

JEE MAIN RELATIONS AND FUNCTIONS (CLASS 12) — PYQS

Max. Marks: 144

Questions: 36

Section A (MCQ) — 32 questions

Q.1 Consider the relation R on the set $\{-2, -1, 0, 1, 2\}$ defined by $(a, b) \in R$ if and only if $1 + ab > 0$.

Then, among the statements :

Statement-I: The number of elements in R is 17

Statement-II: R is an equivalence relation

[JEE Main 2026 (Online) 8th April Evening Shift]

- (1) Only I is true (2) Only II is true
(3) Both I and II are true (4) Neither I nor II is true

Scan or tap for the full solution 

Q.2 Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be defined as $f(x) = \frac{2x^2 - 3x + 2}{3x^2 + x + 3}$.

Then f is :

[JEE Main 2026 (Online) 6th April Evening Shift]

- (1) both one-one and onto
(2) one-one but not onto
(3) onto but not one-one
(4) neither one-one nor onto

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Q.3 The number of functions $f: \{1, 2, 3, 4\} \rightarrow \{a, b, c\}$, which are not onto, is :

[JEE Main 2026 (Online) 4th April Morning Shift]

- (1) 48 (2) 45 (3) 51 (4) 35

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Q.4 For the function $f: [1, \infty) \rightarrow [1, \infty)$ defined by $f(x) = (x-1)^4 + 1$, among the two statements :

- (I) The set $S = \{x \in [1, \infty) : f(x) = f^{-1}(x)\}$ contains exactly two elements, and
(II) The set $S = \{x \in [1, \infty) : f(x) = f^{-1}(x+1)\}$ is an empty set,

[JEE Main 2026 (Online) 4th April Evening Shift]

- (1) only (I) is TRUE
(2) only (II) is TRUE
(3) both (I) and (II) are TRUE
(4) neither (I) nor (II) is TRUE

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Q.5 Let for some $\alpha \in \mathbb{R}$, $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function satisfying $f(x+y) = f(x) + 2y^2 + y + \alpha xy$ for all $x, y \in \mathbb{R}$. If $f(0) = -1$ and $f(1) = 2$, then the value of

$$\sum_{n=1}^5 (\alpha + f(n)) \text{ is :}$$

[JEE Main 2026 (Online) 4th April Evening Shift]

- (1) 110 (2) 140 (3) 150 (4) 170

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Q.6 If $g(x) = 3x^2 + 2x - 3$, $f(0) = -3$ and $4g(f(x)) = 3x^2 - 32x + 72$, then $f(g(2))$ is equal to:

[JEE Main 2026 (Online) 28th January Morning Shift]

- (1) $\frac{7}{2}$ (2) $-\frac{25}{6}$ (3) $\frac{25}{6}$ (4) $-\frac{7}{2}$

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Q.7 Given below are two statements :

Statement-I: The function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by

$$f(x) = \frac{x}{1+|x|} \text{ is one-one.}$$

Statement-II: The function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by

$$f(x) = \frac{x^2 + 4x - 30}{x^2 - 8x + 18} \text{ is many-one.}$$

In the light of the above statements, choose the **correct answer** from the options given below :

[JEE Main 2026 (Online) 28th January Evening Shift]

- (1) Statement-I is true but Statement-II is false
(2) Both Statement-I and Statement-II are false
(3) Both Statement-I and Statement-II are true
(4) Statement-I is false but Statement-II is true

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Q.8 Let R be a relation defined on the set $\{1, 2, 3, 4\} \times \{1, 2, 3, 4\}$ by

$$R = \{((a, b), (c, d)) : 2a + 3b = 3c + 4d\}.$$

Then the number of elements in R is

[JEE Main 2026 (Online) 24th January Morning Shift]

- (1) 6 (2) 15 (3) 12 (4) 18

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Q.9 Let f be a function such that $3f(x) + 2f\left(\frac{m}{19x}\right) = 5x$, $x \neq 0$, where $m = \sum_{i=1}^9 (i)^2$. Then $f(5) - f(2)$ is equal to

[JEE Main 2026 (Online) 24th January Evening Shift]

