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Clock Arithmetic

Did you realize that, when you work with elapsed time, you use a special kind of arithmetic that is called **clock arithmetic**? In clock arithmetic, you use the symbols \oplus for addition and \ominus for subtraction. Here are two examples.





8 o'clock plus 5 hours is 1 o'clock. $8 \oplus 5 = 1$

4 o'clock minus 7 hours is 9 o'clock. $4 \ominus 7 = 9$

Add or subtract using the 12-hour clock above.

1. 11 ⊕ 3	2. 7 ⊕ 9	3. 3 ⊖ 10	4. 7 ⊖ 8
5. 2 ⊕ 12	6. 2 ⊖ 12	7. 4 ⊕ 6	8. 9 ⊖ 4

To solve "clock equations" involving the 12-hour clock, use inverse operations.

 $d \oplus 5 = 2$ $j \ominus 4 = 10$ $j \ominus 4 \oplus 4 = 10 \oplus 4$ $d \oplus 5 \ominus 5 = 2 \ominus 5$ d = 9j = 2

Solve each equation using the 12-hour clocks above.

9. $r \oplus 7 = 5$	10. $x \ominus 9 = 11$	11. $b \oplus 6 = 7$
12. $t \ominus 12 = 4$	13. $n \ominus 4 = 3$	14. $y \oplus 6 = 1$

CHALLENGE In clock arithmetic, you often work with clocks that have different numbers of hours. For example, the clock shown at the right is an 8-hour clock.



Solve each equation using the 8-hour clock at the right.

15. $m \oplus 5 = 2$	16. $z \ominus 4 = 7$	17. $p \oplus 8 = 1$
18. $c \ominus 8 = 6$	19. $w \ominus 4 = 8$	20. $k \oplus 6 = 3$