

Reverend Thomas Robert Malthus (13 February 1766 – 29 December 1834) was an English cleric and scholar, influential in the fields of political economy and demography. Malthus observed that an increase in a nation's food production improved the well-being of the population, but the improvement was temporary because it led to population growth.

In 1800 in England, there were 8.3 million inhabitants, who were mainly poor people, but English agriculture produced exactly the right quantity of food so that everyone got enough to eat.

Thomas Malthus assumed that:

- English agricultural production enabled to feed 400,000 additional inhabitants every year,
- English population was growing by 2% every year.

1. In 1801, did all English people have enough to eat, according to these predictions?
2. For any whole number  $n$ , let  $u_n$  be the number of English inhabitants, in millions, that could be fed by English agriculture in year  $1800+n$ .
  - a) Compute  $u_0$ ,  $u_1$  and  $u_2$ .
  - b) Justify that  $(u_n)$  follows an arithmetic progression, whose first term and common difference you will specify.
  - c) For any whole number  $n$ , express  $u_n$  in terms of  $n$ .
3. For any whole number  $n$ , let  $v_n$  be the number of inhabitants in England in year  $2010+n$ , in millions.
  - a) Compute  $v_0$ ,  $v_1$  and  $v_2$  (rounded to the nearest thousand).
  - b) What type of progression is  $(v_n)$  sequence?
  - c) For any whole number  $n$ , express  $v_n$  in terms of  $n$ .
4. Find out the first year when there wasn't enough food for all English people, according to Malthus' predictions.