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“BEHIND EVERY JOKE …”: HUMORISTIC CONTENT AS A SOURCE FOR EXPLORATION IN THE MATH LESSON

ILYA SINITSKY

ABSTRACT. The paper deals with ways of using humor in mathematics teaching and learning. It thus concerns three areas of human activity: mathematics, pedagogy, and humor. Because we are must try to establish some meaningful relationships in the absence of precise definitions for each area, we will rely on the phenomenological approach and use some of the characteristics of each area that have been considered in the professional literature to describe each one. Accordingly, one would be prudent to accept everything written in this article with a certain reservation. As Bertrand Russell said concerning mathematics: “… we never know what we are talking about, nor whether what we are saying is true.”

PREAMBLE

A couple of years ago, I received a kind invitation to share my vision on teaching and learning mathematics with a group of students from the faculty of mathematics who were taking some classes on the didactics of the subject matter.

I opened our meeting with a question: “What things do you typically encounter in mathematics lessons?” The students mentioned different issues that were all very relevant, yet I was pretty sure that my next prepared-ahead slide − “What are three significant ‘S-words’ that you don’t typically encounter during a mathematics lessons?” − would give them a surprise. Unfortunately, I was right: no one mentioned “Smile,” “Search,” or “Surprise.” Indeed, the inherent seriousness and fundamentality of mathematics knowledge quite often, and to this day, implies dry, boring teaching that leads to dreary, tedious learning.

However, every mathematician certainly knows that although the real practice of mathematics in the field is difficult, it is also a process entailing highly emotional mental activity interspersed with a lot of unpredictability and often-surprising results and discoveries. In “high science phraseology,” it is a foregone conclusion that encouraging a passionate attitude towards learning mathematics can have a positive influence on both the process and its outcomes. In simple words: “Smile in math class, it helps!”

On this note, I will try to show how a joke can assist in class way beyond its affective factor: it provides a smile or two, serves as a tool and source of effective learning that can lead to in-depth investigation, and may even bestow a surprise or two for the students − and maybe for the reader.

INTRODUCTION: THE MATHEMATICIAN’S ALIBI

This paper deals with ways of using humor in mathematics teaching and learning. It thus concerns three areas of human activity: mathematics, pedagogy, and humor. Because we are must try to establish some meaningful relationships in the absence of precise definitions for each area, we will rely on the phenomenological approach and use some of the characteristics

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of each area that have been considered in the professional literature to describe each one. Accordingly, one would be prudent to accept everything written in this article with a certain reservation. As Bertrand Russell said concerning mathematics: "... *we never know what we are talking about, nor whether what we are saying is true.*"

Putting things a little more seriously − be that as it may a paradox − we shall begin with a brief review of the phenomenon of mathematical jokes followed by a brief exposition on humor in pedagogy, especially in the teaching and learning of math. After that, we shall propose and exemplify ways to use humoristic content as a source for in-depth mathematical discussion or activity.

1. MATHEMATICS, MATHEMATICIANS, AND HUMOR: A BRIEF REVIEW

On the map of various mental practices, both mathematics and humor may be branded as peaks of human activity. At first glance, the two seem to be in direct contrast to the other: the first, mathematical knowledge, is the intellectual highpoint of deductive structure and logical thinking and is considered the epitome of accuracy, objectivity, and unambiguity. The second, humor, belongs to the psychological sphere and determines the emotional uniqueness of human personality and humanity as a whole. The perception and awareness of humor depend on age, language, culture, national and individual character, and personality, and therefore humor is highly subjective.[1] Nonetheless, let me cite the following: "Without a sense of humor, mankind would have never survived " (origin unknown).

