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FBISE Mathematics Class 12
Topical workbook - Volume 1 of 3

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

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Functions and Graphs

Domain A: Numbers and Algebra

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

(v)	If $f(x) = \sqrt{x}$ and $g(x) = x$, then find $f(g(x))$, $g(f(x))$, $f(f(x))$ and $g(g(x))$.	04

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

Without finding inverse, state the domain and range of f^{-1}, where $f(x) = 2 + \sqrt{x-1}$	04

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

	for the given domain.	
OR	Express the perimeter P of a square as a function of its area.	04

First Annual 2026 | Section A Q15 | 1 mark

$A(1,1)$ to $C(7,9)$, work done is:				
$f(x) = x^2$ and $g(x) = \sqrt{x}$, then $(f \circ g)(x)$ is:	x^3	x^2	x	$x^2\sqrt{x}$
The function $f(x) = x^2 - 4x + 3$ has a				

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Inverse Function

Domain A: Numbers and Algebra

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

Q1. Fill the relevant bubble against each question. Each part carries ONE mark.

Sr No.	Question	A	B	C	D
i.	The inverse of $f(x)=\frac{x-1}{2}$ is:	$2x-1$	$2x+1$	$x-2$	$x+2$

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

OR	If $f(x)=3x+2$ and $g(x)=2x-3$, and $h(x)=f(g(x))$ then find: **(i)** $h(x)$ **(ii)** $h^{-1}(x)$ **(iii)** value of x if $h^{-1}(x)=2$	**04**

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

(i)	If $f(x) = \frac{2x-3}{x+1}$, find $f^{-1}(x)$. Also determine the domain and range of $f^{-1}(x)$.	04

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

OR	Let $f(x) = \sqrt{x-1}$ for $x \geq 1$. Find $f^{-1}(x)$ and verify that $f(f^{-1}(x)) = x$.	04

If $f(x) = \frac{5x-2}{x+4}$, find $f^{-1}(x)$ then determine the domain and range of $f^{-1}(x)$.	**04**

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Exponential Function

Domain A: Numbers and Algebra

$(12 \times 4 =$

Q.2	Question	Mark
i.	Draw the graph of the function $log_3 y = x$	4

	~~centre of the farthest point.~~	
OR	A company's stock price $S(t)$ (in dollars) is modeled by the function: $S(t) = 50 + 20e^{-0.1t}$, where t is the time in years; a. Find the initial stock price. b. Determine the stock price after 5 years. c. Find the limit of $S(t)$ as $t \to \infty$. d. Determine the time at which the stock price reaches 60 dollars.	8

Find domain and range of the following functions: **(a)** $f(x) = e^{x-2} + 3$, **(b)** $g(x) = ln\,(x + 5)$ Write your answers in interval notation.	**04**

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Graphical Representation

Domain A: Numbers and Algebra

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

Sketch the graph of $y = \lvert x - 2 \rvert$ and find its domain and range.	**04**

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

ii.	The range of the function $f(x) = \lvert x - 5 \rvert$ is:	$(-\infty, 0]$	$[0, +\infty)$	$[5, +\infty)$	$[-5, +\infty)$

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Limit of a Function

Domain A: Numbers and Algebra

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

ii.	Evaluate: $\lim_{x\to 0}\left(\frac{\frac{1}{x-1}+\frac{1}{x+1}}{4x}\right)$	4

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

(i)	Evaluate: $\lim_{\theta\to 0}\frac{1-\cos\theta}{\sin^2\theta}$	04

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

(i)	Evaluate: $\lim_{\theta \to 0} \frac{\sin^2 \theta}{1 - \cos \theta}$	04	OR	If $f(x,y) = 2x^3 - 5xy^2 + 3x^2y - 4y^3$ then: a. Find degree of homogeneous f b. Verify Euler's theorem for $f(x$

