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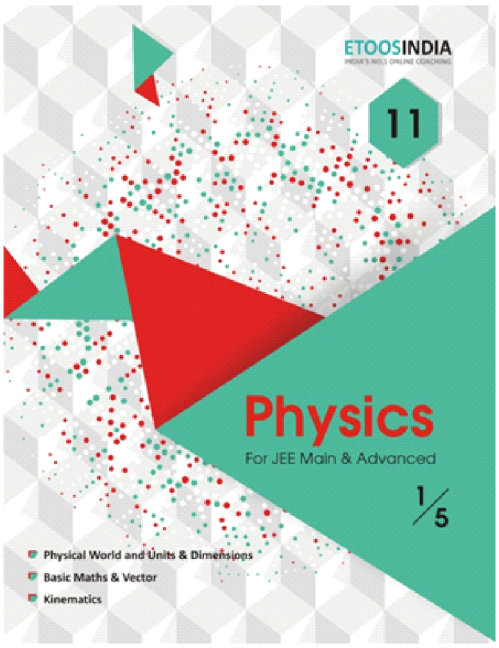
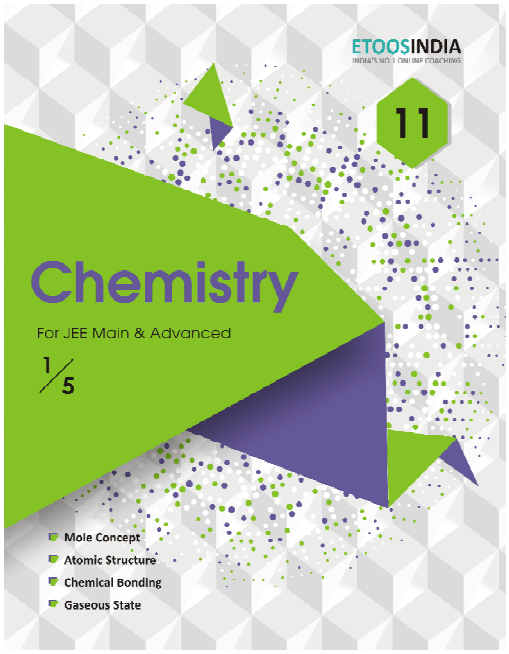
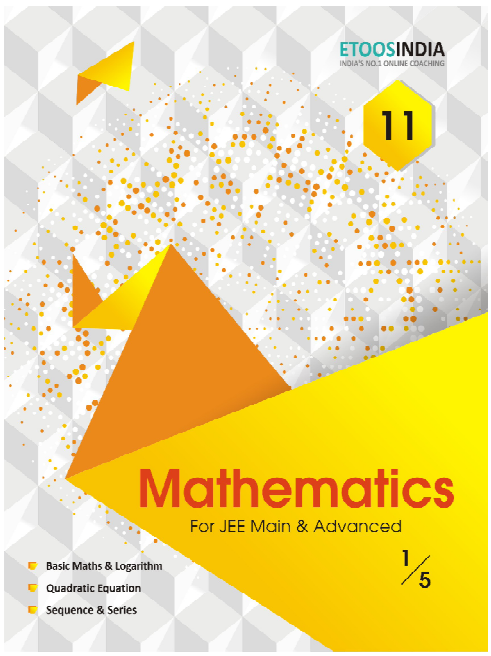
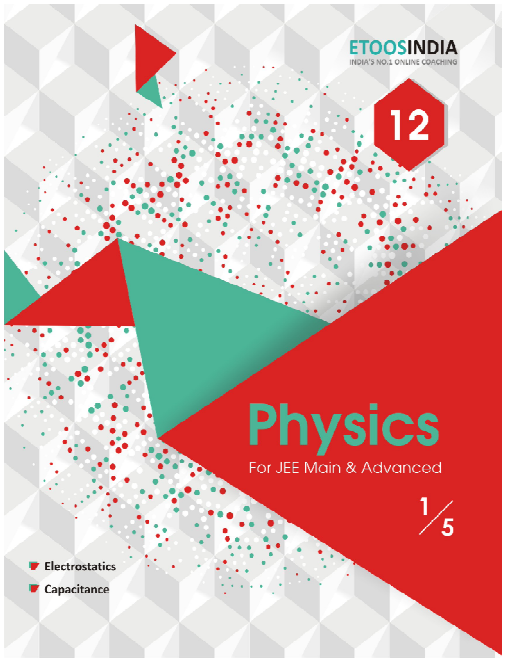
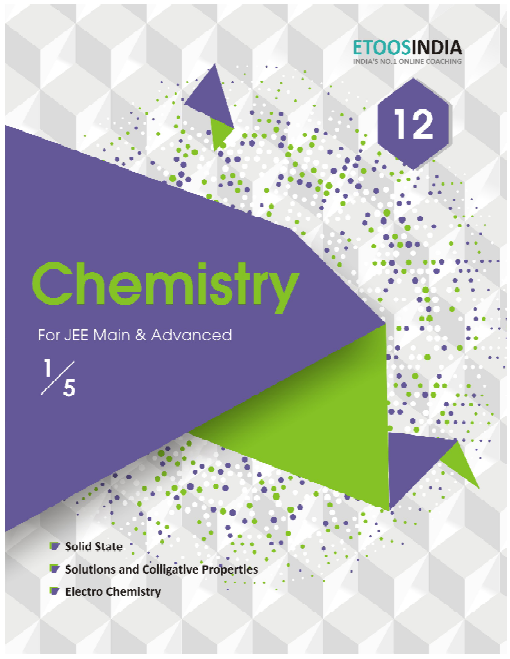
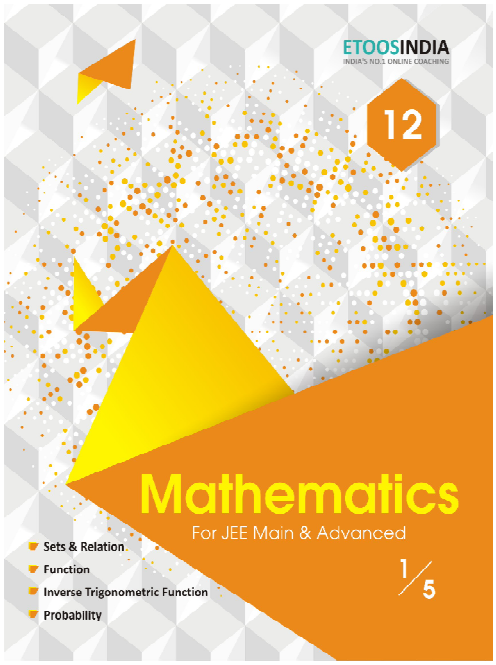












