



**G**lance at this article and quickly guess the number of printable characters in it.

Mathematics is a definitive science because its underlying elements i.e., numbers and operations are definitive. Contrast Mathematics with language (spoken or written) which is prone to differing interpretations—for instance two people reading the same news article can arrive at different conclusions—but Mathematics, in and of itself, is definitive and logically self-contained. In other words, anywhere and everywhere numeral two will always be less than numeral seven; an additive operation always has a definitive answer; but the words “sky blue” can elicit several chromatic interpretations; John Donne's poetic rendering “And therefore never send to know for whom the bell tolls; it tolls for thee” can evoke varying emotions.

Despite its aura abstract Mathematics is an exception in the real world. The daily course of our lives does not present itself with theoretical problem statements with complete information as we see in our Mathematics examinations. The practical utility of Mathematics lies in blending the science of Math with the art of estimation. Estimation—making an informed guess about something one does not know—is inherently an imprecise act and hence error prone. However by blending the definitive science with an imprecise art, the power and value of Mathematics is enhanced.

When my mother cooked I often used to wonder about how she can add the right quantity of salt in her preparations, despite the varying amount of food that she had to make or when she experimented with a new recipe that gave generic advice (“add salt to taste”). In retrospect I figured that skill came from her intuition and long standing experience in cooking, which gave her the ability to estimate and scale the quantity of salt (and, of course, a pinch of good luck to be right about it every time.) Mothers (and all others) make mathematical guesswork and formulate 'rules of thumb' in instances where information is scant, unknown or the payoffs for collecting information is less compared to the effort.

Jonathan Swift elegantly elaborates in “Gulliver's Travels”

on how the small people in the island of Lilliput (who were 1/12th the size of Gulliver) stitched a shirt for Gulliver:

“Then they measured my right Thumb, and desired no more; for by a mathematical Computation, that twice round the Thumb is once around the Wrist, and so on to the Neck and Waist, and by the help of my old Shirt, which I displayed on the Ground before them for a Pattern, they fitted me exactly.”

Swift's Lilliputians, it seems, had good skills in estimation and tailoring.

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Consider a cricket batsman's capabilities to blend art and the science of Math: he has to estimate the pace of the ball to figure out when it will reach him; the curvature of the ball to know where it will come (e.g. wide, full-toss, in-swing etc.); and the willow power he needs to exert on the ball at a precise angle so that the ball is swung towards the boundary line. Even a slightly wrong judgment on any of these estimates will mean a missed ball or flying stumps. For a good batsman all these tasks have to be judged within a fraction of a second. Sachin Tendulkar is an excellent judge of balls bowled at him, which makes him an admirable batsman.

Today's school system in India, unduly emphasizes the abstract Math at the expense of the artful and useful aspects of Mathematics. Mathematics must be taught as

another tool that can be skillfully deployed in real life. For Math to become a tool its utility in terms of estimation and calculation have to be inculcated in schools. For instance children should be simultaneously taught the abstract notion of area of a rectangle and be asked to make informed and educated guesses about estimating the area of their classrooms.

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*What is the amount of money spent by the Indian population on their breakfast? How many total phone calls are made in India on the day of Diwali?*

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While teaching the abstract notions of geometry dealing with right angles and hypotenuse, or simple distance measurement metrics such as meters, centimeters and kilometers, children can be asked to estimate distances in their neighborhood with similar angular features. While teaching children about speed, velocity and distance students could be given hypothetical problems with scant information (e.g. how fast should one walk from school to the bus stand to catch the next bus to their neighboring town?). Such realistic exercises will enable them to apply the abstract concepts, facilitate the skill of making rapid calculations and hone their estimation skills.

Businesses live in a world of uncertainty and incomplete information.

Hence they have to constantly make estimates about the number of products they can sell in the future; prospective prices at which they can sell; potential profit margins that they are likely to get. Such estimations are critical for a business to invest (or not to invest) their capital today. Similar exercises of smaller magnitude can be given to children while they are taught the concepts of money, profit margins, mark-up prices, selling price etc. Such exercises make the mathematical concepts easily comprehensible; provide a sense of application for abstract concepts as well as serve as a platform for young minds to think and compute quickly.

Estimation is also an important skill for children to learn in the context that real life does not present itself with complete information as is provided in examination question papers. The utility of estimation and valuation skills lies in its constant application in the ordinary course of life. If done so, children will no more agonize about Mathematics as a subject reserved for thick bespectacled scientists and woolly-haired mathematicians. Making logical and reasonable assumptions are an important component of estimation. Without worrying about errors here are a few estimations for you to ponder over: (1) In an apartment block with fifty residences, how many litres of water would the residents consume in a year? (2) If 1000 apples fit tight in a carton how many lemons could fit in the same carton? (3) What is the amount of money spent by the Indian population on their breakfast? (4) How many total phone calls are made in India on the day of Diwali?

The number of printable characters in this article is 5296—how close was your estimate?

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