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

OR	Evaluate $\lim_{x \to 0} \left(\frac{x \sin 4x}{1 - \cos 2x} \right)$	04

Q.3	Evaluate $\lim_{\theta \to 0} \frac{1 - \cos p\theta}{1 - \cos q\theta}$	08

Q.3	Verify that $\lim_{x \to a} \frac{x^n - a^n}{x - a} = na^{n-1}$	**08**
Q.4	Find the Taylor series expansion of $\ln(1+x)$ at $x = 2$	**08**

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

04	OR	Evaluate $\lim_{x\to 0}\left(\frac{x\sin 4x}{1-\cos 2x}\right)$

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

iii.	What limit given in the following results $\frac{\text{Sin}(1-x)}{(1-x)} = 1$?	$x \to -1$	$x \to 0$	$x \to 1$	$x \to \infty$

		4
OR	Evaluate $\lim_{x\to 0} \frac{(1+x)^{-2}-1}{x}$	

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Continuous and Discontinuous Functions

Domain A: Numbers and Algebra

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

Q1. Fill the relevant bubble against each question. Each part carries ONE mark.

Sr No.	Question	A	B	C	D
i.	The inverse of $f(x)=\frac{x-1}{2}$ is:	$2x-1$	$2x+1$	$x-2$	$x+2$
ii.	For what value of x, $f(x)=\frac{x-2}{x^2-4}$ is discontinuous?	-2	-1	1	0

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

iii.	Test the continuity of the function $f(x)=\begin{cases}1-3x, & x<-3\\ 5, & x=-3\\ x^2, & x>-3\end{cases}$ at $x=-3$	4

(ii)	Find the value of 'k' if $f(x)=\begin{cases}\dfrac{2x^2-2}{x-1}, & x\neq 1\\ 3(k-1)x, & x=1\end{cases}$ is continuous at $x=1$	04	OR	If line $x-3y+\ell=0$ is tangent to the ellips $\dfrac{x^2}{25}+\dfrac{y^2}{16}=1$, then find:

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**

Q.3

Let

$$f(x)=\begin{cases}\frac{m}{2}x^2-\frac{n}{3}x+1, & x\le 2\\ \frac{3x+m}{4}, & 2<x<5\\ \frac{x^2+2n}{x+1}, & x\ge 5\end{cases}$$

Given that $f(x)$ is continuous at $x=2$ and at $x=5$, find the values of m and n.

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

(vii)	Find the values of m and n, so that the function f is continuous at $x=3$; where $f(x)=\begin{cases} mx \text{ if } x<3 \\ n \text{ if } x=3 \\ -2x+9 \text{ if } x>3 \end{cases}$	04

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

i.	Find the value of z if $f(x)$ is continuous at $x=1$ and $f(x)=\begin{cases} \dfrac{\sqrt{3x+9}-\sqrt{2x+8}}{x-1} & if\ x\neq 1 \\ z & if\ x=1 \end{cases}$	4

OR	Test the continuity of the function $f(x) = \begin{cases} 1-3x, & x<-6 \\ 7, & x=-6 \\ x^3, & x>-6 \end{cases}$ at $x=-6$	4

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Gradient of a Curve

Domain A: Numbers and Algebra

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

OR	Find $\frac{dy}{dx}$, if $y=(2x+3)^{\frac{3}{2}}$ by first principle	**04**

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

(ii)	Differentiate $y=(x+4)^{\frac{1}{2}}$ from first principles.	**04**

(i)	Evaluate $\lim_{x \to \pi} \frac{\sin x}{(x - \pi)}$	04

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Derivative of a Function

Domain A: Numbers and Algebra

(xi)	If $f(x,y)=\sqrt{x^3+y^3}$, then find: **a.** $\frac{\partial f}{\partial x}$ **b.** $\frac{\partial f}{\partial y}$	04

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Differentiation Rules

Domain A: Numbers and Algebra

Q1. Fill the relevant bubble against each question. Each part carries ONE mark.