ETOOS Comprehensive Study Material
For JEE- Main & Advanced

FUNCTION

DEFINITION

A relation R from a set A to a set B is called a function if each element of A has unique image in B.
It is denoted by the symbol.

$f: A \to B$ or $A \xrightarrow{f} B$

which reads f ' is a function from A to B 'or' f maps A to B,
If an element $a \in A$ is associated with an element $b \in B$, then b is called 'the f image of a' or 'image of a under f 'or' the value of the function f at a'. Also a is called the pre-image of b or argument of b under the function f. We write it as

$b = f(A)$ or $f: a \to b$ or $f: (a, b)$

Thus a function 'f ' from a set A to a set B is a subset of $A \times B$ in which each 'a' belonging to A appears in one and only one ordered pair belonging to f.

ETOOS KEY POINTS

Every function from $A \to B$ satisfies the following conditions .

(I) $f \subset A \times B$ **(ii)** $\forall\ a \in A \Rightarrow (a, f(A)) \in f$ and **(iii)** $(a, b) \in f$ & $(a, c) \in f \Rightarrow b = c$

REPRESENTATION OF FUNCTION

(A) Ordered pair : Every function from $A \to B$ satisfies the following conditions :

(i) $f \subset A \times B$ **(ii)** $\forall\ a \in A$ there exist $b \in B$ and **(iii)** $(a, b) \in f$ & $(a, c) \in f \Rightarrow b = c$

(B) Formula based (uniformly/nonuniformly) :

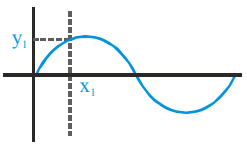
e.g.

(i) $f: R \to R, y = f(x) = 4x, f(x) = x^2$ (uniformly defined)

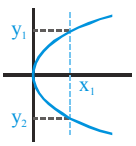
(ii) $f(x) = \begin{cases} x+1 & -1 \le x < 4 \\ -x & 4 \le x < 7 \end{cases}$ (non-uniformly defined)

(iii) $f(x) = \begin{cases} x^2 & x \ge 0 \\ -x-1 & x < 0 \end{cases}$ (non-uniformly defined)

(C) Graphical representation :



Graph (1)



Graph (2)

Graph(1) represent a function but graph(2) does not represent a function.

Domain, Co-domain & Range Of A Function

Let $f: A \to B$, then the set A is known as the domain of f & the set B is known as co-domain of f. The set of f images of all the elements of A is known as the range of f.

Thus : Domain of $f = \{a \mid a \in A, (a, f(A)) \in f\}$
Range of $f = \{f(A) \mid a \in A, f(A) \in B\}$

ETOOS KEY POINTS

(i) If a vertical line cuts a given graph at more than one point then it can not be the graph of a function.
(ii) Every function is a relation but every relation is not necessarily a function.
(iii) It should be noted that range is a subset of co-domain.
(iv) If only the rule of function is given then the domain of the function is the set of those real numbers, where function is defined. For a continuous function, the interval from minimum to maximum value of a function gives the range

METHODS OF DETERMINING RANGE

(i) Representing x in terms of y

If $y = f(x)$, try to express as $x = g(y)$, then domain of $g(y)$ represents possible values of y, which is range of $f(x)$.

