

Clock Arithmetic and Modular Systems

Contemporary Math (MAT-130)

Find each sum or difference on the 12-hour clock.

1. $11 - 5$
2. $3 + 4$
3. $2 - 5$
4. $10 + 9$
5. $6 - 11$

A 4-hour clock system uses the digits (0, 1, 2, 3).

6. Create a 4-hour clock addition table.
7. Create a 4-hour clock multiplication table.
8. Decide if the properties are satisfied by the 4-hour clock system with the property of addition.
 - a. Closure
 - b. Commutative
 - c. Identity (if yes give the identity element)
 - d. Inverse (if yes give the inverse of each element)
9. Decide if the properties are satisfied by the 4-hour clock system with the property of multiplication.
 - a. Closure
 - b. Commutative
 - c. Identity (if yes give the identity element)
 - d. Inverse (if yes give the inverse of each element)

Tell whether each statement is true or false.

10. $3 \equiv 17 \pmod{7}$
11. $12 \equiv 5 \pmod{9}$
12. $27 \equiv 11 \pmod{3}$
13. $43 \equiv 18 \pmod{5}$
14. $124 \equiv 25 \pmod{11}$

Work each modular arithmetic problem.

15. $(5 + 9) \pmod{6}$
16. $(3 * 6) \pmod{7}$
17. $(25 - 11) \pmod{3}$
18. $(48 \div 3) \pmod{5}$
19. $[2 * (37 - 28)] \pmod{9}$

Find all nonnegative solutions for each equation.

20. $x \equiv 4 \pmod{8}$
21. $(x + 4) \equiv 7 \pmod{5}$
22. $2x \equiv 4 \pmod{6}$

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Solutions:

1. 6
2. 7
3. 9
4. 7
5. 7

6.

+	0	1	2	3
0	0	1	2	3
1	1	2	3	0
2	2	3	0	1
3	3	0	1	2

7.

×	0	1	2	3
0	0	0	0	0
1	0	1	2	3
2	0	2	0	2
3	0	3	2	1

8.
 - a. Yes
 - b. Yes
 - c. Yes (0)
 - d. Yes (inverse of 0 is 0, inverse of 1 is 3, inverse of 2 is 2, inverse of 3 is 1)
9.
 - a. Yes
 - b. Yes
 - c. Yes (1)
 - d. No
10. True
11. False
12. False
13. True
14. True
15. 2
16. 4
17. 2
18. 1
19. 0
20. $\{4, 12, 20, 28, \dots\}$ or $(8n + 4)$
21. $\{3, 8, 13, 18, \dots\}$ or $(5n - 2)$
22. $\{2, 5, 8, 11, \dots\}$ or $(3n + 2)$