Sr No.	Question	A	B	C	D
i.	The inverse of $f(x)=\frac{x-1}{2}$ is:	$2x-1$	$2x+1$	$x-2$	$x+2$
ii.	For what value of x, $f(x)=\frac{x-2}{x^2-4}$ is discontinuous?	-2	-1	1	0
iii.	What is the derivative of $\left(\frac{\sin\alpha}{\sec x}\right)$ w. r. t. x?	$\sin\alpha \ \sin x$	$-\cos\alpha \ \cos x$	$-\sin\alpha \ \sin x$	$-\cos x \ \sin\alpha$

OR	Find $\frac{dy}{dx}$, if $x^3+3x^2y^2+y^3=0$	**04**

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

Find $\frac{dy}{dx}$, when $3x^3 - 6x^2y^2 - 5y^3 = 0$

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

OR	Use Euler's theorem to verify that, $f(x,y) = 3x^2y + 2xy^2$ is a homogeneous function of degree 3.	**04**

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

(x)	Find the first-order partial derivatives $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ of the function $z = e^{xy} + x^{3y}$	04

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

Find the derivative of $f(x) = \frac{x^2+1}{x^2-1}$ and simplify.	04

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

Differentiate the function *w.r.t. x.* $y = \frac{2x^3 - 3x + 1}{x^2 + 1}$.	04

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

Find y_2 if $x^2 + y^2 = a^2$	04

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Further on Differentiation

Domain A: Numbers and Algebra

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

iv.	If $y = x^3 \ln\left(\sqrt{x^2+1}\right)$, then find $\frac{dy}{dx}$.	4

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

vi.	Find the derivative of the function w.r.t.*x:* $f(x) = \text{Sin}^{-1}\left(\frac{x}{2}\right) + \text{Tan}^{-1}\left(\frac{\sqrt{4-x^2}}{x}\right)$.	4

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

(iv)	Differentiate $y = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$ w. r. t. x.	04

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

Find $\frac{dy}{dx}$ for $y = e^{2x}\ln(x)$	04

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

(iii)	Evaluate $\int sin^2x\,dx$	04	OR	Determine the intervals in which $f(x) = x^3 - 3x^2 - 9x + 5$ is increasing or decreasing.	04

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

(ii)	Find $\frac{dy}{dx}$ if $y = e^{3x} ln\left(\frac{2x}{x^2+1}\right)$

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

Determine the intervals in which the function $f(x) = x^3 - 6x^2 + 9x - 4$ is increasing or decreasing.	04

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

(iii)	If $\tan y(1 + \tan x) = 1 - \tan x$, then show that $\frac{dy}{dx} = -1$.	04

Differentiate $\ln\left(x^2+2x\right)$ w.r.t x, using Chain Rule.	04

Find $\frac{dy}{dx}$ if $y = \ln\left(x + \sqrt{x^2 + 1}\right)$	08

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

OR	Determine the intervals in which y given by $f(x)=4-x^2$; $x\in(-2,2)$ is increasing or decreasing for the given domain.	**04**
	Express the perimeter P of a square as a function of its	

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

(ii)	Find $\frac{dy}{dx}$ if $y=(x+1)^x$	**04**

First Annual 2026 | Section A Q9 | 1 mark

If $y = \sin(3x^2)$, then $\frac{dy}{dx}$ is:	$cos(3x^2)$	$6xcos(3x^2)$	$cos(6x)$	$3x^2cos(3x^2)$	○	○	○	○
	1		1					

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

answer.	
Determine whether $f(x) = -4x^3 + 6x^2 + 2$ is increasing or decreasing at $x = 1$.	04
Evaluate the integral using substitution $x = 5tan\theta$:	

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

iv.	What is the derivative of $log_5 e^x$ $w.r.t.x$?	$\frac{1}{xlog5}$	$\frac{1}{xln5}$	$x \log_5 e$	$xlne$