Ex. Find the range of $f(x) = \dfrac{x^2+x+1}{x^2+x-1}$

Sol. $f(x) = \dfrac{x^2+x+1}{x^2+x-1}$ $\{x^2+x+1$ and x^2+x-1 have no common factor$\}$

$$y = \frac{x^2+x+1}{x^2+x-1}$$

$$\Rightarrow \quad yx^2+yx-y = x^2+x+1$$

$$\Rightarrow \quad (y-1)x^2+(y-1)x-y-1 = 0$$

If $y = 1$, then the above equation reduces to $-2 = 0$. Which is not true.

Further if $y \neq 1$, then $(y-1)x^2+(y-1)x-y-1 = 0$ is a quadratic and has real roots if

$$(y-1)^2-4(y-1)(-y-1) \geq 0$$

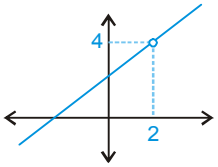
i.e. if $y \leq -3/5$ or $y \geq 1$ but $y \neq 1$

Thus the range is $(-\infty, -3/5] \cup (1, \infty)$

(ii) Graphical Method

The set of y– coordinates of the graph of a function is the range.

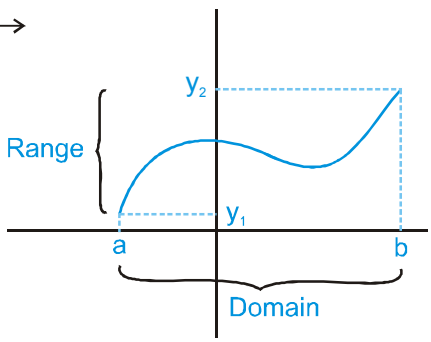
Ex. Find the range of $f(x) = \dfrac{x^2-4}{x-2}$



Sol. $f(x) = \dfrac{x^2-4}{x-2} = x+2;\ x \neq 2$

$\therefore$ graph of f(x) would be

Thus the range of $f(x)$ is $R-\{4\}$



Further if f(x) happens to be continuous in its domain then range of f(x) is [min f(x), max. f(x)]. However for sectionally continuous functions, range will be union of [min f(x), max. f(x)] over all those intervals where f(x) is continuous, as shown by following example.

• Etoos Tips & Formulas •

1. Definition

If to every value (considered as real unless other-wise stated) of a variable x, which belongs to a set A, there corresponds one and only one finite value of the quantity y which belong to set B, then y is said to be a function of x and written as $f : A \to B$, $y = f(x)$, x is called argument or independent variable and y is called dependent variable.

Pictorially : $\xrightarrow[\text{input}]{x}$ [f] $\xrightarrow[\text{output}]{f(x) = y}$

y is called the image of x & x is the pre-image of y, under f. Every function $f : A \to B$ satisfies the following conditions.

(i) $f \subset A \times B$ **(ii)** $\forall a \in A \quad \exists\ b \in B$ such that $(a,b) \in f$ and

(iii) If $(a,b) \in f$ & $(a,c) \in f \Rightarrow b = c$

2. Domain, Co-Domain & Range of a Function

Let $f : A \to B$, then the set A is known as the domain of 'f' & the set B is known as co-domain of 'f'. The set of all f images of elements of A is known as the range of 'f'. Thus

Domain of $f = \{ x \mid x \in A, (x, f(x)) \in f\}$

Range of $f = \{ f(x) \mid x \in A, f(x) \in B\}$

range is a subset of co-domain.

3. Important Types of Function

(A) Polynomial function :

If a function 'f' is called by $f(x) = a_0x^n + a_1x^{n-1} + a_2x^{n-2} + ... + a_{n-1}{}^{x+a}{}_n$ where n is a non negative integer and $a_0, a_1, a_2, ... a_n$ are real numbers and $a_0 \neq 0$, then f is called a polynomial function of degree n.

Note

(I) A polynomial of degree one with no constant term is called an odd linear function. i.e. $f(x) = ax, \neq 0$.

(ii) There are two polynomial functions, satisfying the relation ; f(x), f(1/x). They are :

(A) $f(x) = x^n + 1$ &

(B) $f(x) = 1 - x^n$, where n is a positive integer.

(iii) Domain of a polynofunction is R

(iv) Range of odd degree polynomial is R whereas range of an even degree polynomial is never R.

(B) Algebric function :

A function 'f' is called an algebric function if it can be constructed using algebric operations (such as addition, subtraction, multiplication, division and taking radicals) straight with polynomials

(C) Rational function :

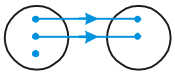
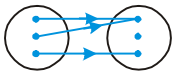
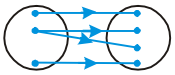
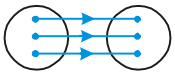
A rational function is a function of the form $y = f(x) = \frac{g(x)}{h(x)}$, where g(x) & h(x) are polynomials & $h(x) \neq 0$,

Domain : $R - \{x \mid h(x) = 0\}$

Any rational function is automatically an algebric function.

