valued Function

Domain B: Geometry

FBISE model paper | Section A Q1(xiv) | 1 mark

xiv.	If $\vec{r}(t) = \ln(t-2)\hat{i} + \sqrt{4-t}\,\hat{j} + e^t\hat{k}$, then domain of $\vec{r}(t)$ is:	$t > 2$	$2 < t \leq 4$	$t \geq 2$	$t \in \mathcal{R}$

Second Annual 2025 | Section B Q2(vi) | 4 marks

(vi)	Evaluate $\lim_{t\to 1}[f(t) \times g(t)]$ with $f(t) = (t^2-1)\hat{i} + \sqrt{t}\hat{j} + 5\hat{k}$ and $g(t) = (sin\pi t)\hat{i} + e^{t-1}\hat{j} + 3t\hat{k}$	04

If $\vec{F}(t) = e^t \tan(t)\underline{i} - \sqrt{\pi}\sec(t)\underline{j} + 2t\underline{k}$, then (a) Evaluate $\vec{F}(0)$, $\vec{F}\left(\frac{\pi}{2}\right)$ and $\vec{F}\left(\frac{2\pi}{3}\right)$ (b) State domain of the function $\vec{F}$.	4

APOLLO

Derivative of a Vector Function

Domain B: Geometry

	two lines.	
OR	If $\vec{r}(t) = e^{2t}\,\hat{i} + e^{-t}\,\hat{j} + e^{t}\,\hat{k}$ at $t = ln2$ is the position vector of a particle, then find its velocity and acceleration at the given value of t in the direction of motion.	4

OR	A drone is programmed to follow the path given by the position vector-valued function: $\vec{r}(t) = 5t\,\hat{i} + 3\sin(t)\,\hat{j} + 2\cos(t)\,\hat{k}$, $0 \le t \le 2\pi$ a. Determine the maximum distance the drone travels in the *y*-direction. b. At what time does the drone return to the $z = 0$ plane?	4

(iv)	If $\vec{r}(t) = \sin 2t\hat{i} + \cos t\hat{j} - t^3\hat{k}$ is position vector of a moving particle at time (t), then find: a. Velocity vector $\vec{v}(t)$ b. Acceleration vector $\vec{a}(t)$	04

at $x = 2$ and $x = 3$

Q.4	A particle is moving in 3D space with position vector $r(t) = (2t^2 + 1)\hat{i} + 3e^{2t}\hat{j} + (4cos3t)\hat{k}$ where t is time in seconds. Find velocity, speed, direction and acceleration of the particle at time $t = 0$ sec.	**08**

First Annual 2026 | Section B Q2(vi) OR | 4 marks

Given $r(t) = \langle t^2 - 1, 3t, \ln(t+1) \rangle$, find $r'(t)$ and the magnitude of $r'(2)$.	**04**

First Annual 2026 | Section B Q2(xii) | 4 marks

(xii)	A car moves along a curve with position $r(t) = \langle t^2 - 2t, t^3 - 3t \rangle$. (a) Find the velocity vector at $t = 1$. (b) Find the speed at $t = 1$.	**04**

Q.6	Find general solution of homogeneous differential equation $\frac{dy}{dx} = \frac{x^2 + y^2}{xy}$	**08**	**OR**	A particle moves such that its position vector is $r(t) = 4\cos(2t)\,\hat{i} + 4\sin(2t)\,\hat{j}$ (a) Find the velocity and acceleration vectors. (b) Show that the acceleration is directed opposite to the position vector. (c) Find the speed of the particle and the magnitude of its acceleration.	**08**

First Annual 2026 | Section B Q2(vi) OR | 4 marks

Given the vector function $r(t) = \langle \sqrt{t+4}, \tan^{-1}(t), 2^t \rangle$ find $r'(t)$ and the magnitude of $r'(3)$.	04

First Annual 2026 | Section B Q2(xii) | 4 marks

A particle moves along a curve with position vector: $r(t) = \langle t^3 - 4t, t^2 + t \rangle$ **(a)** Find the velocity vector at $t = 1$. **(b)** Find the speed at $t = 1$.	04

First Annual 2026 | Section C Q6 OR | 8 marks

A particle moves such that its position vector is: $r(t) = 2\cos(6t)\,\hat{i} + 2\sin(6t)\,\hat{j}$ (a) Find the velocity and acceleration vectors. (b) Show that the acceleration is directed opposite to the position vector. (c) Find the speed of the particle and the magnitude of its acceleration.	08