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

v.	What is the value of $\sqrt{1 - x^2}\frac{dy}{dx}(\sin^{-1}x + \text{Cos}^{-1}x)$?	2	0	$\sqrt{1-x^2}$	$\frac{1}{x}$

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

OR	Determine the equation of the tangent to the curve defined by $y = 2x^2 - 7x + 1$ at $x = 2$.	4

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

OR	Find the derivative of $\sin^{-1}\left(\frac{2x}{1+x^2}\right) w.r.t. \tan^{-1} x.$	4

Find all the points on curve $y = 2x^3 + 4x^2$ where tangent line is parallel to the line $y = 8x - 4$.	4

No.		
Q3	A curve has an equation $y = \frac{1}{2}x^3 - 9x^{1.5} + \frac{8}{x} + 30,\ x > 0$ (a) Find $\frac{dy}{dx}$ (b) Show that a point $(4, -8)$ lies on the curve defined. (c) Find equations of the tangent and normal at $(4, -8)$ giving your answer in the form $ax + by + c = 0 \quad \forall a, b, c \in R$	8

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Higher Order Derivatives

Domain A: Numbers and Algebra

Q1. Fill the relevant bubble against each question. Each part carries ONE mark.

Sr No.	Question	A	B	C	D
i.	The inverse of $f(x)=\frac{x-1}{2}$ is:	$2x-1$	$2x+1$	$x-2$	$x+2$
ii.	For what value of x, $f(x)=\frac{x-2}{x^2-4}$ is discontinuous?	-2	-1	1	0
iii.	What is the derivative of $\left(\frac{\sin\alpha}{\sec x}\right)$ w. r. t. x?	$\sin\alpha \ \sin x$	$-\cos\alpha \ \cos x$	$-\sin\alpha \ \sin x$	$-\cos x \ \sin\alpha$
iv.	If $y=\sin x$, then what is the value of y_4?	$\sin x$	$\cos x$	$-\sin x$	$-\cos x$

No.		
Q3	$y = 3e^{2x} + 2e^{3x}$, then prove that $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$	8

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

(ix)	Differentiate implicitly to find $\frac{dy}{dx}$ if $x^3y^2 + xy + y^3 = 10.$	**04**

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

OR	Use Maclaurin's theorem to expand sin(x) up to the term containing x^3.	**04**

OR	Find the **second derivative** of $y = x^2e^{2x}$	04

Q.4	If $y=\left(\cos^{-1}x\right)^2$, then verify that $\left(1-x^2\right)\frac{d_2y}{dx^2}-x\frac{dy}{dx}-2=0$	08

Second Annual 2025 | Section C Q3 OR | 8 marks

OR	If $x=\frac{1-t^2}{1+t^2}, y=\frac{2t}{1+t^2}$ then find $\frac{dy}{dx}$	**08**

First Annual 2026 | Section A Q2 | 1 mark

If $f(x)=x^4$, then the second derivative $f''(x)$ is:	$4x^3$	$12x^2$	$24x$	24
				x^2

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

Given $f(x) = \ln(2x+1)$, find $f'(x)$, $f''(x)$, $f'''(x)$ and $f^{(4)}(x)$			

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

of $\sin 46°$.			Find the angle between p and q.
Find area of the triangle with vertices $A(1,2)$, $B(4,5)$, and $C(3,0)$.	04	OR	A curve is defined parametrically by $x = e^t \cos t$, $y = e^t \sin t$. Find $\frac{dy}{dx}$ in te

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

04	OR	Find the second derivative of $y = x^2e^{2x}$.

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

vi.	Which of the following represents $(y_2 + y)$, if $y = cosx$?	$-y$	0	y	$2y$

OR	Determine the 4^{th} derivative of $f(z) = 9sin\left(\frac{z}{3}\right) + cos(1-2z)$	4

