PART 1 - MATHEMATICS

Topic : Relations and functions (class 12)

SECTION–1 : (Maximum Marks : 4)

- This section contains **ONE** question.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme :

Full Marks	: +4	ONLY if (all) the correct option(s) is(are) chosen;
Partial Marks	: +3	If all the four options are correct but ONLY three options are chosen;
Partial Marks	: +2	If three or more options are correct but ONLY two options are chosen, both of which are correct;
Partial Marks	: +1	If two or more options are correct but ONLY one option is chosen and it is a correct option;
Zero Marks	: 0	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	: −2	In all other cases.

- For example, in a question, if **(A), (B) and (D)** are the ONLY three options corresponding to correct answers, then choosing ONLY (A), (B) and (D) will get +4 marks; choosing ONLY (A) and (B) will get +2 marks; choosing ONLY (A) and (D) will get +2 marks; choosing ONLY (B) and (D) will get +2 marks; choosing ONLY (A) will get +1 mark; choosing ONLY (B) will get +1 mark; choosing ONLY (D) will get +1 mark; choosing no option (i.e. the question is unanswered) will get 0 marks; and choosing any other combination of options will get −2 marks.

1. Let N denote the set of all natural numbers, and Z denote the set of all integers. Consider the functions $f : \mathrm{N} \longrightarrow \mathrm{Z}$ and $g : \mathrm{Z} \longrightarrow \mathrm{N}$ defined by

$$f(n) = \begin{cases} (n+1)/2 & \text{if } n \text{ is odd,} \\ (4-n)/2 & \text{if } n \text{ is even,} \end{cases}$$

and

$$g(n) = \begin{cases} 3+2n & \text{if } n \geq 0, \\ -2n & \text{if } n < 0. \end{cases}$$

Define $(g \circ f)(n) = g(f(n))$ for all $n \in \mathrm{N}$, and $(f \circ g)(n) = f(g(n))$ for all $n \in \mathrm{Z}$.

Then which of the following statements is (are) TRUE? [JEE Advanced 2025 Paper 1]

(A) $g \circ f$ is NOT one-one and $g \circ f$ is NOT onto

(B) $f \circ g$ is NOT one-one but $f \circ g$ is onto

(C) g is one-one and g is onto

(D) f is NOT one-one but f is onto

Solution

Space for Rough Work

SECTION–2 : (Maximum Marks : 24)

- This section contains **ONE** paragraph.
- Based on each paragraph, there are **SIX** questions.
- The answer to each question is a **NON-NEGATIVE INTEGER**.
- For each question, enter the correct integer corresponding to the answer in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme :

Full Marks : +4 If ONLY the correct answer is entered;
Zero Marks : 0 In all other cases.

2. Let S = {1, 2, 3, …, 10} . Consider the set
X = {R:R is an equivalence relation on the set S such that R has exactly 42 elements} .
Then the number of elements in X is _____. [JEE Advanced 2026 Paper 1]

Scan or tap for the full solution

3. Let N denote the set of all positive integers. Consider the sets
A = {1,2,3,4,5} and B = {1,2,3,4,5,6,7}.
Let S be the set of all functions $f : A \longrightarrow B$ such that $f(2) \neq 2$ and $f(4) \neq 4$. Consider the set
$T = \{f \in S :$ there exists a function $g : B \longrightarrow N$ such that $g(f(x)) = 2^x$ for all $x \in A\}$.
Then the number of elements in the set T is _____. [JEE Advanced 2026 Paper 2]

Scan or tap for the full solution

4. Let the set of all relations R on the set {a, b, c, d, e, f}, such that R is reflexive and symmetric, and R contains exactly 10 elements, be denoted by S.
Then the number of elements in S is _____. [JEE Advanced 2025 Paper 1]

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5. Let $f : R \longrightarrow R$ be a function such that $f(x + y) = f(x) + f(y)$ for all $x, y \in R$, and $g : R \longrightarrow (0, \infty)$ be a function such that $g(x + y) = g(x)g(y)$ for all $x, y \in R$. If $f\left(\frac{-3}{5}\right) = 12$ and $g\left(\frac{-1}{3}\right) = 2$, then the value of $\left(f\left(\frac{1}{4}\right) + g(-2) - 8\right)g(0)$ is _____. [JEE Advanced 2024 Paper 2]

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Paragraph for Questions 6 and 7

Let S = {1,2,3,4,5,6} and X be the set of all relations R from S to S that satisfy both the following properties:
i. R has exactly 6 elements.
ii. For each $(a, b) \in R$, we have $|a - b| \geq 2$.
Let $Y = \{R \in X :$ The range of R has exactly one element$\}$ and $Z = \{R \in X : R$ is a function from S to S$\}$.
Let n(A) denote the number of elements in a set A.

Space for Rough Work

6. If $n(X) = {}^{m}C_{6}$, then the value of m is _____. [JEE Advanced 2024 Paper 2]

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7. If the value of $n(Y) + n(Z)$ is k^2, then $|k|$ is _____. [JEE Advanced 2024 Paper 2]

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Space for Rough Work

JEE ADVANCED RELATIONS AND FUNCTIONS (CLASS 12) — PYQS

Test Pattern : **JEE (Advanced)**

ANSWER KEY

SECTION–1

Ques.	1
Ans.	A, D

SECTION–2

Ques.	2	3	4	5	6	7
Ans.	2520	1860	105	51	20	36

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