

Cyclic (Modular) Arithmetic: Conversions, Negative Numbers & Modulo Tables

This exercise set accompanies the video lesson explaining cyclic/modular arithmetic — how numbers “wrap around” after reaching a fixed modulus. You will practise converting any number (including negative numbers) to its equivalent value within a given modulo, using the rule that adding or subtracting multiples of the modulus does not change a number's cyclic value. This set also covers how to construct and use modulo addition and subtraction tables — a common WAEC/JAMB question format. **Perfect for students preparing for WAEC, NECO, and JAMB Mathematics.**

Exercises

1. Find the remainder when 148 is divided by 9.
2. Simplify $250 \pmod{8}$.
3. If $a \equiv 6 \pmod{7}$ and $b \equiv 5 \pmod{7}$, find:
 - (i) $a + b \pmod{7}$
 - (ii) $a \times b \pmod{7}$
 - (iii) $a - b \pmod{7}$
4. Show that $100 \equiv 2 \pmod{7}$.
5. A clock shows 5 o'clock. What time will it show after 40 hours?
6. Today is Thursday. What day of the week will it be after 100 days?
7. Simplify $(34 \times 5 - 18) \pmod{11}$.
8. Express -17 as a positive residue modulo 8.
9. Express -29 as a positive residue modulo 6.
10. Construct an addition table modulo 5 for the elements $\{0, 1, 2, 3, 4\}$.
11. Using the table from Question 10, find $3 + 4 \pmod{5}$.
12. Solve for x : $x + 7 \equiv 2 \pmod{9}$.
13. Find the last digit of 7^{100} using modular arithmetic. (Hint: consider the pattern mod 10.)
14. A bus leaves a station every 15 days, starting on a Sunday. What day of the week will the 20th departure fall on?
15. Simplify $(56 \pmod{9}) + (79 \pmod{9})$, then reduce the result mod 9.

ANSWERS

1. 4

2. 2

3. (i) 4 (ii) 2 (iii) 1

4. $100 - 98 = 2$, and $98 = 14 \times 7$, so $100 \equiv 2 \pmod{7}$ ✓

5. 9 o'clock

6. Saturday

7. 9

8. 7

9. 1

10. Table: rows/columns 0–4, each entry = $(\text{row} + \text{column}) \bmod 5$

11. 2

12. $x = 4$

13. 1 (cycle length 4: 7, 9, 3, 1, ...; $100 \bmod 4 = 0 \rightarrow$ last in cycle $\rightarrow 1$)

14. Friday

15. 0