

Honors HW2 (due 28 January)

Why is it true that  $\int_1^x \frac{1}{t} dt = \ln(x)$ ? In this homework, you will investigate this.

- 1.) Let  $F(r) = \int_1^2 t^r dt$ . Calculate  $F(r)$  for three values of  $r$  close to (but not equal to)  $-1$ . Do the values of  $F(r)$  seem to approach a limit? Do you recognize said limit (if it exists)?
- 2.) Let  $x$  be some positive number and assume  $r \neq -1$ . Define  $G(r) = \int_1^x t^r dt$  and find a simpler formula for it (i.e. calculate the integral). Based on your formula, why is there trouble when setting  $r = -1$ ?
- 3.) Compute  $\lim_{r \rightarrow -1} G(r)$  (hint: L'Hôpital's rule). What do you conclude about how we should interpret  $G(-1)$ ?