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

1. [2 points] Let $p=13$ and $g=7$. Find $\log _{g}(11)$ in $\mathbb{F}_{p}$.
2. [ $\mathbf{2}$ points] Let $p=3167$ and $g=7$; note that $p$ is prime. Given that in $\mathbb{F}_{p}$, we have $\log _{g}(2)=786$ and $\log _{g}(3)=953$, find $\log _{g}(12)$.
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?