But are these areas – mathematics and humor − really so far apart from each other? Perhaps not. Cognitively, humor relies on the human ability to identify discrepancies and contradictions in phenomena [15]. Therefore, the process of understanding humor involves subliminal rational thinking and logical analysis. According to [10], humor originates when *bisociation* occurs. "Bisociation" is defined as the view of unique features of a phenomenon that are created by the combination and interaction of two (or more) incompatible systems, each one with its own internal logic and mental processes. Indeed, both the generation and understanding of a humorous item is often through the invention of a new meaning. While appearing sudden and impulsive, this creative process is actually based on a deep, logical insight of the various aspects of the phenomenon. Therefore, the construction of mathematical knowledge and the understanding – or even the creation − of humor have the same, or at least a similar, cognitive basis, i.e. critical logical thinking.

Moreover, the manifestations of the connection between the logical aspects of mathematics humor are multi-faceted. On one hand, Russell's aforementioned sentence sounds funny, but it is an aphorism that describes his deep insight into the incompleteness of mathematics as a formal axiomatic system. On the other hand, the same author, in his work with Whitehead, finalizes the proof of the equality $1 + 1 = 2$ (in Volume 2!) with an almost melancholic declaration: "The above proposition is occasionally useful" and seriously points to further uses of this fact in their manuscript [24]. Similarly, Russian mathematician Chebyshev titled his public lecture at a university on the differential geometry of surfaces "On the cutting of clothes" and opened it with "Suppose the shape of the human body were a sphere." So, the innocent mathematicians' statements are occasionally interpreted as jokes and invite laughter.

Further on in this exposition, I shall present a variety of mathematical jokes without any attempt to define them based on some taxonomy. So this time, the common acronym WLOG will actually mean *with* loss of generality!

At this point, let us return to the consideration of logics. Sometimes mathematical jokes are nothing but a *logical game.* Consider, for example, the apparently benign statement: "There are

[1] Excellent evidence for this thesis may be found by observing the collection of images - or their absence - in articles on *Humor* in different languages in Wikipedia.

three categories of people, those who know how to count and those who do not ...." This seems benign until one attempts its analysis! Furthermore, *pure* mathematical logic often seems to contradict common sense as in the case of "Did you come up to this floor by elevator or by stairs?" To this query, a logician can only reply with the simple "*yes,"* as the truth value of *at least* one of the operands implies the truth of a logical disjunction.

Often, mathematical jokes are a result of the unique character of mathematical language[2] and its vocabulary. For example, even well-known mathematical *symbols* are sometimes interpreted by a mathematician in a non-standard manner and familiarity with the relevant notion is a necessary condition to understand the joke. Take for example, a "digital era" version of the above-mentioned joke concerning counting: "There are only 10 categories of people: those who know how to count in binary and those who do not." Here, a minimal knowledge of binary notation (i.e., the use of "10" to represent the value 2) is required. And here is something similar, but a bit more advanced: "... quartic polynomial $ax^4 + bx^3 + cx^2 + dx + e$, *where e need not be the base of the natural logarithms*" [12].

Because the meaning of symbols in mathematics typically differs from their meaning in everyday life or other disciplines, this inconsistency offers the basis for some humor, as in the following. "A math student is reading the Taylor series[3] aloud. Each time he reads out a denominator, he shouts out the number. The teacher asks him the reason of this strange behavior. 'But it is clear: there are exclamation marks here!'" This is a fine interpretation of the factorial sign (!), is it not? One might also include in this category the following sequence of mathematical symbols that can be read out as a sentence in the natural English language (e.g., "$\sqrt{-1}\ 2^3\ \sum\ \pi$" as "I ate some pie") – although perhaps this should be considered to be an imposter that vulgarizes the issue.