SOLVED EXAMPLES

Ex. 1 Which of the following pictorial diagrams represent the function

(A)  **(B)**  **(C)**  **(D)** 

Sol. B and D. In **(A)** one element of domain has no image, while in **(C)** one element of 1st set has two images in 2nd set

Ex. 2 Find the Domain of the following function :

(i) $y = \log_{(x-4)}(x^2 - 11x + 24)$ **(ii)** $f(x) = \sqrt{x^2 - 5}$

(iii) $\sin^{-1}(2x - 1)$ **(iv)** $f(x) = \sqrt{\sin x} - \sqrt{16 - x^2}$

Sol. (i) $y = \log_{(x-4)}(x^2 - 11x + 24)$

Here 'y' would assume real value if,

$x - 4 > 0$ and $\neq 1$, $x^2 - 11x + 24 > 0$ $\Rightarrow$ $x > 4$ and $\neq 5$, $(x-3)(x-8) > 0$

$\Rightarrow$ $x > 4$ and $\neq 5$, $x < 3$ or $x > 8$ $\Rightarrow$ $x > 8$

$\Rightarrow$ Domain $(y) = (8, \infty)$

(ii) $\sqrt{x^2 - 5}$ $f(x) =$ is real iff $x^2 - 5 \geq 0$

$\Rightarrow$ $|x| \geq \sqrt{5}$ $\Rightarrow$ $x \leq -\sqrt{5}$ or $x \geq \sqrt{5}$

$\therefore$ the domain of f is $(-\infty, -\sqrt{5}\,] \cup [\sqrt{5}, \infty)$

(iii) $\sin^{-1}(2x - 1)$ is real iff $-1 \leq 2x - 1 \leq +1$

$\therefore$ domain is $x \in [0, 1]$

(iv) $\sqrt{\sin x}$ is real iff $\sin x \geq 0$ $\Leftrightarrow$ $x \in [2n\pi, 2n\pi + \pi]$, $n \in I$.

$\sqrt{16 - x^2}$ is real iff $16 - x^2 \geq 0$ $\Leftrightarrow$ $-4 \leq x \leq 4$.

Thus the domain of the given function is $\{x : x \in [2n\pi, 2n\pi + \pi], n \in I\} \cap [-4, 4] = [-4, -\pi] \cup [0, \pi]$.

Ex. 3 Find the range of following functions :

(i) $f(x) = \dfrac{1}{8 - 3\sin x}$ **(ii)** $f(x) = \dfrac{x^2 - 4}{x - 2}$

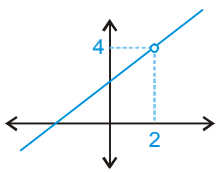
Sol. (i) $f(x) = \dfrac{1}{8 - 3\sin x}$

$-1 \leq \sin x \leq 1$

$\therefore$ Range of $f = \left[\dfrac{1}{11}, \dfrac{1}{5}\right]$

(ii) $f(x) = \dfrac{x^2 - 4}{x - 2} = x + 2;\ x \neq 2$

$\therefore$ graph of f(x) would be



Thus the range of f(x) is $R - \{4\}$

Exercise # 1 [Single Correct Choice Type Questions]

1. The domain of $f(x)=\sqrt{\frac{1-|x|}{2-|x|}}$, is -

(A) $(-\infty,\infty)-[-2,2]$ **(B)** $(-\infty,\infty)-[-1,1]$

(C) $[-1,1]\cup(-\infty,-2)\cup(2,\infty)$ **(D)** none

2. The domain of the function $f(x)=\sin^{-1}\left(\frac{1+x^3}{2x^{3/2}}\right)+\sqrt{\sin(\sin x)}+\log_{(3\{x\}+1)}(x^2+1)$, where $\{.\}$ represents fractional part function, is:

(A) $x\in\{1\}$ **(B)** $x\in R-\{1,-1\}$ **(C)** $x>3, x\neq I$ **(D)** none of these

3. The domain of the function $f(x)=\frac{1}{\log_{10}(1-x)}+\sqrt{x+2}$, is -

(A) $[-2,0)\cup(0,1)$ **(B)** $(-2,0)\cup(0,1]$ **(C)** $(-2,0)\cup(0,1]$ **(D)** $(-2,0)\cup[0,1]$

4. If $q^2-4pr=0$, $p>0$, then the domain of the function $f(x)=\log(px^3+(p+q)x^2+(q+r)x+r)$ is:

(A) $R-\left\{-\frac{q}{2p}\right\}$ **(B)** $R-\left[(-\infty,-1]\cup\left\{-\frac{q}{2p}\right\}\right]$

(C) $R-\left[(-\infty,-1)\cap\left\{-\frac{q}{2p}\right\}\right]$ **(D)** none of these

5. If f(x) is a polynomial function satisfying the condition $f(x).f(1/x)=f(x)+f(1/x)$ and $f(2)=9$ then -

(A) $2f(4)=3f(6)$ **(B)** $14f(1)=f(3)$ **(C)** $9f(3)=f(5)$ **(D)** $f(10)=f(11)$