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Applications of Derivatives

Domain A: Numbers and Algebra

First Annual 2026 | Section B Q2(viii) | 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**

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

(viii)	The side length of a cube is measured as 12 cm with a possible error of 0.03 cm. Use differentials to find the approximate percentage error in the volume.	**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.	**04**

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

(iv)	Use differentials to find (approximately) the values of $\sqrt[4]{17}$	04

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

(iii)	Find δy and dy for the function defined by $f(x)=x^2$, when $x=2$ and $dx=0.01$	04

divides AB internally in the ratio $1:2$.
Use differentials to find the approximate value of $\sin 46°$.
Find area of the triangle with vertices $A(1,2)$, $B(4,5)$

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Extreme Values

Domain A: Numbers and Algebra

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

v.	Use the second derivative test to determine whether each critical point corresponds to relative maxima, minima or neither, if $f(x)=3x^5-5x^3+2$.	4

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

(vii)	Find the extreme values of $f(x)=\frac{1}{3}x^3-x^2-3x+6$	04

(vii)	Find the extreme values of $f(x)=\frac{1}{3}x^3+\frac{1}{2}x^2-6x+5$	04

OR	Examine the extreme values of $f(x) = sinx\ cosx$, where $x \in [0, \pi]$.	**08**

Q.4	Given the function $f(x) = 2Sinx + Cos2x, \quad x \in [0, \pi]$ (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. (c) Determine the absolute (global) maximum and absolute (global) minimum values of $f(x)$.	**08**

Q.4	Given the function: $f(x) = 3\sin x + \cos 2x, x \in [0, \pi]$ **(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. **(c)** Determine the absolute (global) maximum and absolute (global) minimum values of $f(x)$.	**08**

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

Find the extreme values for the function defined by $f(x) = x^2 - x - 2$	04

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

OR	Find the dimensions of a rectangle of largest area having perimeter 120 centimeters.	**04**

First Annual 2026 | Section A Q16 | 1 mark

16.	$(f \circ g)(x)$ is: The function $f(x) = x^2 - 4x + 3$ has a minimum value at:	$x = 0$	$x = 1$	$x = 2$	$x = 3$
	The solution of the differential			x^2	

xi.	Find whether $f(x) = (x^4 - 4x + 2)^5$ shows relative maximum, relative minimum or neither at critical value $x = 1$.	4

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Integration-I

Domain A: Numbers and Algebra

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

Q1. Fill the relevant bubble against each question. Each part carries ONE mark.

Sr No.	Question	A	B	C	D
i.	The inverse of $f(x)=\frac{x-1}{2}$ is:	$2x-1$	$2x+1$	$x-2$	$x+2$
ii.	For what value of x, $f(x)=\frac{x-2}{x^2-4}$ is discontinuous?	-2	-1	1	0
iii.	What is the derivative of $\left(\frac{\sin\alpha}{\sec x}\right)$ w. r. t. x?	$\sin\alpha \ \sin x$	$-\cos\alpha \ \cos x$	$-\sin\alpha \ \sin x$	$-\cos x \ si$
iv.	If $y=\sin x$, then what is the value of y_4?	$sinx$	$cosx$	$-sinx$	$-cosx$
v.	The absolute maximum value of $f(x)=-x^2+3x-2$ over $[1,3]$ is:	$\frac{3}{2}$	$\frac{1}{4}$	3	-2

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

Q1. Fill the relevant bubble against each question. Each part carries ONE mark.