- (1) 36 (2) 9 (3) -9 (4) 18

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Q.10 Let $A = \{-2, -1, 0, 1, 2, 3, 4\}$. Let R be a relation on A defined by xRy if and only if $2x + y \leq 2$. Let l be the number of elements in R . Let m and n be the minimum number of elements required to be added in R to make it reflexive and symmetric relations respectively. Then $l + m + n$ is equal to :

[JEE Main 2026 (Online) 23rd January Morning Shift]

- (1) 34 (2) 32 (3) 33 (4) 35

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Q.11 Consider two sets $A = \{x \in \mathbb{Z} : |(|x-3|-3)| \leq 1\}$ and $B = \left\{x \in \mathbb{R} - \{1, 2\} : \frac{(x-2)(x-4)}{x-1} \log_e(|x-2|) = 0\right\}$. Then the number of onto functions $f: A \rightarrow B$ is equal to :

[JEE Main 2026 (Online) 23rd January Evening Shift]

- (1) 32 (2) 81 (3) 79 (4) 62

Scan or tap for the full solution



Q.12 Let $A = \{0, 1, 2, \dots, 9\}$. Let R be a relation on A defined by $(x, y) \in R$ if and only if $|x - y|$ is a multiple of 3.

Given below are two statements :

Statement-I: $n(R) = 36$.

Statement-II: R is an equivalence relation.

In the light of the above statements, choose the **correct** answer from the options given below :

[JEE Main 2026 (Online) 23rd January Evening Shift]

- (1) Statement-I is correct but Statement-II is incorrect
(2) Both Statement-I and Statement-II are correct
(3) Both Statement-I and Statement-II are incorrect
(4) Statement-I is incorrect but Statement-II is correct

Scan or tap for the full solution



Q.13 Let the relation R on the set $M = \{1, 2, 3, \dots, 16\}$ be given by $R = \{(x, y) : 4y = 5x - 3, x, y \in M\}$.

Then the minimum number of elements required to be added in R , in order to make the relation symmetric, is equal to

[JEE Main 2026 (Online) 22nd January Morning Shift]

- (1) 4 (2) 3 (3) 1 (4) 2

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Q.14 Let f and g be functions satisfying $f(x + y) = f(x)f(y)$, $f(1) = 7$ and $g(x + y) = g(xy)$, $g(1) = 1$, for all $x, y \in \mathbb{N}$. If $\sum_{x=1}^n \left(\frac{f(x)}{g(x)}\right) = 19607$, then n is equal to :

[JEE Main 2026 (Online) 22nd January Evening Shift]

- (1) 6 (2) 7 (3) 4 (4) 5

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Q.15 The number of strictly increasing functions f from the set $\{1, 2, 3, 4, 5, 6\}$ to the set $\{1, 2, 3, \dots, 9\}$ such that $f(i) \neq i$ for $1 \leq i \leq 6$, is equal to :

[JEE Main 2026 (Online) 21st January Morning Shift]

- (1) 21 (2) 28 (3) 27 (4) 22

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Q.16 The number of relations, defined on the set $\{a, b, c, d\}$, which are both reflexive and symmetric, is equal to:

[JEE Main 2026 (Online) 21st January Morning Shift]

- (1) 16 (2) 64 (3) 256 (4) 1024

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Q.17 Let $A = \{2, 3, 5, 7, 9\}$. Let R be the relation on A defined by xRy if and only if $2x \leq 3y$. Let l be the number of elements in R , and m be the minimum number of elements required to be added in R to make it a symmetric relation. Then $l + m$ is equal to:

[JEE Main 2026 (Online) 21st January Evening Shift]

- (1) 21 (2) 25 (3) 23 (4) 27

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Q.18 Let $A = \{0, 1, 2, 3, 4, 5\}$. Let R be a relation on A defined by $(x, y) \in R$ if and only if $\max\{x, y\} \in \{3, 4\}$. Then among the statements (S_1) : The number of elements in R is 18, and (S_2) : The relation R is symmetric but neither reflexive nor transitive

[JEE Main 2025 (Online) 8th April Evening Shift]

- (1) both are false (2) only (S_1) is true
(3) only (S_2) is true (4) both are true