6. Domain to function $\sqrt{\log\{(5x-x^2)/6\}}$ is -

(A) $(2,3)$ **(B)** $[2,3]$ **(C)** $[1,2]$ **(D)** $[1,3]$

7. Domain and range of $f(x)=\sqrt{x-1}+2\sqrt{3-x}$ is

(A) $D:[1,3]; R:\left[\sqrt{2},\sqrt{10}\right]$ **(B)** $D:[1,5]; R:\left[\sqrt{2},\sqrt{10}\right]$

(C) $D:(-\infty,1]\cup[3,\infty), R:\left[1,\sqrt{3}\right]$ **(D)** $D:[1,5], R:\left[1,\sqrt{3}\right]$

8. If $A=\{-2,-1,0,1,2\}$ & $f:A\to Z$; $f(x)=x^2+1$, then the range of f is

(A) $\{0,1,2,5\}$ **(B)** $\{1,2,5\}$ **(C)** $\{-5,-2,1,2,3\}$ **(D)** A

Exercise # 2 Part # I [Multiple Correct Choice Type Questions]

1. Which of the functions defined below are NOT one-one function(s) ?

(A) $f(x)=5(x^2+4), (x\ R)$ **(B)** $g(x)=2x+(1/x)$

(C) $h(x)=\ell n(x^2+x+1), (x\ R)$ **(D)** $f(x)=e^{-x}$

2. Which of the following functions from Z to itself are NOT bijections ?

(A) $f(x)=x^3$ **(B)** $f(x)=x+2$ **(C)** $f(x)=2x+1$ **(D)** $f(x)=x^2+x$

3. If $f(x)=\sin \ell n\left(\frac{\sqrt{4-x^2}}{1-x}\right)$, then

(A) domain of f(x) is $(-2, 1)$ **(B)** domain of f(x) is $[-1, 1]$

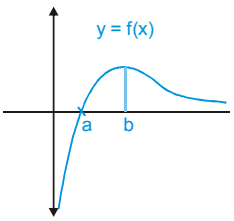
(C) range of f(x) is $[-1, 1]$ **(D)** range of f(x) is $[-1, 1)$

4. The function cot(sinx) -

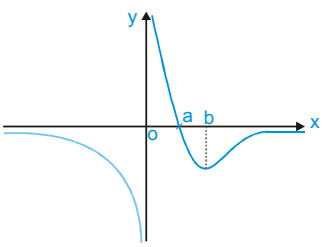
(A) is not defined for $x=(4n+1)\frac{\pi}{2}$ **(B)** is not defined for $x=n\pi$

(C) lies between –cot1 and cot1 **(D)** can't lie between –cot1 and cot1

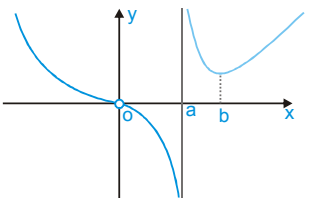
5. The graph of function f(x) is as shown, adjacently. Then the graph of $\frac{1}{f(|x|)}$ is -



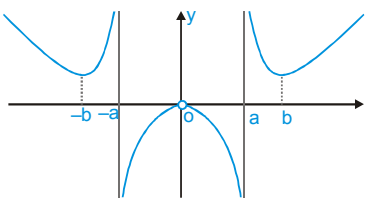
(A)



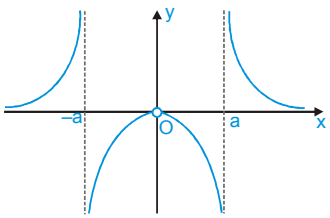
(B)



(C)



(D)



Exercise # 3 Part # I [Matrix Match Type Questions]

Following questions contains statements given in two columns, which have to be matched. The statements in **Column-I** are labelled as A, B, C and D while the statements in **Column-II** are labelled as p, q, r and s. Any given statement in **Column-I** can have correct matching with one statement in **Column-II**.

1. Let $f(x) = \sin^{-1} x$, $g(x) = \cos^{-1} x$ and $h(x) = \tan^{-1} x$. For what complete interval of variation of x the following are true.

Column – I		Column – II	
(A)	$f\left(\sqrt{x}\right) + g\left(\sqrt{x}\right) = \pi/2$	(p)	$[0, \infty)$
(B)	$f(x) + g\left(\sqrt{1-x^2}\right) = 0$	(q)	$[0, 1]$
(C)	$g\left(\frac{1-x^2}{1+x^2}\right) = 2h(x)$	(r)	$(-\infty, 1)$
(D)	$h(x) + h(1) = h\left(\frac{1+x}{1-x}\right)$	(s)	$[-1, 0]$

2.