Sr No.	Question	A	B	C	D
i.	The inverse of $f(x)=\frac{x-1}{2}$ is:	$2x-1$	$2x+1$	$x-2$	$x+2$
ii.	For what value of x, $f(x)=\frac{x-2}{x^2-4}$ is discontinuous?	-2	-1	1	0
iii.	What is the derivative of $\left(\frac{\sin\alpha}{\sec x}\right)$ w. r. t. x?	$\sin\alpha \ \sin x$	$-\cos\alpha \ \cos x$	$-\sin\alpha \ \sin x$	$-\cos x \ \sin\alpha$
iv.	If $y=\sin x$, then what is the value of y_4?	$sinx$	$cosx$	$-sinx$	$-cosx$
v.	The absolute maximum value of $f(x)=-x^2+3x-2$ over $[1,3]$ is:	$\frac{3}{2}$	$\frac{1}{4}$	3	-2
vi.	What is the integrated value of $(3x+1)^5$ w.r.t. x?	$\frac{(3x+1)^6}{18}+C$	$\frac{(3x+1)^6}{6}+C$	$\frac{3(3x+1)^6}{6}+C$	$\frac{\left(\frac{3x^2}{2}+x\right)^6}{2}+C$

Q1. Fill the relevant bubble against each question. Each part carries ONE mark.

Sr No.	Question	A	B	C	D
i.	The inverse of $f(x)=\frac{x-1}{2}$ is:	$2x-1$	$2x+1$	$x-2$	$x+2$
ii.	For what value of x, $f(x)=\frac{x-2}{x^2-4}$ is discontinuous?	-2	-1	1	0
iii.	What is the derivative of $\left(\frac{\sin\alpha}{\sec x}\right)$ w. r. t. x?	$\sin\alpha \ \sin x$	$-\cos\alpha \ \cos x$	$-\sin\alpha \ \sin x$	$-\cos x \ \sin\alpha$
iv.	If $y=\sin x$, then what is the value of y_4?	$sinx$	$cosx$	$-sinx$	$-cosx$
v.	The absolute maximum value of $f(x)=-x^2+3x-2$ over $[1,3]$ is:	$\frac{3}{2}$	$\frac{1}{4}$	3	-2
vi.	What is the integrated value of $(3x+1)^5$ w.r.t. x?	$\frac{(3x+1)^6}{18}+C$	$\frac{(3x+1)^6}{6}+C$	$\frac{3(3x+1)^6}{6}+C$	$\frac{\left(\frac{3x^2}{2}+x\right)^6}{2}+C$
vii.	What evaluates $\int_{-a}^{a}\left(x^3+x\right)dx$?	$2\int_0^a\left(x^3+x\right)dx$	0	$\int_{-a}^{0}\left(x^3+x\right)dx$ $-\int_0^a\left(x^3+x\right)dx$	$\int_0^a\left(x^3+x\right)dx$

Q1. Fill the relevant bubble against each question. Each part carries ONE mark.

Sr No.	Question	A	B	C	D
i.	The inverse of $f(x)=\frac{x-1}{2}$ is:	$2x-1$	$2x+1$	$x-2$	$x+2$
ii.	For what value of x, $f(x)=\frac{x-2}{x^2-4}$ is discontinuous?	-2	-1	1	0
iii.	What is the derivative of $\left(\frac{\sin\alpha}{\sec x}\right)$ w. r. t. x?	$\sin\alpha \ \sin x$	$-\cos\alpha \ \cos x$	$-\sin\alpha \ \sin x$	$-\cos x \ s$
iv.	If $y=\sin x$, then what is the value of y_4?	$sinx$	$cosx$	$-sinx$	$-cos$
v.	The absolute maximum value of $f(x)=-x^2+3x-2$ over $[1,3]$ is:	$\frac{3}{2}$	$\frac{1}{4}$	3	-2
vi.	What is the integrated value of $(3x+1)^5$ w.r.t. x?	$\frac{(3x+1)^6}{18}+C$	$\frac{(3x+1)^6}{6}+C$	$\frac{3(3x+1)^6}{6}+C$	$\frac{\left(\frac{3x^2}{2}+x\right)}{2}$
vii.	What evaluates $\int_{-a}^{a}(x^3+x)dx$?	$2\int_0^a(x^3+x)dx$	0	$\int_{-a}^{0}(x^3+x)dx$ $-\int_0^a(x^3+x)dx$	$\int_0^a(x^3+$
viii.	If $\int_2^4 f(x)\,dx=6$, then what results $\int_2^4[f(x)+3]\,dx$?	12	3	6	9