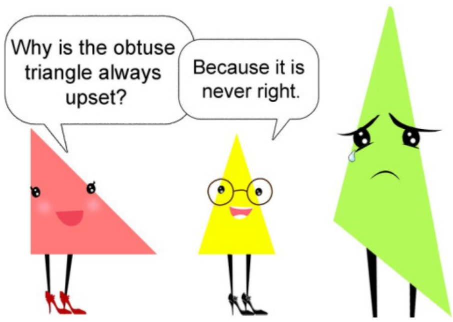


FIGURE 1. A triangle with an obtuse angle can never be right(-angled)
(Source: https://www.pinterest.com/pin/514043744943160844/)

In a similar vein, mathematics uses the natural language but often the *meaning* of the everyday-life *words* differs from that of the mathematical. This kind of joke typically involves puns (and therefore, unfortunately, rarely survives translation). Figure 1 shows a mathematical joke that actually exploits this discrepancy in order to *clarify* a concept or *highlight* a feature of an object. The response of the acute triangle to the right triangle's question, "Why is the obtuse triangle always upset?" in fact helps to distinguish between the types of triangles. The answer "Because it is never right" gives a real reason for being upset in everyday life, but in mathematical terms it accentuates that a triangle with an obtuse angle can never be right(-

[2] The common saying "Mathematics itself is a language" is attributed to the physicist Gibbs who stated this during a discussion on the need to increase the time afforded to language studies at the expense of mathematics for undergraduate students in the Faculty of Science at Yale University [17](Rukeyser, 1942: 280). Pretty serious, I believe…

[3] Just as a reminder, an example: $(1+x)^n \sim 1 + \frac{nx}{1!} + \frac{n(n-1)x^2}{2!} + \cdots$.

angled). Similarly, both of the outcries being made in Figure 2 ask for the impossible: π can no more become rational than imaginary i can be real. (Bear in mind, of course, that the unusual properties of these items are what originated their names of the relevant sets of numbers. I was initially going to use of the word “odd” instead of “unusual,” but again, the difference between the meaning of this word in common language – strange − and in mathematics – lack of parity − would certainly have been too confusing here.)

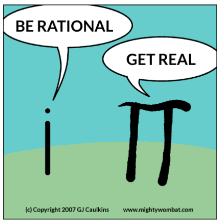


FIGURE 2. π can no more become rational than imaginary i can be real
(Source: http://www.mathwarehouse.com/jokes/best-math-jokes.php)

The reader can easily extend the list of humoristic mathematical items on various levels by perusing extensively through the digital networks. However, the systematization and classification of mathematical jokes remain, apparently, an open issue. Nevertheless, the examples above show that a good portion of mathematical jokes certainly have some pedagogical potential.

2. HUMOR IN PEDAGOGY: GENERAL AND MATH-ORIENTED VIEWS

Integrating humor in pedagogy has a relatively short formal history [2]. For generations of mass education, teaching meant transfer of information and drilling of skills. Pedagogic theory considered the student's brain to be a reservoir that needed to be gradually filled with objective and absolute knowledge with no attention to the individual peculiarities of the learner ([16], IV, p. 237). Modern pedagogy, however, defines teaching and learning as an interactive discourse and emphasizes the role of personality in the process of knowledge construction. Accordingly, today, the role of humor is explored side by side with other communicative and affective factors of the process [6].

Common “tips” for integrating humor into the classroom tend to generalize the experience for the different learning stages, from kindergarten to academia, and thus seem too general [3]. Attempts to classify classroom jokes are also incomplete and most are based on gathering data from students in academic institutions. The lists include funny stories, funny comments, short jokes, and topic-related humor, but do not actually illuminate the value of the specific brands of humor [22].

The teaching encyclopedia [18] does include the topic of humor and notes that there are four types of humor appropriate to the classroom: jokes related to the syllabus, jokes with no link to the discipline, jokes the lecturer makes about himself (self-irony), and unplanned humor as the result of slips. The problem with this “list” is that, first, it is easy to see that the proposed types are not disjoint. Second, this list is far too short to cover all the types of humor in teaching and some classroom situations, such as a student’s humorous responses in a dialogue with the teacher, are missing here. Furthermore, this categorization is one-dimensional and does not address different characteristics of the same humorous item, be they the presentation format (verbal, visual, etc.), the in-class situation, the purpose of the joke, the status of the presenter (teacher, learner, or group of learners), the origin of the joke, and more.

