

PART 1 - MATHEMATICS

Topic : Relations and functions (class 12)

SECTION-A : (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	: -1	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 -1 marks.

1. Let N denote the set of all natural numbers, and Z denote the set of all integers. Consider the functions $f: N \rightarrow Z$ and $g: Z \rightarrow N$ 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 $n \in N$, and $(f \circ g)(n) = f(g(n))$ for all $n \in Z$.

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

Scan or tap for the full solution



Space for Rough Work

SECTION-B : (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 $S = \{1, 2, 3, \dots, 10\}$. Consider the set

$X = \{R: R \text{ is an equivalence relation on the set } S \text{ such that } R \text{ has exactly 42 elements}\}$.

Then the number of elements in X is _____.

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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 $f: A \rightarrow B$ such that $f(2) \neq 2$ and $f(4) \neq 4$. Consider the set

$T = \{f \in S: \text{there exists a function } g: B \rightarrow N \text{ such that } g(f(x)) = 2^x \text{ for all } x \in A\}$.

Then the number of elements in the set T is _____.

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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 _____.

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5. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function such that $f(x + y) = f(x) + f(y)$ for all $x, y \in \mathbb{R}$, and $g: \mathbb{R} \rightarrow (0, \infty)$ be a function such that $g(x + y) = g(x)g(y)$ for all $x, y \in \mathbb{R}$. 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 _____.

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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 $Y = \{R \in X: \text{The range of } R \text{ has exactly one element}\}$ and $Z = \{R \in X: R \text{ is a function from } S \text{ to } S\}$.

Let $n(A)$ denote the number of elements in a set A .

Space for Rough Work

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6. If $n(X) = {}^mC_6$, then the value of m is _____.

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7. If the value of $n(Y) + n(Z)$ is k^2 , then $|k|$ is _____.

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JEE ADVANCED RELATIONS AND FUNCTIONS (CLASS 12) — PYQS

Test Pattern : JEE (Advanced)

ANSWER KEY

SECTION-A

[illegible]

SECTION-B

[illegible]