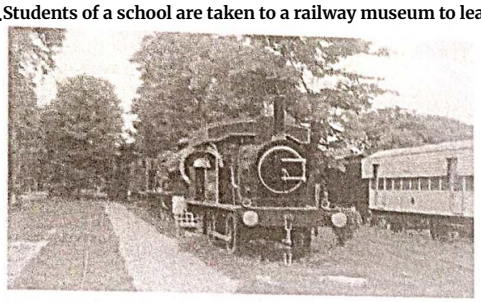
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Questions:

Case Study Questions

1. Students of a school are taken to a railway museum to learn about railways heritage and its history.



An exhibit in the museum depicted many rail lines on the track near the railway station. Let L be the set of all rail lines on the railway track and R be the relation on L defined by
R = {(l_1, l_2) : l_1 is parallel to l_2}
On the basis of the above information, answer the following questions.
(i) Find whether the relation R is symmetric or not.
(ii) Find whether the relation R is transitive or not.
(iii) If one of the rail lines on the railway track is represented by the equation y = 3x + 2, then find the set of rail lines in R related to it.
Or
Let S be the relation defined by S= ((l_1,l_2) : l_1 is perpendicular to l_2) check whether the relation S is symmetric and transitive.

5 Marks

2. Let A = (-1, 0, 1, 2) B = (-4, -2, 0, 2) and f,g:A →B be function defined by f(x) = x^2 -x, x ∈ A and g(x) = 2 $|x - \frac{1}{2}|$ -1 x ∈ A. Are f and g equal? Justify your answer. (Hint: One may note that two functions f : A → B and g : A → B such that f(a) = g(a) ∀ a ∈ A, are called equal functions).

3. Let $f : R - \left\{-\frac{4}{3}\right\} \to R$ be a function defined as $f(x) = \frac{4x}{3x+4}$. Show that f is a one-one function. Also, check whether f is an onto funciton or not.

3 Marks

4. Let $f : N \to R$ be a function defined as $f(x) = 4x^2 + 12x + 15$ Show that $f : N \to$ Range f is invertible. Find the inverse off.

5. Show that the relation R in the set A = {1, 2, 3, 4, 5} given by is even R = {(a, b) : |a - b| is even} is an equivalence relation. Show that all the elements of {1, 3, 5} are related to each other and all the elements of {2, 4} are related to each other. But no element of {1, 3, 5} is related to any element of {2, 4}.

6. Let N denote the set of all natural numbers and R be the relation on $N \times N$ defined by:
(a, b)R(c, d) if ad(b+c)(a+d) = bc(a + d)
Show that R is an equivalence relation.

7. If the function f: $R \to R$ be given by $f(x) = x^2$ and g: $R \to R$ be given by $g(x) = \frac{x}{x-1}, x \neq 1$, find fog and gof and hence find fog (2) and gof (-3).

8. Let f: $N \to N$ be a function defined as: $f(x) = 9x^2 + 6x - 5$.
Show that $f : N \to S$, where S is the range of f, is invertible. Find the inverse of f and hence find f^{-1} (43) and f^{-1} (163).

9. Show that the relation S defined on set N x N by (a, b) S (c, d) ⇒ a + d = b + c is an equivalence relation.

2 Marks

10. If f(x) = x + 7 and g(x) = x - 7, $X \in R$, find fog(7)?

11. If the binary operation * defined on Q is defined as a*b=2a+b-ab, for all $a, b \in Q$, find the value of 3*4.

12. Let R=[(a,a^2) : a is a prime number less than 5) be a relation Find the range of R

13. State the reason why the Relation R = [(a, b) : $a \leq b^2$ on the set R of the real numbers is not reflexive