Let us turn now to mathematical education in particular. Here there is a difference between the deductive structure of mathematical knowledge and the inductive, informal way to construct this knowledge. Mathematics as a subject is often considered both difficult and boring, and the implementation of humoristic situations in teaching is a way to view this discipline in a more positive light and reduce learner anxiety.

Despite this, math educators tend to use humor just in an ad-lib, intuitive way. Surprisingly, there has been almost no systematic research on the ways and effects of combining humor into the learning and teaching of mathematics. Scattered studies have reported on an improvement in math test results among adult learners when the wording of the problems included jokes (with no mathematical content) [4], on the increase of student involvement in learning the subject of statistics when some humoristic examples were included [5], on the preference for formulating mathematical problem as humoristic situations vs. "regular" descriptions for middle school students [20], on the intention of 75% of prospective math teachers to incorporate humor in their future teaching [7], and so on. Also, due to the advantage that visualization can contribute, researchers have suggested that subject-related cartoons and comics offer an especially promising tool to improve the attitude of students towards mathematics [8], [19].

Beyond the affective factors, [11] and [7] emphasize the cognitive factor that humor with mathematical content has as a tool to highlight mathematical properties in a witty manner. A recently published collection of tasks that begin with a cartoon or two [13] show an attempt to integrate this concept into school practice.

3. USING HUMOR TO BETTER UNDERSTAND MATHEMATICS: METHODS, EXAMPLES, AND ADMONITIONS

This section presents the various roles that humoristic items may take in helping to construct content knowledge. Because this author's special interest is pedagogy for math teachers, the examples highlight mathematical pedagogical knowledge as well.

Most of the jokes presented throughout this section belong to mathematical folklore, meaning that their precise origin is typically unknown.

3.1. Mathematical notation: The reinvention of symbols

In some cases, the widely acceptable way of denomination of a mathematical object or operation differs from the verbal description of the item. For instance, if thinking literally (i.e., "picturing the object") the second degree of a would seem to require the following notation − $\boxed{a}$ literally "a squared" instead of the traditional a^2. Similarly, the symbolization in Figure 3 works when considering "opposite" numbers: the graphics of the invented symbols is based on the property of whole negatives being "mirror" reflections of their corresponding natural numbers on a number line. In both cases, the joke highlights the meaning of the object and invites a discussion about conventional notation, including not only its origin but also its limitations. Certainly, 5^2 can be pronounced "five-squared" and thought of as the area of a 5-unit-length-side square, but in the case of $(-2.5)^2$, the exponent is surely better pronounced as "to the power of 2." Also, the familiar minus sign (from the 17th century only!), such as that in (-5), is advocated by the equality $0 - 5 = -5$, which, mathematically, is just the corollary of a definition of a negation term that provides $5 + ? = 0$. See [23] for dilemmas of notation with directed numbers.

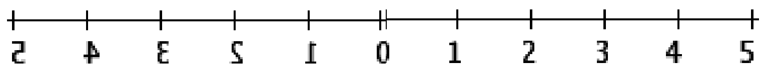


FIGURE 3. The pairs of opposite numbers on a number line. It is really a pity that the digit 8 exists…

3.2. The name as the description of the object: Explicit and hidden

The mathematician typically prefers precise, rigorous definitions over verbal descriptions. However, sometimes even a dubbed *name* can say a lot. For example, *repunit* (portmanteau of “rep” and “unit) is clearly a number composed by repeating the unit digit, as in 1, 11, 111, …. It was coined as a joke in recreational mathematics: these numbers, which are divisors of $10^n - 1$, are useful in discussions on the length of period of decimals and other issues of number theory. Another dub, “higher than wider matrix” [14], requires no explanation.

On the other hand, some names for mathematical objects and procedures hide − and even mislead! The lecturer may (and should!) “explain” such contradictions with a joke that can serve as a starting point for in-depth discussion. For example, the long division algorithm is not named so because of the amount of time takes to perform it, but rather for its visual impression. A truncated pyramid in is not, by definition, a pyramid! Other examples are not difficult to find.