Column - I		Column - II	
(A)	Total number of solution $x^2 - 4 - [x] = 0$ where [ ] denotes greatest integer function.	(p)	0
(B)	Minimum period of $e^{\cos^4 \pi x + \cos^2 \pi x + x - [x]}$	(q)	1
(C)	If $A = \{(x, y); y = \frac{1}{x}, x \in R_0\}$ and $B = \{(x, y) : y = x, x \in R\}$ then number of elements in $A \cap B$ is (are)	(r)	2
(D)	Number of integers in the domain of $\sqrt{2^x - 3^x} + \log_3 \log_{1/2} x$	(s)	3

3.

Column – I		Column – II	
(A)	The period of the function $y = \sin(2\pi t + \pi/3) + 2\sin(3\pi t + \pi/4) + 3\sin 5\pi t$ is	(p)	1/2
(B)	$y = \{\sin(\pi x)\}$ is a many one function for $x \in (0, a)$, where $\{x\}$ denotes fractional part of x, then a may be	(q)	8
(C)	The fundamental period of the function $y = \frac{1}{2}\left(\frac{\lvert\sin(\pi/4)x\rvert}{\cos(\pi/4)x} + \frac{\sin(\pi/4)x}{\lvert\cos(\pi/4)x\rvert}\right)$ is	(r)	2
(D)	If $f: [0, 2] \to [0, 2]$ is bijective function defined by $f(x) = ax^2 + bx + c$, where a, b, c are non-zero real numbers, then f(2) is equal to	(s)	0

Exercise # 4 [Subjective Type Questions]

1. Find the domain of definitions of the following functions :

(i) $f(x) = \sqrt{3 - 2^x - 2^{1-x}}$

(ii) $f(x) = (x^2 + x + 1)^{-3/2}$

(iii) $f(x) = \sqrt{\tan x - \tan^2 x}$

(iv) $f(x) = \ell og_{10}(1 - \ell og_{10}(x^2 - 5x + 16))$

(v) If $f(x) = \sqrt{x^2 - 5x + 4}$ & $g(x) = x + 3$, then find the domain of $\frac{f}{g}(x)$

(vi) $f(x) = \frac{1}{[x]} + \log_{1-\{x\}}(x^2 - 3x + 10) + \frac{1}{\sqrt{2 - |x|}} + \frac{1}{\sqrt{\sec(\sin x)}}$

2. Find the range of the following functions :

(i) $f(x) = 1 - |x - 2|$

(ii) $f(x) = \frac{1}{\sqrt{x - 5}}$

(iii) $f(x) = \frac{1}{2 - \cos 3x}$

(iv) $f(x) = \frac{x + 2}{x^2 - 8x - 4}$

(v) $f(x) = \frac{x^2 - 2x + 4}{x^2 + 2x + 4}$

(vi) $f(x) = 3 \sin \sqrt{\frac{\pi^2}{16} - x^2}$

(vii) $f(x) = x^4 - 2x^2 + 5$

(viii) $f(x) = x^3 - 12x$, where $x \in [-3, 1]$

(ix) $f(x) = \sin^2 x + \cos^4 x$

3. Let f be a function such that $f(3) = 1$ and $f(3x) = x + f(3x - 3)$ for all x. Then find the value of f(300).

4. Let $f(x) = \frac{9^x}{9^x + 3}$ then find the value of the sum $f\left(\frac{1}{2008}\right) + f\left(\frac{2}{2008}\right) + f\left(\frac{3}{2008}\right) + \ldots\ldots f\left(\frac{2007}{2008}\right)$

5. Examine whether the following functions are even or odd or neither even nor odd, where [ ] denotes greatest integer function.

(i) $f(x) = \frac{(1 + 2^x)^7}{2^x}$

(ii) $f(x) = \frac{\sec x + x^2 - 9}{x \sin x}$

(iii) $f(x) = \sqrt{1 + x + x^2} - \sqrt{1 - x + x^2}$

(iv) $f(x) = \begin{cases} x|x|, & x \le -1 \\ [1 + x] + [1 - x], & -1 < x < 1 \\ -x|x|, & x \ge 1 \end{cases}$

(v) $f(x) = \frac{2x(\sin x + \tan x)}{2\left[\frac{x + 2\pi}{\pi}\right] - 3}$

Exercise # 5 Part # I [Previous Year Questions] [AIEEE/JEE-MAIN]

1. Which of the following is not a periodic function- **[AIEEE 2002]**

(1) $\sin 2x + \cos x$ **(2)** $\cos\sqrt{x}$ **(3)** $\tan 4x$ **(4)** $\log\cos 2x$

2. The period of $\sin^2 x$ is- **[AIEEE 2002]**

(1) $\pi/2$ **(2)** π **(3)** $3\pi/2$ **(4)** 2π

3. The function $f : R \to R$ defined by $f(x) = \sin x$ is- **[AIEEE 2002]**

(1) into **(2)** onto **(3)** one-one **(4)** many-one

4. The range of the function $f(x) = \frac{2+x}{2-x}$, $x \neq 2$ is- **[AIEEE 2002]**

(1) R **(2)** $R - \{-1\}$ **(3)** $R - \{1\}$ **(4)** $R - \{2\}$

5. The domain of $\sin^{-1}\left[\log_3\left(\frac{x}{3}\right)\right]$ **[AIEEE 2002]**

(1) [1, 9] **(2)** [-1, 9] **(3)** [-9, 1] **(4)** [-9, -1]

