

In fact... (Part 1/3)

These are sample answers to **Practice in Educated Guessing**. Your estimate is excellent if it is correct within $\times 10^{\pm 0.5}$, still acceptable if correct within $\times 10^{\pm 1}$. The exponents on all the variables must be exact. After “—” I added extra questions for more practice. In fact, you should get into the habit of inventing your own questions every day.

1) $10\text{ cm} \times 15\text{ cm} \times 0.2\text{ mm}$, 3 g.

— Are these figures about the size and the mass consistent? [They give the density of water, as they should: paper \approx wood barely floats in water.]

— What is a comfortable walking speed? [1 m/sec. With legs modeled as pendula, and leg $\ell \approx 1\text{ m}$, this is consistent with the period (2 steps) $= 2\pi\sqrt{\ell/g} \approx 2\text{ sec}$.]

— How long is a typical lecture, in units of century? [1 microcentury.]

2) About $10^{4.5}$ in 10^3 pages.

— How many *distinct* words appear in a typical novel? [Think of a novelist’s vocabulary size.]

3) $337274 \approx 10^{5.5}$ in a population of about 6×10^7 (data of 2007).

— Fermi’s original version queried the number of piano tuners in Chicago. [About 100 in a population of 5×10^6 , but how common pianos are varies from culture to culture.]

4) In giga-euros the revenue was 1154, the expenditure 1291 (data of 2010), which amounts to 2×10^4 euros per capita.

— In other countries? [10^4 euros per capita for the US, 10^3 for China, roughly 40 for Madagascar.]

5) MathSciNet says $78167 \approx 10^5$ papers (data of 2010).

— And physics papers? [Double.]

6) About $3 \times 10^5 \approx 10^{5.5}$ cal (1680 cal/g). The daily recommended allowance for an adult is 2×10^6 cal/day.

— How much more power does running hard spend than the metabolic rate? [About 10^3 W, i.e. factor of 10; consistent with the longest hike $\approx 10^{4.5}$ m in a day, with an effective coefficient of friction of 1/10.]