FBISE model paper | Section A Q1(viii) | 1 mark

viii.	For a velocity vector $\vec{v} = cos(t)\underline{i} - 2sin(t)\underline{j} + 3\underline{k}$, the acceleration vector $\vec{a}$ is:	$sin(t)\underline{i} + 2cos(t)\underline{j} + 3\underline{k}$	$sin(t)\underline{i} - 2cos(t)\underline{j} + 3\underline{k}$	$-sin(t)\underline{i} + 2cos(t)\underline{j}$	$-sin(t)\underline{i} - 2cos(t)\underline{j}$

OR	A person on a hang glider is spiraling upward due to rapidly rising air on a path having position vector $\vec{r}(t) = (3cost)\underline{i} + (3sint)\underline{j} + (t^2)\underline{k}$. Find velocity and acceleration vectors.	4

If $\vec{F}(t) = \underline{i} + 2e^{2t}\underline{j} + t^3\underline{k}$ and $\vec{G}(t) = 3t^2\underline{i} + 5e^{-t}\underline{j} - t3\underline{k}$ are the vector functions then evaluate a) $\frac{d}{dt}(\vec{F} \times \vec{G})(t)$ b) $\frac{d\vec{F}}{dt} \times \vec{G}$ c) $\vec{F} \times \frac{d\vec{G}}{dt}$ and verify d) $\frac{d}{dt}(\vec{F} \times \vec{G})(t) = \frac{d\vec{F}}{dt} \times \vec{G} + \vec{F} \times \frac{d\vec{G}}{dt}$	8

APOLLO

Inverse Trigonometric Functions

Domain B: Geometry

FBISE model paper | Section A Q1(xvi) | 1 mark

xvi.	What is the principal value of $Cot^{-1}\left(-\sqrt{3}\right)$?	$-\frac{\pi}{6}$	$\frac{5\pi}{6}$	$-\frac{\pi}{3}$	$\frac{2\pi}{3}$

First Annual 2026 | Section B Q2(x) | 4 marks

Find the domain and range of $f(x) = \sin^{-1}(2x - 1)$.	**04**

First Annual 2026 | Section B Q2(x) | 4 marks

Find the domain and range of: $f(x) = \text{cosec}^{-1}(3x + 2)$	**04**

APOLLO

Graphs of Inverse Trigonometric Functions

Domain B: Geometry

OR	Draw the graph of $y = Cos^{-1}\left(\frac{1-x}{3}\right)$ where $x \in [0, 2]$.	4

Q.4	(a) Find all critical points of $f(x)$. (b) Use the second derivative test to classify each critical point as a local maximum or local minimum.	**08**	**OR**	Draw the graph of $y = \sin^{-1}(x)$ for $x \in [-2\pi, 2\pi]$. Use a proper scale. Label domain, range, intercepts, and endpoints.	**08**

Draw the graph of $y = \cos^{-1}(x)$ for $x \in [-2\pi, 2\pi]$. Use a proper scale. Label the domain, range, intercepts, and endpoints.	08

APOLLO

Inverse Trigonometric Identities and Solution of Trigonometric Equations

Domain B: Geometry

FBISE model paper | Section A Q1(xvii) | 1 mark

xvii.	What is the general solution of the trigonometric equation $sin(x)=\frac{\sqrt{3}}{2}$?	$-\frac{\pi}{6}$	$\frac{\pi}{6}$	$\frac{\pi}{3}$	$-\frac{\pi}{3}$

FBISE model paper | Section B Q2(ix) OR | 4 marks

ix.	The region bounded by $y=x^2$ and $y=x+2$ is revolved around x-axis. Calculate the volume of a solid formed by the revolution of this region.	4	***OR***	Solve the trigonometric equation $2cos^2(x)-3cos(x)+1=0$ in the interval $[0,2\pi]$.	4
x.	A car starts from rest and accelerates along			Find the equations of tangent and normal	

OR	Without using calculator, prove that $Csc^{-1}\left(\frac{2\sqrt{3}}{3}\right)-Csc^{-1}\left(\frac{2}{\sqrt{2}}\right)=\frac{\pi}{12}$	4

OR	An engineer is designing a bridge over a river. The bridge will have an inclined ramp that forms an angle of elevation with the ground. The total height of the bridge at its peak is 20 meters, and the base of the ramp is 50 meters long. a. Determine the angle of elevation of the ramp using an appropriate inverse trigonometric function. b. If the engineer wants to increase the height of the bridge to 30 meters while keeping the base length constant, calculate the new angle of elevation.	8