3.3. The description of the property: A good choices and bad!

An important place on the list of humoristic devices is certainly occupied by humoristic descriptions of this or that algorithm or property. Mnemonic rules in humoristic form seem to be a first and main representative here. Some researchers argue that the use of mnemonics help to memorize a routine or a difficult formula. However, these are typically based on aural similarity or visual analogy. An example of a visual analogy is the “>” sign being equated to “an alligator’s mouth opening to the larger food” (…) with no link to the actual meaning of the sign. The wise pedagogue, however, is admonished to keep in mind that some mnemonics might be considered too “negative” (no pun intended). For example, this jingle − *“Minus times minus is plus, The reason for this* ***we need not discuss****”* [4] (bolded by author; pay attention to the name of the resource: “Education World”) brings a doubtful didactic message, and this one − “*In this mnemonic, "good" is positive and "bad" is negative and a bad thing happening to a bad person is good”* − problematic ethics.[5]

Yet, some mnemonics prove to be both funny and useful. For example: “Number the fingers from the pinky to the thumb from 0 to 4 and then bend it towards the palm to form a right angle. Thus the sine of the acute angle between any finger and the pinky equals half the square root of that finger’s number.” So, while I do not advocate avoiding humoristic mnemonics at all, I suggest checking them carefully before use.

A similar type of humoristic pedagogy is the use of jokes that impart the precise characteristic of an object. For example, consider this seemingly absurd, but accurate explanation: “to paint a Möbius strip on ‘only’ one side, just put it into a bucket of color.”

3.4. Be careful: It doesn’t work

Reasoning by analogy serves as one of the principal tools in human activity and constitutes a basis for our habits and skills. This is also true concerning how we reason and perform repetitive mathematics.

Sometimes, expansion by analogy works quite well to support some mathematical concept; sometimes, though, it is absurd, and this absurdity leads to humor and, by extension, learning. For example, all students learn early on how to cancel elements that appear in both numerators and denominators. However, the correct way to behave under some circumstances will not prove correct “by analogy” in others. Thus the following, although they seem to be true “by analogy,” are clearly absurd, leading to a sense of amusement and offer the opportunity to engage in valuable discussions about the concepts underlying routine operations. You cannot simplify $\frac{\sqrt{2}}{2} = \sqrt{}$ the same way as $\frac{4\cancel{(x^2+1)}}{\cancel{(x^2+1)}} = 4$. Even more absurd (and funnier!) is “What’s wrong with

[4] From: https://www.educationworld.com/a_curr/mnemonics/mnemonics018.shtml.
[5] From https://www.educationworld.com/a_curr/mnemonics/mnemonics030.shtml.

the following: $\lim_{n\to\infty} \frac{\sin x}{n} = \lim_{n\to\infty} \frac{si\cancel{n}x}{\cancel{n}} = \lim_{n\to\infty} six = 6$?" Yes, it seems like nobody would consider the latter as anything but just funny to the point of silly, yet most math teachers are familiar with real classroom "inventions" such as $\frac{5x+3}{3x} = \frac{5\cancel{x}+3}{3\cancel{x}} = \frac{8}{3}$ or the imaginative $3x^2 + x = 3x(x + \;)$ (with an intentional blank space within the parenthesis). These jokes convey the danger in the formal use of well-known tools, and at the end of the paper, I'll revisit this point.

These funny − approaching the mathematically absurd − examples can illustrate an error in a humorous visual way and bring a user-friendly framework for *capitalizing on errors* [1]. In other words, they are able to exploit student errors as a teaching tool. A classic example of such a "capitalized error" is the scene from the 1949 movie "Ma and Pa Kettle"[6] where the characters use "good formal" mathematics to prove that the number 14 is the correct quotient for 25 divided by 5.

