

1. (1 point) Let  $G$  be the group  $U_{20}$  (the units of the group  $\mathbb{Z}_{20}$ ).

(a) (1 point) List the elements of  $U_{20}$  using roster notation. What is  $|U_{20}|$ ?

(b) (1 point) Let  $H = \langle [13] \rangle$ . Find  $|H|$ .

(c) (1 point) Find all elements that are generators for  $H$ .

(d) (1 point) Find the left cosets of  $H$  in  $G$ .

(e) (1 point) Find the right cosets of  $H$  in  $G$ .

(f) (1 point) Is  $H$  a normal subgroup of  $G$ ? Justify your answer.

(g) (2 points) Give a complete listing of **all** subgroups of  $G$ . Explain how you know your list is complete.