6. The function $f(x) = \log(x + \sqrt{x^2+1})$, is- **[AIEEE 2003]**

(1) neither an even nor an odd function **(2)** an even function

(3) an odd function **(4)** a periodic function

7. Domain of definition of the function $f(x) = \frac{3}{4-x^2} + \log_{10}(x^3 - x)$, is- **[AIEEE 2003]**

(1) $(-1, 0) \cup (1, 2) \cup (2, \infty)$ **(2)** $(1, 2)$

(3) $(-1, 0) \cup (1, 2)$ **(4)** $(1, 2) \cup (2, \infty)$

8. If $f : R \to R$ satisfies $f(x + y) = f(x) + f(y)$, for all $x, y \in R$ and $f(1) = 7$, then $\sum_{r=1}^{n} f(r)$ is - **[AIEEE 2003]**

(1) $\frac{7n(n+1)}{2}$ **(2)** $\frac{7n}{2}$ **(3)** $\frac{7(n+1)}{2}$ **(4)** $7n(n+1)$

9. A function f from the set of natural numbers to integers defined by $f(n) = \begin{cases} \frac{n-1}{2}, & \text{when n is odd} \\ -\frac{n}{2}, & \text{when n is even} \end{cases}$ is - **[AIEEE 2003]**

(1) neither one-one nor onto **(2)** one-one but not onto

(3) onto but not one-one **(4)** one-one and onto both

MOCK TEST

SECTION - I : STRAIGHT OBJECTIVE TYPE

1. If $f(x) \cdot f(y) = f(x) + f(y) + f(xy) - 2 \quad \forall\, x, y \in R$ and if $f(x)$ is not a constant function, then the value of $f(1)$ is equal to

(A) 1 **(B)** 2 **(C)** 0 **(D)** –1

2. The domain of the function $f(x) = \sqrt{-\log_{\frac{x+4}{2}}\left(\log_2 \frac{2x-1}{3+x}\right)}$ is

(A) $(-4,-3)\cup(4,\infty)$ **(B)** $(-\infty,-3)\cup(4,\infty)$ **(C)** $(-\infty,-4)\cup(3,\infty)$ **(D)** None

3. Let $f(x) = ax^2 + bx + c$, where a, b, c are rational and $f : Z \to Z$, where Z is the set of integers. Then $a + b$ is :

(A) a negative integer **(B)** an integer

(C) non-integral rational number **(D)** none of these

4. If $f(x) = \frac{\sin^2 x + 4\sin x + 5}{2\sin^2 x + 8\sin x + 8}$, then range of $f(x)$ is

(A) $\left(\frac{1}{2}, \infty\right)$ **(B)** $\left(\frac{5}{9}, 1\right)$ **(C)** $\left[\frac{5}{9}, 1\right]$ **(D)** $\left[\frac{5}{9}, \infty\right)$

5. If $f(x) = x + \tan x$ and $g(x)$ is the inverse of $f(x)$ then $g'(x)$ is equal to

(A) $\frac{1}{1+(g(x)-x)^2}$ **(B)** $\frac{1}{2+(g(x)-x)^2}$ **(C)** $\frac{1}{2+(g(x)-x)^2}$ **(D)** none of these

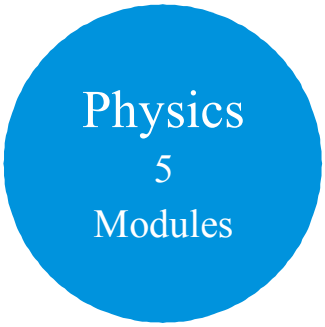
6. Let $f(x) = \tan x$, $g(f(x)) = f\left(x - \frac{\pi}{4}\right)$, where $f(x)$ and $g(x)$ are real valued functions. For all possible values of x, $f(g(x)) =$

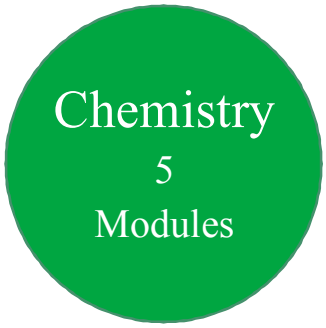
(A) $\tan\left(\frac{x-1}{x+1}\right)$ **(B)** $\tan(x-1) - \tan(x+1)$ **(C)** $\frac{f(x)+1}{f(x)-1}$ **(D)** $\frac{x-\pi/4}{x+\pi/4}$

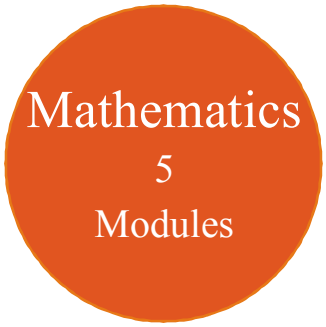
7. The range of the function $f(x) = \sin^{-1}\left[x^2 + \frac{1}{2}\right] + \cos^{-1}\left[x^2 - \frac{1}{2}\right]$, where [ ] is the greatest integer function, is:

