



**AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES
SCHOOLS ENRICHMENT CENTRE
TEACHER NETWORK**

THOUSANDS AND MILLIONS

Try a few of these:

Do human beings live for as long as a million hours?

If you have been alive for a million seconds, how many birthdays have you had?

What year was it one billion minutes ago?

How long would it take to count to a million ?

Could you run one thousand metres in one minute?

Could you eat exactly one tonne of food in a year without getting either very thin or very fat?

Could you walk as much as one hundred thousand kilometres during your lifetime?

Could one thousand drink cans fit into one cubic metre?

Solution:

Do human beings live for as long as a million hours?

Suppose someone lives for 80 years: that is $80 \times 365 = 29200$ days,
or $29200 \times 24 = 700800$ hours which is less than one million.

Alternatively 1 million hours = $1,000,000 / 24$ days which is just over 41, 666 days.

That would be $41,666/365$ years which is just over 114 years.

So it is possible for a human being to live that long but very rare.

Or estimate this as over 40000 days (dividing by 25). Then $40000/400 = 100$ is less $40000/365$ so the real answer is over 100 years.

If you have been alive for a million seconds, how many birthdays have you had?

1 million seconds is $1000000/60$ minutes, this is just over 16666 minutes.

16666 minutes is $16666/60$ hours that is just over 277 hours or less than 12 days.

So a baby that has been alive for a million seconds has not had any birthdays.

Or you could estimate this as less than $18000/60$ hours or 300 hours.

What year was it one billion minutes ago?

1 billion minutes is 10^9 minutes. Dividing by 60 that is 16 666 667 to the nearest hour and, dividing by 24 that is just over 694 444 days or about 1 908 years. So if we are in the year 2015 then 1 billion minutes ago was in the year 107 AD.

How long would it take to count to a million

Here you must estimate the average time to count each number. If you estimate one second for each number counted, then to count to 1 million would take a million seconds or about 12 days.

Could you run one thousand metres in one minute?

No you could not run 1000 metres in 2 minutes. Noah Ngeny from Kenya holds the men's World Record for 1000 metres in 2 minutes and just over 11 seconds which he achieved in 1999.

Could you eat exactly one tonne of food in a year without getting either very thin or very fat?

One tonne is 1000 kilograms so this would be an average of 2.74 kilograms per day or you could estimate this as between 2 and 3 kilograms a day.

A medical study in the UK found that the average weight of food consumed per day is 1.277 kg and this is certainly more than an international average. So if a person ate one tonne of food in a year he or she would get very fat.

Could you walk as much as one hundred thousand kilometres during your lifetime?

One hundred thousand kilometres at 5 kilometres a day would take about 55 years so it is possible to

walk one hundred thousand kilometres in a lifetime.

Could one thousand drink cans fit into one cubic metre?

One cubic metre is 100 by 100 by 100 cubic centimetres.

A drink can is typically 7.5 cm in diameter and 11 cm high and $100/7.5$ is just over 13. so $13 \times 13 = 169$ cans would fit on each layer of a one cubic metre box.

There is room for $100/11 = 9$ layers making altogether $169 \times 9 = 1521$, that is over 1000.

So 1000 drink cans would fit into 1 cubic metre.

Notes for teachers

Diagnostic Assessment

Put up 1 finger if you think the answer is A, 2 fingers for B, 3 fingers for C and 4 fingers for D.

Estimate 3138×127

310 000

390 000

300 000

398 526



Common Misconceptions

Answer C

3138×127 roughly equals 3000×100 , so $3 \times 1 = 3$ and there are 5 zero's, so the answer would be 300 000

Answer D

That must be the answer because $8 \times 7 = 56$ so the units digit must be 6.

As an estimate the best answer is B because $3000 \times 130 = 390\,000$

<https://diagnosticquestions.com>

Why do this activity?

This activity gives learners an opportunity to work with large numbers and to work out solutions that need more than one simple step.

Possible approach

Start your lesson with the diagnostic assessment. This should take about 5 minutes.

Steps for diagnostic assessment:

1. Write the question on the board and ask the class to put up 1 finger if they think the answer is A, 2 fingers for B, 3 fingers for C and 4 fingers for D.
2. Ask a learner who gave answer A to explain why he or she gave that answer and DO NOT say whether it is right or wrong but simply thank them for giving the answer.
3. Then do the same for answers B, C and D. Try to make sure that learners listen to these reasons and try to decide if their own answer was right or wrong.
4. Ask the class **again** to vote for the right answer by putting up 1, 2, 3 or 4 fingers. Notice if there is a change and who gave right and wrong answers.
5. Give an explanation of why answer B is correct emphasising that estimating should be a calculation that you can do in your head so it will not give the exact answer. Also they can do better than 3000×100 which will be too small

Discuss the kinds of thinking required for these types of questions.

"If I ask you to work out answers to these questions, what information would you need to know?"

Make a list on the board.

To answer the questions you can let learners use calculators or you can insist on them working with estimates and pencil and paper. The learners should work in pairs, in threes or in small groups.

Tell the class: "You can work out some of these answers from what you already know. Some of them need an estimate."

Assign the questions to the class so that all the questions will be worked on by several groups of learners.

Tell the class that they will compare their answers with other groups, so they should make sure that they write down their explanations carefully, to make it easier to see differences between their thinking and other people's.

Each question should be done on a separate sheet of paper so that the answers to each question can be stuck on the board next to other answers to the same question. Learners should check whether their answer is the same or different to what other groups have done.

If two groups work on the same question and get different answers, how will they work whether it is because their estimates are different or because one method is wrong?

The teacher should check answers and ask groups to discuss them if their methods are different. For example one representative from each of the different groups could join another group and troubleshoot each others' working, then feed back to their own group.

Alternatively get one pair to come to the board and explain their working and answer to the class. Ask if anyone has a different answer and ask all groups who get different answers to explain their working. Ask the class to check and decide who is right.

Key questions

1. How can you ensure that you make reasonable estimates?
2. How can you set out your working most clearly?
3. These two answers are different. How will you work whether it is because the estimates are different or because one method is wrong?

Possible extension

Which of these questions is the hardest, and why? Have a go at answering it.

Ask the learner to suggest 10 more questions using large numbers, and to decide whether they are very difficult, average or easy and why. Solve some of your questions and swap with another fast student and solve some of theirs.

See also this NRICH time activities

<https://nrich.maths.org/6044> - A nice reaction timer/data gathering (Age 11 to 13)

Possible support

The process of adapting difficult problems, and "making sense" of them in simpler cases, is a powerful technique for dealing with hard questions. This may be a good moment at which to model this:

Pick one question to work on as a class task.

Ask the students to pose related, smaller questions that they can answer, and build up a body of work (display work?) around the theme, for example:

Your age if you are 100 seconds old, 1000 seconds old, 10000 seconds old, etc.

The age in months/days/hours/minutes or seconds of people in the class, their siblings, etc.

The time since key moments in history (or sport, etc) measured in different units.

Then encourage students to work towards the original question.

Note: The Grades or School Years specified on the AIMING HIGH Website correspond to Grades 4 to 12 in South Africa and in the USA and to Years 4 to 12 in the UK.				
	Lower Primary or Foundation Phase	Upper Primary	Lower Secondary	Upper Secondary
South Africa	Grades R and 1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
USA	Kindergarten and G1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
UK	Reception and Years 1 to 3	Years 4 to 6	Years 7 to 9	Years 10 to 13
East Africa	Nursery and Primary 1 to 3	Primary 4 to 6	Secondary 1 to 3	Secondary 4 to 6

