

Jethmalani

Introduction. The ace criminal lawyer Ram Jethmalani is always in the news in India. Quite recently, the media was all up in arms against him, simply because he had agreed to defend in court someone against whom the evidence was, according to one expert, 'clearer than $2+2 = 4$ '. That made me dream up the following question about a question whose unique correct answer is allegedly as cut and dried, open and shut, or, if you like, black and white. Moreover, it belongs to a class of objective-type questions allegedly very efficacious in gauging correctly the mental brightness of our young people. My question has no such merit, in particular, it has numerous correct answers. So please don't despair if your favourite answer is different from the one that I have included below just by way of example, and then discussed a bit more in the final section. And, oh yes, the attorney figuring in my question, though he happens to share the same surname, is in no way related to the celebrity who inspired this flight of fancy.

Question. During one of the usual intelligence tests a student was asked to write the next term in sequence:

1, 4, 9, 16, 25, ...

He wrote 73 and was awarded zero. The student hired Jethmalani and went to court. After listening to learned counsel, court decided that the marking had been unfair, and directed full marks be given to the student. Can you think of an argument that could have so convinced the court?

Answer. The usual I.Q. test question of this type goes: 'write the next term of the following sequence.' As if there were a unique answer. Nothing could be farther from the truth! Practically any answer is justifiable, as is obvious to all mathematicians. However, for a typical judge, Jethmalani would need to elaborate some.

For example here is just one of numerous explicit ways of justifying 73 (or indeed any number) as a correct answer:--

There is a unique fifth degree polynomial $p(x) = a + bx + cx^2 + dx^3 + ex^4 + fx^5$ whose values at $x = 0, 1, 2, 3, 4, 5$ are 1, 4, 9, 16, 25, 73 respectively: this because if we set up and solve the six linear equations corresponding to these six conditions we can uniquely determine the six coefficients a, b, c, d, e, f . Jethmalani could say that his client interpreted the written terms as $p(0), p(1), p(2), p(3), p(4)$, so quite reasonably the next term must be $p(5) = 73$.

Why should his client suffer for someone having asked a dumb question?

Discussion. Of course the calculation itself was not disclosed, Jethmalani simply sprang the polynomial $p(x)$ all worked out, that is,

$$1 + \frac{47}{5}x - \frac{173}{12}x^2 + \frac{259}{24}x^3 - \frac{37}{12}x^4 + \frac{37}{120}x^5 ,$$

and proffered perhaps his calculator also to the judge, pleading that "his honour" should check for himself that for $x = 0, 1, 2, 3, 4$ this has the given values, so "quite obviously" the next number must be the value of this polynomial at $x = 5$, that is 73, just as his inspired client had seen in a flash of genius despite the exam pressure.

The calculation is shortened by noting that a polynomial of degree at most 5 having the given values at $x = 0, 1, 2, 3, 4$, is of the type

$$(1 + x)^2 + k \cdot x(x-1)(x-2)(x-3)(x-4),$$

where k is a constant. To get 73 at $x = 5$ we should take $k = \frac{37}{120}$, now it only remains to multiply out to put polynomial in standard form.

It is curious how intelligent but non-mathematical people are often over-awed by trivial and/or inane formulas. Exploitation of this weakness has been rightfully called "misuse of mathematics". It must be admitted that our legal-eagle succumbed too to the temptation of exploiting this weakness. He was aware of arguments not involving any mathematics, indeed he had toyed for some time with: "Your honour, not every one in Venice taking five steps east is going like Marco Polo to China. Et cetera." Eventually however, he plonked for $p(x)$, for he felt formulas would make a deeper impact in court.

It is funnier still how questions, whose unintelligent wording -- what is *the* next number, indeed! -- sorely tests our intelligence, continue to be almost the staple on these so-called intelligence tests.

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