3.5. Be careful: It does work

As an extension of the above concept, sometimes situations are purposely worded in a humorous way to initiate further mathematical exploration. For example, the 14 mentioned in the previous paragraph is the result of some specific, self-consistent operation. So, let us denote it as $25 \oslash 5 = 14$, where $\oslash$ stands for this "revised division." It would then be natural to ask what the value would be for, say, $28 \oslash 7$ (which is, apropos, inspiration for an Abbott and Costello sketch[7]). And even further, would it be possible to arrive at a result that is greater than the first operand (i.e., the "quotient" is greater than the "dividend") or other questions along these lines.

The above is not a unique example. Often, the close examination of a "mere" joke may provide a source for elegant mathematics. In fact, teachers of mathematics sometimes suggest activities of this type. For example, consider the following "joke" using cancellation with a single cancellation line: $\frac{19}{95} = \frac{1}{5}$. Despite that it looks absurd at first glance, it works as well as for $\frac{2\cancel{6}}{\cancel{6}5} = \frac{2}{5}$ and some other cases. Moreover, it seems to be a pattern after discovering that $\frac{1999}{9995} = \frac{1}{5}$. Consider also palindromic sums and products (e.g., $25 + 63 = 36 + 52$; $68 \times 43 = 34 \times 86$). They, too, will generate ironic smiles but can lead to a generalization in simple algebra [21] (p. 215-217).

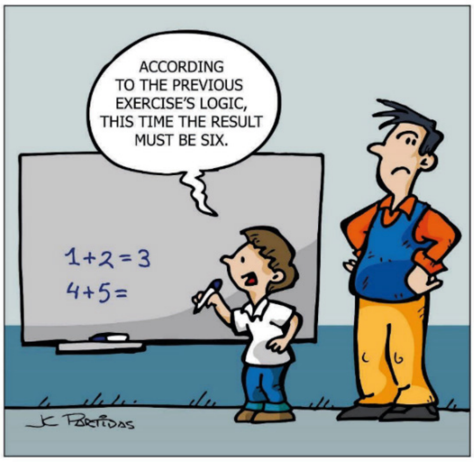


FIGURE 4. Analogous reasoning (Source: [13])

[6] See https://www.youtube.com/watch?v=X0aPKvNI9ek&ab_channel=22tango

[7] See https://www.youtube.com/watch?v=lzxVyO6cpos

One and the same "joke" may sometimes be explored in various ways. At first glance, the cartoon in Figure 4 [13] does, more or less plainly, invite the observer to suggest $n + (n + 1) = 2n + 1$ as the correct replacement for the boy's analogy. But systematically increasing the *number* of addends in *both* parts of the equality produces a much deeper and more surprising continuation of the original. That is, we will observe that $4 + 5 + 6 = 7 + 8$, and, going one step further, one may be amazed to see that $9 + 10 + 11 + 12 = 13 + 14 + 15$. This observation can be culminated by deriving a general balance of two series in the segment of natural numbers from any perfect square to the number one less than the next perfect square.

3.6. Homework for math educators: Jokes we prefer to avoid

In this penultimate subsection, I am *not* going to discuss degrading jokes by noting that the issue can sometimes be a complicated one. As an example, the blooper of a university math student who declares that "Seven times seven is 47" may (nay, needs!) to be followed by the response "This class is intended for those who are familiar with multiplication table!" But the same response would be highly inappropriate in the case of the same error made by a second-grade pupil.

Instead, my focus here is on jokes generated by the didactical faults of teachers and teaching materials. As I mentioned above, similar to every scientific discipline, mathematics has its own notations and vocabulary that are familiar from everyday life but mean something else in the discipline. This can certainly confuse the student. But sometimes our *instructions* (and sometimes us, I am afraid) provoke them to make a joke. For example, the answer given by the pupil in Figure 5 is certainly straight and to the point because our (as teachers) didactic jargon omits the clearly necessary "the value of" before "*x.*"