Scan or tap for the full solution



Q.19 Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a continuous function satisfying $f(0) = 1$ and $f(2x) - f(x) = x$ for all $x \in \mathbb{R}$. If $\lim_{n \rightarrow \infty} \left\{f(x) - f\left(\frac{x}{2^n}\right)\right\} = G(x)$, then $\sum_{r=1}^{10} G(r^2)$ is equal to

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 215 (2) 420 (3) 385 (4) 540

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Q.20 Consider the sets $A = \{(x, y) \in \mathbb{R} \times \mathbb{R} : x^2 + y^2 = 25\}$, $B = \{(x, y) \in \mathbb{R} \times \mathbb{R} : x^2 + 9y^2 = 144\}$, $C = \{(x, y) \in \mathbb{Z} \times \mathbb{Z} : x^2 + y^2 \leq 4\}$ and $D = A \cap B$. The total number of one-one functions from the set D to the set C is:

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 15120 (2) 18290 (3) 17160 (4) 19320

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Q.21 Let $f, g : (1, \infty) \rightarrow \mathbb{R}$ be defined as $f(x) = \frac{2x+3}{5x+2}$ and $g(x) = \frac{2-3x}{1-x}$. If the range of the function $f \circ g : [2, 4] \rightarrow \mathbb{R}$ is $[\alpha, \beta]$, then $\frac{1}{\beta - \alpha}$ is equal to

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 56 (2) 2 (3) 29 (4) 68

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Q.22 Let $A = \{-3, -2, -1, 0, 1, 2, 3\}$ and R be a relation on A defined by xRy if and only if $2x - y \in \{0, 1\}$. Let l be the number of elements in R. Let m and n be the minimum number of elements required to be added in R to make it reflexive and symmetric relations, respectively. Then $l + m + n$ is equal to:

[JEE Main 2025 (Online) 4th April Evening Shift]

- (1) 17 (2) 18 (3) 15 (4) 16

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Q.23 Let $A = \{-3, -2, -1, 0, 1, 2, 3\}$. Let R be a relation on A defined by xRy if and only if $0 \leq x^2 + 2y \leq 4$. Let l be the number of elements in R and m be the minimum number of elements required to be added in R to make it a reflexive relation. Then $l + m$ is equal to

[JEE Main 2025 (Online) 3rd April Morning Shift]

- (1) 18 (2) 20 (3) 17 (4) 19

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Q.24 Let f be a function such that $f(x) + 3f\left(\frac{24}{x}\right) = 4x$, $x \neq 0$. Then $f(3) + f(8)$ is equal to

[JEE Main 2025 (Online) 3rd April Evening Shift]

- (1) 13 (2) 11 (3) 10 (4) 12

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Q.25 Let $A = \{-2, -1, 0, 1, 2, 3\}$. Let R be a relation on A defined by xRy if and only if $y = \max\{x, 1\}$. Let l be the number of elements in R. Let m and n be the minimum number of elements required to be added in R to make it reflexive and symmetric relations, respectively. Then $l + m + n$ is equal to

[JEE Main 2025 (Online) 3rd April Evening Shift]

- (1) 11 (2) 12 (3) 14 (4) 13

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Q.26 Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be a twice differentiable function such that

$$(\sin x \cos y)(f(2x+2y) - f(2x-2y)) = (\cos x \sin y)(f(2x+2y) + f(2x-2y)),$$

for all $x, y \in \mathbb{R}$. If $f'(0) = \frac{1}{2}$, then the value of $24f''\left(\frac{5\pi}{3}\right)$ is :

[JEE Main 2025 (Online) 2nd April Morning Shift]

- (1) 2 (2) 3 (3) -3 (4) -2

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Q.27 Let A be the set of all functions $f : \mathbb{Z} \rightarrow \mathbb{Z}$ and R be a relation on A such that $R = \{(f, g) : f(0) = g(1) \text{ and } f(1) = g(0)\}$. Then R is :

[JEE Main 2025 (Online) 2nd April Morning Shift]

- (1) Symmetric and transitive but not reflexive
(2) Symmetric but neither reflexive nor transitive
(3) Transitive but neither reflexive nor symmetric
(4) Reflexive but neither symmetric nor transitive

