

1. Find  $q, r$  with  $0 \leq r < a$ , so that  $b = a \cdot q + r$  with:
    - (a)  $a = 351763, b = 1280012$
    - (b)  $a = 286170, b = -3186815$ .
    - (c)  $a = 657810, b = 1497$ .
  2. Compute the following:
    - (a)  $88280 \% 8995$
    - (b)  $992543831 \% 395513$
  3. Without a calculator find the last digit of:  $3509 \cdot 5973 + 1698 \cdot 36912 + 8857 \cdot 74334$ .
  4.
    - (a) Without a calculator determine the remainder of 1009669116197 when it is divided by 9.
    - (b) Is 1009669116197 divisible by 9?
  5. Encipher the message "tube" using an affine cipher with key  $a = 5$  and  $b = 17$ .
  6. (Wait until Wednesday to try this problem.) Find the inverse of 7 (mod 31) (that is, find  $c$  such that  $7c \equiv 1 \pmod{31}$ ).
- Do one of the following two problems, you can do both for extra credit.**
7. Prove that if  $a \equiv b \pmod{m}$  and  $c$  is an integer then  $a + c \equiv b + c \pmod{m}$ . You will use both the definition of mod and divisibility.
  8. Prove that if  $d|a$  and  $d|b$  then  $d|a + b$  and  $d|a - b$ .
  9. Find the following places on campus and take a picture of yourself there and send it to me.
    - (a) The Math Learning Center
    - (b) The Logic Center
    - (c) The Writing Center