

CLASS 12

MATHEMATICS

EXTRA QUESTIONS

Class 12 Mathematics Chapter 1 Extra Questions (HOTS) – Relations and Functions

For complete step-by-step answers and a quick summary, check the Class 12 Mathematics Chapter 1 Solutions and Class 12 Mathematics Chapter 1 Revision Notes. These Class 12 Mathematics Chapter 1 important questions are handy for last-minute exam practice.

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Q1 (General/abstract proof). Let R be a relation on set A defined by aRb iff a and b leave the same remainder when divided by a fixed positive integer m . Prove that R is an equivalence relation for any m , and describe the equivalence classes.

Answer: Reflexive, symmetric, transitive all follow from properties of equality of remainders, so R is an equivalence relation for every $m \geq 1$. The equivalence classes are the **m residue classes mod m** — this generalises Solutions Q9(i) (the $m=4$ case) to any modulus.

Q2 (Reverse-engineering). A relation R on $\{1,2,3,4,5\}$ is known to be reflexive and symmetric, contains $(1,2)$ and $(2,3)$, and is NOT transitive. List one such relation R with the minimum possible number of ordered pairs.

Answer: $\{(1,1),(2,2),(3,3),(4,4),(5,5),(1,2),(2,1),(2,3),(3,2)\}$ — 9 pairs, already fails transitivity since $(1,3)$ is absent.

Q3 (Assertion-Reason). Assertion (A): $f:R \rightarrow R$, $f(x)=x^2$ is not invertible. Reason (R): A function is invertible iff it is bijective. Options: (a) Both true, R explains A (b) Both true, R does not explain A (c) A true, R false (d) A false, R true.

Answer: (a). $f(x)=x^2$ is neither one-one nor onto, so it is not invertible exactly by the criterion in R .

Q4 (Fresh-number application). If $f:R \rightarrow R$ is defined by $f(x)=5x-3$, find $f^{-1}(x)$ and verify $f(f^{-1}(7))=7$.

Answer: $f^{-1}(x)=(x+3)/5$. $f^{-1}(7)=2$; $f(2)=7$. Verified.

Q5 (Multi-part composition, fresh numbers). Let $f(x)=2x+1$, $g(x)=x^2-4$. Find (i) $f \circ g(3)$ (ii) $g \circ f(3)$ (iii) is $f \circ g = g \circ f$?

Answer: (i) $g(3)=5$, $f(5)=11$. (ii) $f(3)=7$, $g(7)=45$. (iii) **$f \circ g \neq g \circ f$** since $11 \neq 45$.

Q6 (General proof, harder than the Solutions-post version). If $f:A \rightarrow B$ and $g:B \rightarrow C$ are both bijections, prove $g \circ f:A \rightarrow C$ is a bijection and $(g \circ f)^{-1}=f^{-1} \circ g^{-1}$.

Answer: One-one and onto both follow directly by chaining the bijectivity of f and g ; the inverse composition $(f^{-1} \circ g^{-1}) \circ (g \circ f) = 1_A$ confirms the inverse formula.

Q7 (Word problem, fresh numbers, binary operations). A binary operation $*$ is defined on the integers by $a*b=a+b-ab$. Check commutativity, associativity, and find the identity.

Answer: Commutative (symmetric formula), associative ($((a*b)*c)=a+b+c-ab-ac-bc+abc=a*(b*c)$), identity **$e=0$** ($a*0=a$).

Q8 (Reverse-engineering, equivalence classes). A relation R on Z is defined as aRb iff $a^2=b^2$. Show R is an equivalence relation and find the equivalence class of 5.

Answer: Reflexive/symmetric/transitive all hold since equality of squares is an equality relation. Equivalence class of 5 is **$\{-5,5\}$** .

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