First Annual 2026 | Section B Q2(v) OR | 4 marks

From a point on the ground, the angle of elevation to the top of a tower is $30°$. After walking 40 meters closer to the tower, the angle of elevation becomes $60°$. (a) Find the height of the tower. (b) Find the original distance from the first point to the base of the tower.	04

First Annual 2026 | Section B Q2(vi) | 4 marks

(vi)	Solve $2\cos x + 1 = 0$ for x in $[0,2\pi)$ using periodic properties.	04

First Annual 2026 | Section B Q2(v) OR | 4 marks

An engineer is designing a ramp such that it rises 6 m over a horizontal distance of 18 m. **(a)** Find the angle of inclination of the ramp with the horizontal using inverse trigonometric functions. **(b)** Find the length of the reop.	**04**

First Annual 2026 | Section B Q2(vi) | 4 marks

(vi)	Solve $2\sin x + \sqrt{3} = 0$ for x in $[0,2\pi)$ using periodic properties.	**04**

APOLLO

Circle (Equation of a circle)

Domain B: Geometry

FBISE model paper | Section A Q1(xviii) | 1 mark

xviii.	If center of the circle $x^2 + y^2 + mx + ny + 2 = 0$ lies at $(4, -8)$, then what is the value of $m + n$?	-8	-4	8	4

FBISE model paper | Section B Q2(xi) OR | 4 marks

OR	Find the equation of a circle passing through two points $(2,6),(6,4)$ with its centre on the line $3x + 2y - 1 = 0$.	4

First Annual 2025 | Section B Q2(v) OR | 4 marks

OR	Find the equation of the circle passing through the points $(4,0),(0,5)$ and $(0,0)$	**04**

First Annual 2025 | Section B Q2(v) OR | 4 marks

Find the equation of the circle passing through the points $(0,4),(5,0)$ and $(0,0)$	**04**

OR	Find center and radius of the circle $2x^2 + 2y^2 - \frac{5}{2}x + \frac{3}{2}y - \frac{7}{4} = 0$	**04**

OR	Find equation of a circle passing through points A (1,2), B (4,3) and C (2,5)	08

Q.3	Let $f(x) = \begin{cases} ax^2 + bx + 2, & x \leq 1 \\ 3x + a, & 1 < x < 3 \\ \frac{2x^2+b}{x}, & x \geq 3 \end{cases}$ Given that $f(x)$ is continuous at $x = 1$ and at $x = 3$, find the values of a and b.	08	**OR**	A circle passes through $(0,0)$, $(2,0)$, and $(0,2)$. (a) Find its equation. (b) Find the tangent at $(0,2)$. (c) Find the normal at $(0,2)$.	08	

First Annual 2025 | Section B Q2(iv) OR | 4 marks

	Find an equation of the circle with centre at $\left(\sqrt{2}, -3\sqrt{3}\right)$ and radius 4	04

First Annual 2025 | Section B Q2(x) | 4 marks

(x)	Determined whether the point $P(-5, 6)$ lies outside, on or inside the circle. $x^2 + y^2 + 4x - 6y - 12 = 0$	04

Second Annual 2025 | Section B Q2(vii) OR | 4 marks

OR	Find and equation of circle with ends of a diameter at $(-3,2)$ and $(5,-6)$	04

First Annual 2026 | Section A Q8 | 1 mark

8. The equation $x^2 + y^2 = 9$ represents a:	parabola	circle	hyperbola	straight line

First Annual 2026 | Section A Q20 | 1 mark

substitution is: A circle has equation $x^2 + y^2 = 25$. The point $P(3,4)$ lies:	inside the circle	outside the circle	on the circle	at the center	○ ○ ○ ○

2HA-I 26008 (Old)

FBISE model paper | Section A Q1(xiii) | 1 mark

xiii.	Which one of the following is an equation of a circle with center $(3,-7)$ and goes through a point (1, 1)?	$(x + 3)^2 + (y - 7)^2 = 52$	$(x - 3)^2 + (y + 7)^2 = 68$	$(x - 3)^2 + (y + 7)^2 = 32$	$(x + 3)^2 + (y - 7)^2 = 40$

APOLLO

Tangent and Normal

Domain B: Geometry

Second Annual 2025 | Section B Q2(v) OR | 4 marks

OR	Find equation of tangent to the circle $x^2 + y^2 - 6x - 8y + 9 = 0$ at the point (5,3).	**04**

First Annual 2026 | Section B Q2(iv) OR | 4 marks

Check whether the line $y = 2x + 1$ intersects, touches, or misses the circle $x^2 + y^2 = 5$.	**04**

Examine whether the line $y = -2x + 5$ cuts, is tangent to, or lies outside the circle $x^2 + y^2 = 17$.	**04**

08	OR	A circle has equation: $x^2 + y^2 - 6x + 4y - 12 = 0$ **(a)** Find the equation of the tangent to the circle at the point $P(7, -1)$. **(b)** Find the equation of the normal to the circle at the same point $P(7, -1)$.