FBISE model paper | Section B Q2(ix) | 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

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

Find the area of the region enclosed between the curves $y = 4 - x^2$ and $y = x^2$.	4

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

xi.	Estimate the value of the integral $I = \int_0^{\pi} sin(x)\,dx$, using the trapezium rule with 4 subintervals. Round your answer to 4 decimal places.	4

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

Evaluate: $\int (3t+1)(t-1)dt$	04

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

OR	Find the area under the graph of $f(x)=3x^2-2x$ over the interval $[1,3]$	04

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

(v)	Evaluate: $\int(2z-3)(z+2)dz$	04

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

	b. Angle between these lines	
OR	Find the area under the graph of $f(x) = 6x^2 + 4x$ over the interval $[1,3]$	**04**

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

OR	Find area between $y = x^2 - 3x$ and x-axis from $x = 0$ to $x = 4$.	**04**

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

OR	Approximate $\int_0^1 (1+x)\ dx$ using Simpson's rule with $n = 2$.	**04**

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

Find the area bounded by the curve $y = x^2 + 2$, the x-axis, and the lines $x = 1$ and $x = 3$.	**04**

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

Find area of the region bounded by the curves $y = x^2$ and $y = 4x - x^2$.	04

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

(ii)	Evaluate the indefinite integral $\int\left(1+\sqrt{x}\right)^2 dx,\ (x>0)$	04	OR	Find a vertex whose magnitude is 4 and is parallel to $2\underline{i} - 3\underline{j} + 6\underline{k}$	04

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

(v)	Evaluate $\int \frac{dx}{\sqrt{x+1}-\sqrt{x}}$	04

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

Find the area between the $x-$axis and the curve $y=4x-x^2$	04

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

(xii)	Evaluate the definite integral $\int_{-1}^{5} \lvert x-3 \rvert dx$	04

First Annual 2026 | Section A Q3 | 1 mark

	derivative $f''(x)$ is:				
3.	$\int \frac{1}{x} dx =$	$\ln\lvert x \rvert + C$	$e^x + C$	$x \ln x + C$	$\frac{x^2}{2} + C$

First Annual 2026 | Section A Q10 | 1 mark

dx				
10. What results $\int_0^1 x^2\, dx$?	$\frac{1}{3}$	1	$\frac{1}{2}$	0

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

and $f'(x)$

Find the total area bounded by $y = x^3 - 4x$, the x-axis, and the vertical lines $x = -2$ and $x = 2$.

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

ix.	For what value of k, the integral $\int_1^k x^{n-1}\,dx = \frac{1}{n}$? ; $n \in Z$	$\sqrt[n]{\frac{2}{n}}$	$\sqrt[n]{2}$	2^n	$\sqrt[n]{\frac{2n-1}{n}}$

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

x.	What is the evaluated value of $\int_0^{2\pi} Sinx\,dx$?	-2	0	2	4

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

xx.	If $f(0) = 1, f(1) = 2.72$ then, what is the approximated value of $\int_0^1 f(x)dx$ by using the trapezoidal rule?	1.86	1.88	1.87	1.72

ii.	Find the area under the graph of $f(x) = x^3 - x$ over the interval $[-1, 1]$	4

APOLLO

Mechanics (Kinematics of motion in a straight line)

Domain A: Numbers and Algebra

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

ix.	A car accelerates uniformly from rest and travels a distance of 100 m in 10 s. What is the acceleration of the car?	$1m/s^2$	$2m/s^2$	$4m/s^2$	$0.5m/s^2$