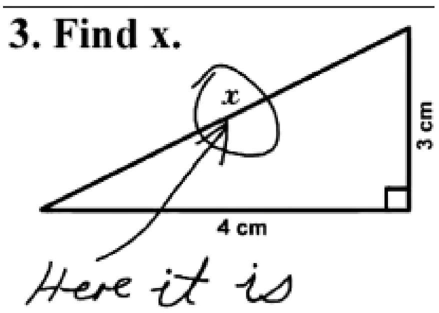


FIGURE 5. Nothing is wrong
(Source: https://www.pinterest.com/pin/408983209885930689/)

Similar is the case where one word might have numerous meanings, as in the case for the verb "*expand.*" Mathematically, it means one thing but its definition can also apply to the creative binomial expansion shown in Figure 6. Not so funny considering that the term often leads to student error. Consider the incessant use of the word "*simplify,*" which seems straightforward enough in everyday jargon, but is a contranym in school algebra textbooks where it implies opposite actions depending on the situation: on the one hand, multiplication within addends to combine similar terms (as in $x(x + 2) - (x + 5)\,(x - 3)$), or on the other hand, a search for a common factor in each of the addends in order to factorize the algebraic sum (as in $x^2 + 2x$).

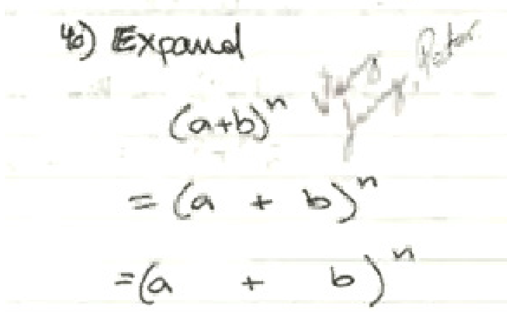


FIGURE 6. Math expand joke
(Source: https://www.pinterest.com/gbillstheboss12/funny-math-answers/)

We seem to have arrived at the very end of the list, yet something is missing. Ah, I did promise a smile or two – and I trust this objective was met. But I also promised a surprise. Where is it? Read on.

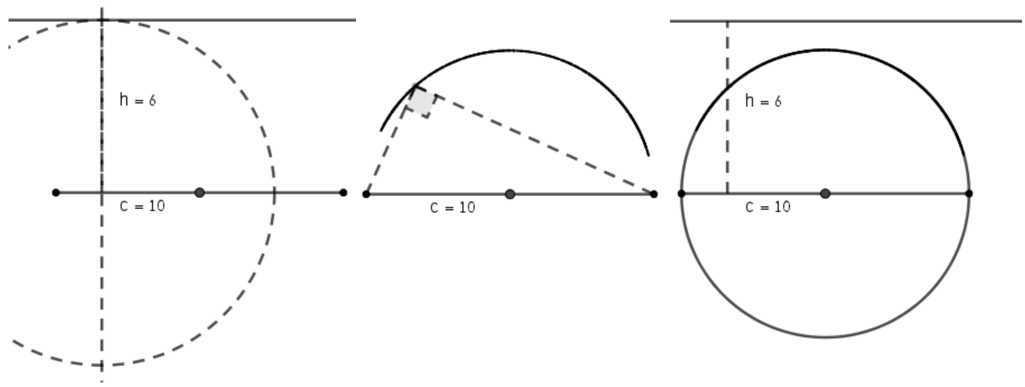
3.7. A surprise: The hidden jokes in math instruction

Sometimes jokes are phrased as "serious" questions to emphasize the limitations of the notion. For example, the question "What is the consecutive number of ½?" includes a hidden reminder of the irrelevance of this concept for non-integers. In this particular case, the joke is clear for the expert. For the inexperienced, however, it may provoke an erroneous answer, and thus teaches.

This concept is more intriguing in the following two examples of questions from a mini-test (reference currently unavailable) that have been slightly modified by this author to prove my point (my additions are in *italics*).