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Q.28 Define a relation R on the interval $\left[0, \frac{\pi}{2}\right)$ by xRy if and only if $\sec^2 x - \tan^2 y = 1$. Then R is :

[JEE Main 2025 (Online) 29th January Morning Shift]

- (1) both reflexive and symmetric but not transitive
(2) both reflexive and transitive but not symmetric
(3) reflexive but neither symmetric nor transitive
(4) an equivalence relation

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Q.29 If $f(x) = \frac{2^x}{2^x + \sqrt{2}}$, $x \in \mathbb{R}$, then $\sum_{k=1}^{81} f\left(\frac{k}{82}\right)$ is equal to

[JEE Main 2025 (Online) 28th January Morning Shift]

- (1) 82 (2) $81\sqrt{2}$ (3) 41 (4) $\frac{81}{2}$

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Q.30 The relation $R = \{(x, y) : x, y \in \mathbb{Z} \text{ and } x + y \text{ is even}\}$ is:

[JEE Main 2025 (Online) 28th January Morning Shift]

- (1) reflexive and transitive but not symmetric
- (2) reflexive and symmetric but not transitive
- (3) an equivalence relation
- (4) symmetric and transitive but not reflexive

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Q.31 Let $f: \mathbb{R} - \{0\} \rightarrow (-\infty, 1)$ be a polynomial of degree 2, satisfying $f(x)f\left(\frac{1}{x}\right) = f(x) + f\left(\frac{1}{x}\right)$. If $f(K) = -2K$, then the sum of squares of all possible values of K is:

[JEE Main 2025 (Online) 28th January Evening Shift]

- (1) 9
- (2) 1
- (3) 6
- (4) 7

Scan or tap for the full solution



Q.32 Let $f: [0, 3] \rightarrow A$ be defined by $f(x) = 2x^3 - 15x^2 + 36x + 7$ and $g: [0, \infty) \rightarrow B$ be defined by $g(x) = \frac{x^{2025}}{x^{2025} + 1}$. If both the functions are onto and $S = \{x \in \mathbb{Z} : x \in A \text{ or } x \in B\}$, then $n(S)$ is equal to:

[JEE Main 2025 (Online) 28th January Evening Shift]

- (1) 29
- (2) 31
- (3) 30
- (4) 36

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Section B (Numerical) — 4 questions

Q.33 Let f be a polynomial function such that $\log_2(f(x)) = \left(\log_2\left(2 + \frac{2}{3} + \frac{2}{9} + \dots\right)\right) \cdot \log_3\left(1 + \frac{f(x)}{f\left(\frac{1}{x}\right)}\right)$, $x > 0$ and $f(6) = 37$. Then $\sum_{n=1}^{10} f(n)$ is equal to _____.

[JEE Main 2026 (Online) 8th April Evening Shift]

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Q.34 Let $R = \{(x, y) \in \mathbb{N} \times \mathbb{N} : \log_e(x + y) \leq 2\}$. Then the minimum number of elements, required to be added in R to make it a transitive relation, is _____.

[JEE Main 2026 (Online) 6th April Evening Shift]

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Q.35 Let $A = \{1, 2, 3, 4, 5, 6\}$. The number of one-one functions $f: A \rightarrow A$ such that $f(1) \geq 3$, $f(3) \leq 4$ and $f(2) + f(3) = 5$, is _____.

[JEE Main 2026 (Online) 5th April Morning Shift]

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Q.36 The number of relations on the set $A = \{1, 2, 3\}$, containing at most 6 elements including $(1, 2)$, which are reflexive and transitive but not symmetric, is _____.

[JEE Main 2025 (Online) 7th April Morning Shift]

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ANSWER KEY

Section A (MCQ) — 32 questions

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	1	4	2	1	2	1	3	3	4	3	4
Ques.	12	13	14	15	16	17	18	19	20	21	22
Ans.	4	4	4	2	2	2	3	3	3	1	1
Ques.	23	24	25	26	27	28	29	30	31	32	
Ans.	1	2	2	3	2	4	4	3	3	3	

Section B (Numerical) — 4 questions

Ques.	33	34	35	36			
Ans.	395	15	72	6			