Name: \_\_\_\_\_\_ Directions: Show all work. No credit for answers without work.

1. [2 points] Let p = 13 and g = 7. Find  $\log_q(11)$  in  $\mathbb{F}_p$ .

2. [2 points] Let p = 3167 and g = 7; note that p is prime. Given that in  $\mathbb{F}_p$ , we have  $\log_q(2) = 786$  and  $\log_q(3) = 953$ , find  $\log_q(12)$ .

- 3. [2 parts, 3 points each] Alice and Bob use the Diffie-Hellman key exchange protocol with p = 179 and g = 2.
  - (a) Alice picks a = 33 as her private number. What should she send to Bob?

(b) Alice receives B = 145 from Bob. What is their shared secret?