

1. Imagine a garden or farm field in which some kind of food crop is grown. If you had to pick enough food to feed yourself for one typical day, roughly how many square meters of that field would you harvest?
2. Roughly how much farm land do you think is needed to feed one person reasonably well for a year? Show how you use #1 to make an estimate *as a power of ten*, as in the examples below:

$10 \text{ m}^2?$... $10^2 \text{ m}^2?$... $10^3 \text{ m}^2?$... $10^4 \text{ m}^2?$... $10^5 \text{ m}^2?$...

3. The earth's radius is roughly 4000 miles, or 6.4×10^6 meters. How many square meters of farm land can there be on this planet? Again, please make a rough estimate as a power of ten. Show how the given data are used to make your estimate.
4. Roughly how many people can this planet support?
Show how you use #2 and 3 to make another rough estimate as a power of ten.
5. In 1952 the world population reached 2.5 billion. (That's 2.5×10^9 mouths to feed.)
By 1982 it had grown to about 5 billion. In 1994 government officials in eastern Germany noticed a decline in the birth rate and responded by offering to pay couples in that region \$650 for each baby born.
 - a. Suppose we continue to double our population every 30 years:
In 60 years the population will be ____ times its present value.
 - b. By what factor will the population grow in 90 years? ____ - in 120 years? ____
 - c. Roughly how long will it take for the population to become ten times greater? ____ years
Please express your estimate as a power of ten, as in #2 - 4.
6. Roughly how many years of growth as in #5 will it take for the population to reach the limit that you found in #4? Using 5c, show how your estimate is made.
7. Make a time line showing the dawn of civilization, the present, and the limit point found in #6. Also show one or two well-known historical events on your line. Try to get the scale right.
8. Suppose we double our farming efficiency or the amount of farmland available by making giant rafts in the Pacific ocean or by some other miracle: How much extra time will that give us?
9. Suppose we find a way to move lots of people to another planet like ours, with a climate just as nice as ours: How much extra time can that give us?