Q.6	Find the coordinates of the points of intersection of the line $x+2y=6$ with the circle. $x^2+y^2-2x-2y-39=0$	08

First Annual 2026 | Section B Q2(ii) OR | 4 marks

For the circle $x^2 + y^2 = 25$, write the equations of the tangent and normal at the point (3, 4).
Prove the identity $\operatorname{sech}^2 x = \operatorname{cath}^2 x = 1$

FBISE model paper | Section A Q1(xiv) | 1 mark

xiv.	What is the length of tangent drawn from an external point $(-1, 2)$ to the circle $2x^2 + 2y^2 - 4x + 8y = 0$?	17	$\sqrt{3}$	5	$\sqrt{5}$

vi.	For what value of k, line $x - y + k = 0$ will touch the circle $x^2 + y^2 = 81$. Also find tangent to the circle.	4

APOLLO

Parabola

Domain B: Geometry

Second Annual 2025 | Section B Q2(ix) OR | 4 marks

OR	Find equation of a parabola with **focus** (0,1) and **directrix** $y + 1 = 0$.	**04**

First Annual 2026 | Section B Q2(vii) | 4 marks

(vii)	For the parabola $y^2 = -12x$, find the vertex, focus, directrix, and length of latus rectum.	**04**

First Annual 2026 | Section B Q2(vii) | 4 marks

For the parabola $x^2 = -8y$, find the vertex, focus, directrix, and length of the latus rectum.	**04**

First Annual 2025 | Section B Q2(ix) | 4 marks

(ix)	Find the focus, vertex and directrix of the parabola $y^2 = -8(x-3)$	**04**

Second Annual 2025 | Section B Q2(viii) | 4 marks

(viii)	Find focus, vertex and directrix of the parabola $x^2 = -16y$	04

First Annual 2026 | Section A Q6 | 1 mark

For parabola $y^2 = 4ax$, the focus is at:	$(a, 0)$	$(-a, 0)$	$(0, -a)$	$(0, a)$

First Annual 2026 | Section B Q2(vi) | 4 marks

Graph the feasible region by shading.
A parabola has its focus at $F(2,3)$ and vertex at $V(2,1)$. Write equation of the parabola in standard form.
Find volume of the tetrahedron

xv.	Which one of the following represents a parabola with focus $(5, 0)$ and vertex $(0, 0)$?	$x^2 = 20y$	$x^2 = -20y$	$y^2 = -20x$	$y^2 = 20x$

APOLLO

Equations of Tangent and Normal

Domain B: Geometry

FBISE model paper | Section A Q1(xix) | 1 mark

xix.	For what value of a, line $2x-3y+6=0$ is tangent to the parabola $y^2=4ax$?	$-\frac{4}{3}$	$-\frac{3}{4}$	$\frac{4}{3}$	$\frac{3}{4}$

FBISE model paper | Section A Q1(xx) | 1 mark

xx.	If $x-y+\lambda=0$ is tangent to ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$, then value of λ is:	$\pm\sqrt{13}$	± 2	$\pm\sqrt{5}$	± 3

FBISE model paper | Section B Q2(x) OR | 4 marks

	Find the equations of tangent and normal to the parabola $x^2=8y$ at a point $(4,2)$.	
OR		4

First Annual 2025 | Section B Q2(ix) | 4 marks

(ix)	Find the equation of tangent and normal to parabola $x^2 = 8y - 8$ at $x = 4$	**04**

First Annual 2025 | Section B Q2(ix) | 4 marks

(ix)	Find the equations of tangent and normal to parabola $x^2 = -8y + 8$ at $x = 4$.	**04**

(xii)	Find equations of tangent normal to $y^2 = 4ax$ at $\left(at^2, 2at\right)$	04

OR	Find equations of the common tangents to the conics: $y^2 = 16x$ *and* $x^2 = 2y$	08