

COUNT TO ONE MILLION

Aims:

This problem requires students to use a little initiative in that there is no single correct solution, and indeed any solution is up for debate! Even arriving at an answer requires the student to make certain assumptions (as is the case with all real life problems!) The activity presents several opportunities for class discussion.

Equipment:

Calculators.

Working in small groups, students are to decide how long it would take an individual to count to 1 million.

The group who **present** the most '*sophisticated*' and convincing solution (no simple estimates of time are allowed!) are to receive a prize. I myself give prizes to any group who fashion a reasonably '*realistic*' solution.

That's it. The hope is that the teacher would not need to give any extra details or assistance, though of course this will depend upon the particular class in question. Perhaps give a few **hints** as the groups work upon the problem.

Give the class no more than 20 minutes (say) to complete the task and seek an answer. Then either invite each group to present their solution to the whole class in the search for the most convincing solution, or ask each group to construct a written report which the teacher can take away.

An outline 'solution'.

- The first assumption is that the person who is counting can continue indefinitely without slowing the rate of speech.
- Larger numbers require more time to say out loud than smaller numbers. At this point we either assume an **average number of words per second or minute** etc. or proceed as follows:

"for numbers up to 1000; I can say roughly 3 numbers per second"
(after timing myself)

"for numbers up to 10000; I can say roughly 2 numbers per second"

"for numbers bigger than 10000; I can say roughly 1 number per second"

This gives an estimated time of:

$$\begin{aligned} & 1000 \div 3 \text{ seconds} \\ + & (10000 - 1000) \div 2 \text{ seconds} \\ + & (1000000 - 10000) \text{ seconds} \\ \approx & 995000 \text{ seconds } \textbf{(this requires a judgement regarding} \\ & \textbf{accuracy on the part of the students. An opportunity for} \\ & \textbf{discussion here.)} \end{aligned}$$

- The sensible thing to do at this point is to convert our answer into convenient units; e.g. days, hours, minutes etc. **(An opportunity for discussion here.)**
Answer \approx 11 days, 12 hours.
- This answer clearly assumes that the person counting can continue indefinitely, 24 hours a day without a break!
If we now assume that the person can manage 8 hours a day (say) then he/she will finish roughly half way through the 35th day after beginning the count.

Any groups who take all of the above into consideration really are doing well. Most hit upon some of the more subtle problems, which can of course be elaborated upon in any plenary session.

Of course, an extension could be to consider counting to 1 billion!