(A) $\left\{\frac{\pi}{2}, \pi\right\}$ **(B)** $\left\{0, \frac{\pi}{2}\right\}$ **(C)** $\{\pi\}$ **(D)** $\left(0, \frac{\pi}{2}\right)$

11th Class Modules Chapter Details

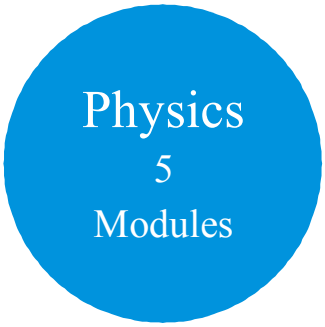


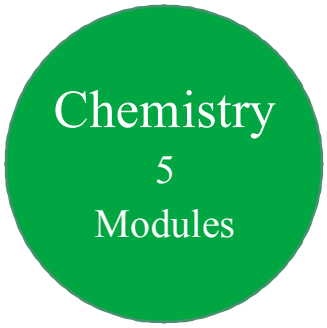


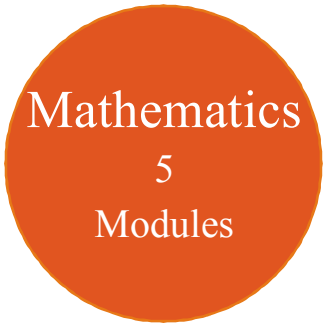


PHYSICS	CHEMISTRY	MATHEMATICS
Module-1 1. Physical World and Units & Dimensions 2. Basic Maths & Vector 3. Kinematics **Module-2** 1. Newton's Law of Motion & Friction 2. Work, Energy & Power **Module-3** 1. Centre of Mass & Collisions 2. Rotational Motion 3. Gravitation **Module-4** 1. Mechanical Properties of Matter 2. Thermal Properties of Matter **Module-5** 1. Simple Harmonic Motion 2. Wave Motion 3. Measurement Error & Experiment	**Module-1(PC)** 1. Mole Concept 2. Atomic Structure 3. Chemical Bonding 4. Gaseous State **Module-2(PC)** 1. Thermodynamics 2. Thermochemistry 3. Chemical Equilibrium 4. Ionic Equilibrium **Module-3(IC)** 1. Periodic Table & Its Properties 2. Redox Reaction & Equivalent Concepts 3. Hydrogen & Its Components 4. S-Block **Module-4(OC)** 1. Nomenclature of Organic Compounds 2. Isomerism 3. General Organic Chemistry **Module-5(OC)** 1. Reaction Mechanism 2. Hydrocarbon 3. Aromatic Hydrocarbon 4. Environmental Chemistry	**Module-1** 1. Basic Maths and Logarithm 2. Quadratic Equation 3. Sequence and Series **Module-2** 1. Trigonometric Ratio and Identities 2. Trigonometric Equation 3. Properties & Solution of Triangle **Module-3** 1. Permutation & Combination 2. Binomial Theorum 3. Complex Number **Module-4** 1. Straight Line 2. Circle 3. Conic Section (Parabola,Ellipse & Hyperbola) **Module-5** 1. Mathematical Induction 2. Mathematical Reasoning 3. Statistics

12th Class Modules Chapter Details







PHYSICS

Module-1
1. Electrostatics
2. Capacitance

Module-2
1. Current Electricity
2. Magnetic Effect of Current and Magnetism

Module-3
1. Electromagnetic Induction
2. Alternating Current

Module-4
1. Geometrical Optics
2. Wave Optics

Module-5
1. Modern Physics
2. Nuclear Physics
3. Solids & Semiconductor Devices
4. Electromagnetic Waves
5. Principle of Communication

CHEMISTRY

Module-1(PC)
1. Solid State
2. Solutions and Colligative Properties
3. Electro Chemistry

Module-2(PC)
1. Chemical Kinetics and Nuclear Chemistry
2. Surface Chemistry

Module-3(IC)
1. Metallurgy
2. P- Block
3. Transition Elements (d & f block)
4. Co-ordination Compound
5. Salt Analysis & Qualitative Analysis

Module-4(OC)
1. Alkyl Halides & Aryl Halides
2. Alcohol, Phenol & Ether
3. Carbonyl Compound

Module-5(OC)
1. Carboxylic Acid & Their Derivatives
2. Biomolecules & Polymers
3. Chemistry in Everyday Life

MATHEMATICS

Module-1
1. Sets & Relation
2. Function
3. Inverse Trigonometric Function
4. Probability

Module-2
1. Limit
2. Continuity
3. Differentiability
4. Method of Differentiation

Module-3
1. Indefinite Integration
2. Definite Integration
3. Area Under the Curve

Module-4
1. Application of Derivative
2. Matrix
3. Determinant

Module-5
1. Differential Equation
2. Vector & 3-Dimensional