

1. (a) Compute  $\gcd(119, 315)$ , the greatest common divisor of 119 and 315.  
(b) Find  $r$  and  $s$  such that  $\gcd(119, 315) = 119r + 315s$ .
  
2. (a) Encode the message "SUN" one letter at a time, using the RSA system with  $m = 77$  and  $e = 7$ . In translating letters into numbers, send A to 10, B to 11, ..., Z to 35. Leave your answer as a sequence of numbers.  
(b) Using the same system as part (a), decode the message "73", a single letter.
  
- (3) In devising an RSA system you choose a public modulus  $m = 1081 = 23 \cdot 47$  and an encrypting exponent of 73. Find the decrypting exponent.
  
3. The RSA system is used with a public exponent of  $e=27$  and modulus  $m=1189=(29)(41)$   
Find the decrypting exponent.  
(b) Compute  $13^{2409} \pmod{4819}$ . (Hint:  $13^{39} = 1 \pmod{4819}$ )
  - (1) Find  $\phi(206437)$  (note:  $206437 = 7^2 \cdot 11 \cdot 383$ ).
  - (2) Calculate
$$3^{160445} \pmod{206437}.$$
  
1. (a) Compute  $\gcd(741, 221)$ , the greatest common divisor of 741 and 221.  
(b) Find  $r$  and  $s$  such that  $\gcd(741, 221) = 741r + 221s$ .