

## CUET Mathematics Test - Set 11

Chapter: Relations, Functions, and Inverse Trigonometric Functions

### SOLUTIONS

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## Solutions

- Solution:** To be reflexive,  $R$  must have  $(1, 1), (2, 2), (3, 3)$ . To be symmetric with  $(1, 2)$  and  $(1, 3)$ , it must have  $(2, 1)$  and  $(3, 1)$ . If we don't add  $(2, 3)$  and  $(3, 2)$ , it remains non-transitive. There is only 1 such relation. **Correct Option: (A)**
- Solution:**  $f(2) = 2/5$  and  $f(1/2) = (1/2)/(5/4) = 2/5$ . Not one-one. Maximum value is  $1/2$  (at  $x = 1$ ), minimum is  $-1/2$  (at  $x = -1$ ). Range is  $[-1/2, 1/2]$ , not  $\mathbb{R}$ , so not onto. **Correct Option: (D)**
- Solution:** To be symmetric, we add  $(b, a)$ . Now  $R = \{(a, a), (b, b), (c, c), (a, b), (b, a)\}$ . This is already transitive. Only 1 pair added. **Correct Option: (A)**
- Solution:** Total functions =  $2^n$ . Functions that are NOT onto are those where all elements map to 'a' (1 way) or all map to 'b' (1 way). Onto functions =  $2^n - 2$ . **Correct Option: (C)**
- Solution:**  $3\pi \approx 9.42$ .  $10 - 3\pi \approx 0.58$ , which lies in  $[-\pi/2, \pi/2]$ . Since  $\sin(10) = \sin(10 - 3\pi)$  is false (it's  $-\sin(10 - 3\pi)$ ), we use  $3\pi - 10$ . **Correct Option: (C)**
- Solution:** Using identities,  $f(x)$  simplifies to a constant value  $5/4$ . Thus  $g(f(x)) = g(5/4) = 1$ . **Correct Option: (D)**
- Solution:**  $-1 \leq 2x - 1 \leq 1 \implies 0 \leq 2x \leq 2 \implies 0 \leq x \leq 1$ . **Correct Option: (A)**
- Solution:** Let  $\theta = \cos^{-1}(-3/5)$ .  $\sin(2\theta) = 2\sin\theta\cos\theta = 2(4/5)(-3/5) = -24/25$ . **Correct Option: (B)**
- Solution:**  $f(x) = (x - 2)^2 + 1$ . For  $x \geq 2$ ,  $(x - 2)^2 \geq 0$ , so  $f(x) \geq 1$ . Range is  $[1, \infty)$ . **Correct Option: (B)**
- Solution:**  $(\pi/2 - \cos^{-1}x) + (\pi/2 - \cos^{-1}y) = 2\pi/3 \implies \pi - (\cos^{-1}x + \cos^{-1}y) = 2\pi/3 \implies \pi/3$ . **Correct Option: (A)**
- Solution:**  $|a - a| = 0$  (not prime, not reflexive).  $|a - b| = |b - a|$  (Symmetric).  $|3 - 1| = 2$  (P),  $|5 - 3| = 2$  (P), but  $|5 - 1| = 4$  (Not P, not Transitive). **Correct Option: (B)**
- Solution:**  $f(f(x)) = \frac{\frac{x-1}{x+1}-1}{\frac{x-1}{x+1}+1} = \frac{x-1-x-1}{x-1+x+1} = \frac{-2}{2x} = -1/x$ . **Correct Option: (B)**
- Solution:**  $\tan^{-1}a + \cot^{-1}a = \pi/2$ .  $\cot(\pi/2) = 0$ . **Correct Option: (B)**
- Solution:** For  $x > 0$ ,  $f(x) = 1$ . For  $x < 0$ ,  $f(x) = -1$ . Range is  $\{-1, 1\}$ . **Correct Option: (B)**
- Solution:**  $\tan^{-1} \frac{1/2+1/3}{1-1/6} = \tan^{-1} \frac{5/6}{5/6} = \tan^{-1} 1 = \pi/4$ . **Correct Option: (A)**