The Division Algorithm

quotient = q = n div d
remainder = r = n mod d

$$n = qd + r$$

div = integer division
mod = modulus operation

$0 \leq r \leq (d-1)$

The Division Algorithm

Theorem: Let n be an integer and let d be a positive integer. Then, there are unique integers q and r, with $0 \leq r \leq (d-1)$, such that $n = qd + r$.

Procedural version of the Division Algorithm

Input: Integers n and d, with $d > 0$
Output: $q = n$ div d and $r = n$ mod d

```
LET q equal zero
LET r equal n

IF n ≥ 0:                →    ELSE (i.e n < 0):
  WHILE (r ≥ d):                WHILE (r < 0):
    q := q+1                      q := q-1
    r := r-d                      r := r+d
  END-WHILE                     END-WHILE

END IF
```