(1) Find the area of a right-angle triangle if its hypotenuse is 10 cm and the height dropped on the hypotenuse is 6 cm. *Then, in order to verify the answer, construct the triangle in GeoGebra and use the "Area" feature.*

(2) Find the derivative of the function $y = ln(2sin\,(3x) - 4)$. *Plot the graph of the function and its derivative using GeoGebra.*



a b c

FIGURE 7. The stages of construction of a right triangle with given hypotenuses *c* and height *h*: (a) Segment *c* of length 10 cm is constructed. The height is dropped to *c* from point *C*; *C* lies on the line which is 6 cm away from *c*. (b) Because angle *C* is a right one, vertex *C* must lie on the circle with diameter *c*. (c) Point *C* needs to designate the intersection of the line with the circle. Where is it?

The wording in problem (1) renders it a fine exercise that is a combination of calculation and construction with the use of dynamic geometry tools. After a trivial calculation of the area, students will typically try to construct the triangle with GeoGebra as in Figure 7. (Initially, the students will be only a little bit surprised by realizing that there is no need to exploit the advantage afforded by a dynamic change of segment lengths.)

And what about problem (2)? Also here, the first part seems algorithmic and pretty clear. But this transparency becomes excessive in Figure 8, which shows the fine-shaped $y'(x)$ (really?) and no point from the graph of function itself, $y(x)$. So, "What's wrong with GeoGebra?" or maybe "What's wrong with our domain knowledge?"

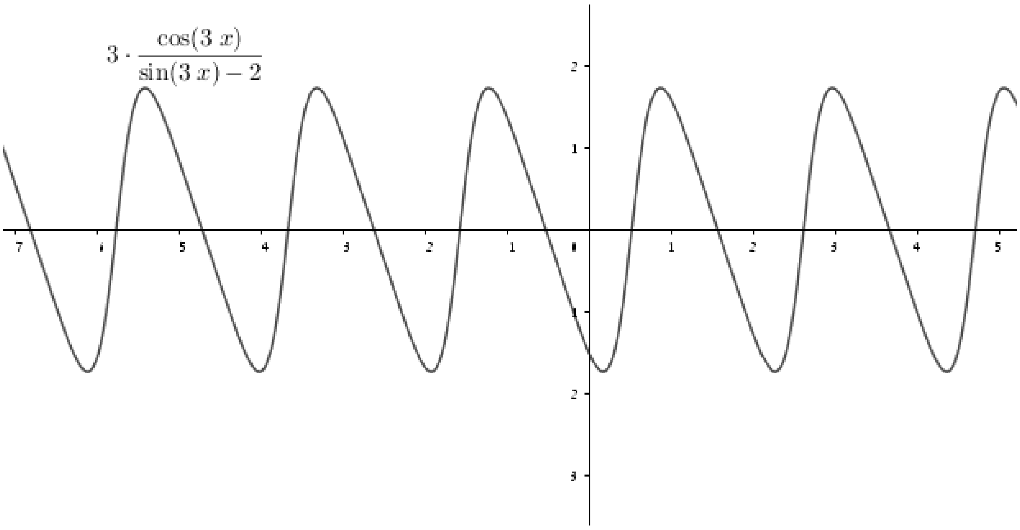


FIGURE 5. The graphs of the function $y = ln(2sin\ (3x) - 4)$ and of the function $y = 3\frac{\cos 3x}{\sin 3x - 2}$

Or perhaps, the question for both cases (1) and (2) should be: "What's wrong with our solutions?" according to [9]. That is a point: there is no point! Agree with me, a really *hidden* joke. Are you surprised?

CONCLUSION

Humor in the math classroom is M(ulti)-dimensional and M(ulti)-functional (with possible failure of the reflexive rule $M = M$). A joke can help to understand, originate, and even replace various mathematical problems. As Littlewood claimed, "A good mathematical joke is better … than a dozen mediocre papers" [12]. Let's teach and learn mathematics with a smile!

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GORDON COLLEGE OF EDUCATION, HAIFA, ISRAEL
E-mail address: `sinitzsk@gordon.ac.il`