CUET (UG) – MATHEMATICS

Chapter Test - Section B2: Applied Mathematics - Numbers and Numerical Applications

SOLUTIONS

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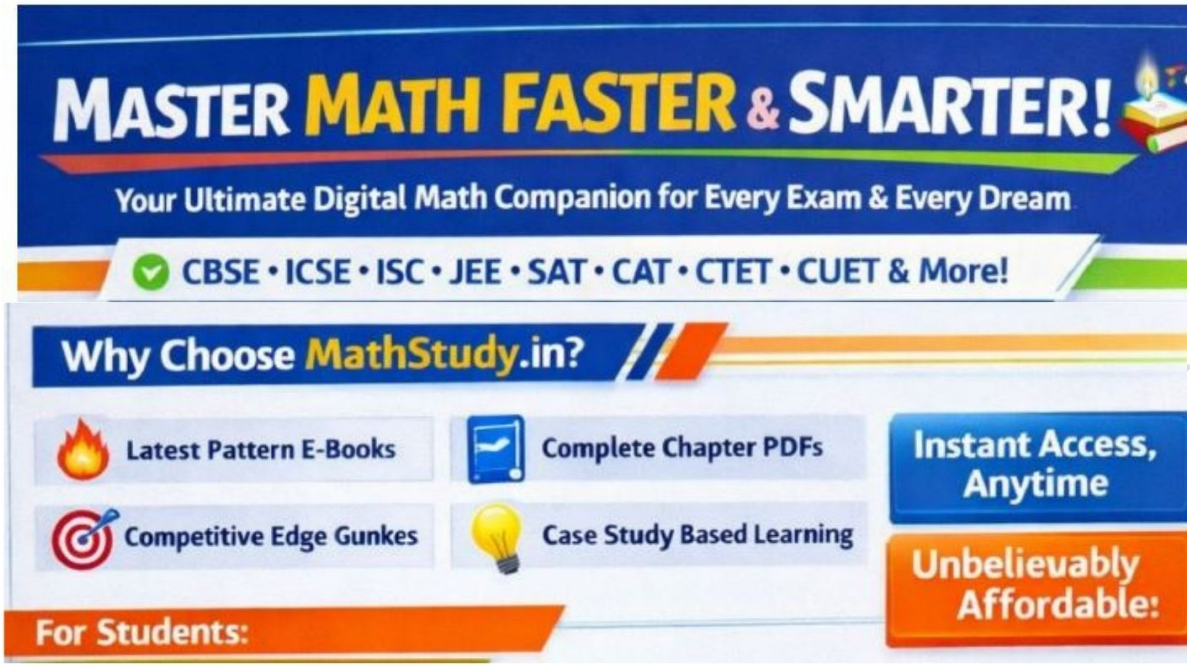

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Solutions

1. **Correct Option: (A)**. $3^1 = 3, 3^2 = 9, 3^3 = 27, 3^4 = 81$. The cycle is 4. 2024 is divisible by 4, so the last digit is the same as 3^4, which is 1.

2. **Correct Option: (D)**. Division is not well-defined in modular arithmetic unless the divisor is coprime to the modulus.

3. **Correct Option: (D)**. Wine in Mix 1 = 3/5, Mix 2 = 4/9. Target Wine = 1/2. Allegation: $(1/2 - 4/9) : (3/5 - 1/2) = (1/18) : (1/10) = 10 : 18 = 5 : 9$. (Wait, recalculating: 1/18 vs 1/10 is 5 : 9).

4. **Correct Option: (A)**. $T_{up} = 2T_{down} \implies D/(x-y) = 2D/(x+y) \implies x + y = 2x - 2y \implies x = 3y$. Ratio is 3 : 1.

5. **Correct Option: (B)**. Combined rate = $1/14 + 1/16 = 15/112$. Time without leak = 112/15 hrs = 7 hrs 28 min. With leak, time = 7 hrs 28 min +32 min = 8 hours. Rate with leak = 1/8. Leak rate = $15/112 - 1/8 = (15-14)/112 = 1/112$. Time = 112 hours.

6. **Correct Option: (C)**. $A/B = 100/75$, $B/C = 100/96$. $A/C = (100/75) \times (100/96) = 100/72$. A beats C by $100 - 72 = 28$ m.

7. **Correct Option: (B)**. Check values: $4(6) = 24$. $24 = 3 \times 7 + 3$. Thus $24 \equiv 3 \pmod 7$. $x = 6$.

8. **Correct Option: (B)**. Allegation: $(18 - 14) : (14 - 8) = 4 : 6 = 2 : 3$. Quantity at 18% is $(3/5) \times 1000 = 600$ kg.

9. **Correct Option: (A)**. A's time = 190 sec, B's time = 200 sec. Distance B covers in 190 sec = $(1000/200) \times 190 = 950$ m. A beats B by 50 m.

10. **Correct Option: (A)**. $2x \geq 8 \implies x \geq 4$. $5x \leq 25 \implies x \leq 5$. So $4 \leq x \leq 5$.

11. **Correct Option: (C)**. $1/12 - 1/15 = (5-4)/60 = 1/60$. Leak empties in 60 hours.

12. **Correct Option: (B)**. $26/(10+y) = 14/(10-y) \implies 260 - 26y = 140 + 14y \implies 120 = 40y \implies y = 3$.

13. **Correct Option: (A)**. $7 \equiv -1 \pmod 4$. $7^{100} \equiv (-1)^{100} = 1 \pmod 4$.

14. **Correct Option: (B)**. $A = 100, B = 80, C = 72$. $C/B = 72/80 = 9/10$. In a 100 pt game, C scores 90 when B scores 100. B gives C 10 points.

15. **Correct Option: (C)**. Initial Syrup = 5/8. Final Syrup = 1/2. Part replaced = $(Initial - Final)/Initial = (5/8 - 1/2)/(5/8) = (1/8)/(5/8) = 1/5$.

16. **Correct Option: (A)**. $3^2 = 9$. $9 \pmod 4 = 1$.

17. **Correct Option: (B)**. First half filled in 3 hours. For second half, 4 taps work. Time = (1/2 tank)/(4 × 1/6 tank/hr) = $(1/2)/(2/3) = 3/4$ hrs = 45 min. Total = 3 hrs 45 min.

18. **Correct Option: (A)**. Speed in still water = $(18 + 12)/2 = 15$ km/h.

19. **Correct Option: (A)**. 11 is prime. $11 = 6(1) + 5 \implies 11 \equiv 5 \pmod 6$.

20. **Correct Option: (A)**. Water in can 1 = 1/4, can 2 = 1/2. Target water = 3/8. Allegation: $(1/2 - 3/8) : (3/8 - 1/4) = 1/8 : 1/8 = 1 : 1$. Mix 6L from each to get 12L.

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