

962-20-1424

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1400 E 155 S, JWB 233, Salt Lake City, UT 84112-0090. *Translation lengths in  $Out(F_n)$ .*

Define the translation length  $\tau(g)$  of  $g \in G$  to be

$$\lim_{n \rightarrow \infty} \frac{\|g^n\|}{n},$$

where  $G$  is a group with a finite generating set  $X$ , and  $\|g\|$  denotes the length of  $g$  in the word metric on  $G$  associated with  $X$ . **Theorem:** Every element  $\mathcal{O}$  of infinite order in  $Out(F_n)$  has positive translation length. Furthermore, there exists a positive constant  $c_n$  such that

$$\tau(\mathcal{O}) \geq c_n.$$

Consequences include a new proof that solvable subgroups of  $Out(F_n)$  are finitely generated and virtually abelian and the new result that such subgroups are quasi-convex. (Received October 04, 2000)