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

A car starts from rest and accelerates along a straight road. The acceleration of the car is given by $a(t) = 3t\, m/s^2,\ t \geq 0$ where t is time in seconds. a. Find the velocity $v(t)$ of the car at any time t, given that the initial velocity $v(0) = 0.$ b. Determine the displacement $s(t)$ of the car at any time t, given that the initial displacement $s(0) = 0$.	4

Q6	A runner accelerates uniformly from rest to a velocity of 8 m/s in 4 seconds, maintains this velocity for 6 seconds, and then decelerates uniformly to rest in 5 seconds. a. Sketch the velocity-time graph for this motion. b. Interpret the graph to determine: (i) The total time of motion. (ii) The total distance covered by the runner.	8

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

The displacement–time graph of a particle is a straight line from $(0, 2)$ to $(5, 12)$, where displacement is in meters and time in seconds. (a) Find the velocity of the particle. (b) Sketch the displacement–time graph. (c) Sketch the corresponding velocity–time graph.	**04**

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

(ix)	The velocity of a particle is $v(t) = 3t^2 - 12t + 9$ m/s. (a) Find displacement from $t = 0$ to $t = 5$ seconds. (b) Find total distance travelled in the same interval.	**04**

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

04	OR	The displacement–time graph of a particle is a straight line from $(1, -4)$ to $(6, -11)$, where displacement is in meters and time in seconds. **(a)** Find the velocity of the particle. **(b)** Sketch the displacement–time graph. **(c)** Sketch the corresponding velocity-time graph.

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

The velocity of a particle is $v(t) = 4t^2 - 16t + 12$ m/s. **(a)** Find displacement from $t = 0$ to $t = 3$ seconds. **(b)** Find total distance travelled in the same interval.	**04**

APOLLO

Integration-II (Techniques of Integration)

Domain A: Numbers and Algebra

xii.	Evaluate: $\int \frac{dx}{x^2\sqrt{4-x^2}}$.	4

OR	Evaluate: $\int \frac{x^2 + x - 2}{3x^3 - x^2 + 3x - 1} dx$	8

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

OR	Evaluate $\int x^2 \cos x \, dx$ using integration by parts method	**04**

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

(x)	Evaluate $\int \frac{e^x dx}{e^{2x}+1}$ by substitution method	

Q.6	Evaluate: $\int \frac{dx}{4x^3 - x}$	08

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

OR`	Evaluate $\int x^2 \sin x \, dx$ using integration by parts method.	**04**

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

(x)	Evaluate $\int \frac{e^{\theta}}{e^{2\theta}+1} d\theta$ by substitution method.	**04**	**OR**	If $\frac{x^2}{16} - \frac{y^2}{9}$:

Q.5	Evaluate: $\int \frac{2x+1}{x^3+3x^2+2x}dx$	**08**

OR	Evaluate $\int \frac{dx}{x^2\sqrt{x^2-9}}$	**04**

Solve the homogeneous differential equation $\frac{dy}{dx} = \frac{x+y}{x-y}$	08	OR	Evaluate $\int \frac{6x^2+5x+4}{x(x+1)(x-1)(x+2)} dx$	08

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

(iii)	Evaluate $\int sin^2x\, dx$	04

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

Evaluate $\int_0^1 x\, e^x\, dx$ using integration by parts.	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**	**OR**	**(a)** Resolve into partial fractions: $\frac{x^2+3x+4}{(x^2+2x+5)(x-1)}$ **(b)** Hence find: $\int \frac{x^2+3x+4}{(x^2+2x+5)(x-1)}\,dx$	**08**

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

(iii)	Evaluate the integral: $\int \cos^2(2\theta)\, d\theta$	04

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

Use the method of integration by parts to evaluate: $\int_1^2 x(lnx)\, dx$	04

(a) Resolve into partial fractions: $\frac{3x^2 + 2x + 7}{(x^2 + 4x + 5)(x - 3)}$ **(b)** Hence find: $\int \frac{3x^2+2x+7}{(x^2+4x+5)(x-3)}\, dx$	**08**