

# Modular Arithmetic (General Problems)

Los Angeles Math Circle

4 July 2021

1. If a biology experiment begins at 7:00 AM and runs for 80 hours, at what time will it end?
2. Cory's birthday lies on a MOnday this year. What day of the week will his birthday be on in 2016?
3. Reduce the following numbers using modular arithmetic:
  - (a)  $136283 \times 192758237582389 \equiv \quad (\text{mod } 2)$
  - (b)  $19342347328 + 1894837483 \equiv \quad (\text{mod } 10)$
  - (c)  $1934232 \times 1894837480 \equiv \quad (\text{mod } 10)$

4. Suppose hot dog buns come in packages of 34, and hot dogs come in packages of 8.
- (a) What is the smallest number of packages of hot dogs and hot dog buns Ivy should buy if she doesn't want to have left-over hot dogs or left-over hot dog buns? (Assume that hot dogs can't be eaten without a bun, or vice versa).
- (b) Suppose that hot dog buns come in packages of 33. What is the smallest number of packages of hot dogs and hot dog buns Ivy should buy now?
- (c) Now assume hot dog buns come in packages of  $n$ . Write expressions that show how many packages of hot dog buns Ivy should buy. Note that there will be two expressions: one where the reduced form of  $n$  in mod 8 is divisible by 8, and one where it is not.