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ON THE LITERARY INTEREST OF MATHEMATICAL TEXTS[1]

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In this essay I show a way in which some mathematical texts may be read in productive conjunction with literary texts. That might be thought by some a provocative project. It might be thought that if one suggests that the texts of mathematics and literature can be mutually enriching, one thereby implicitly endorses a claim that mathematics just is a kind of literature or that literature is somehow mathematical. I do not, however, make either of those claims. I shall show that productive paired readings of mathematical and literary texts are possible because mathematical texts can possess certain minimally literary qualities. By minimally literary, I shall mean a quality of a text that is necessary but (perhaps) not sufficient for the text to be considered literary. I am therefore agnostic as to whether, all things considered, mathematical texts may properly be regarded as literary; the claims of this essay do not presuppose a substantive view about philosophy of literature or philosophy of mathematics. In particular, no equivalence claim about mathematics and literature is here defended; rather, my aim is to establish the possibility and value of reading prima facie dissimilar kinds of texts together.

[1] This essay benefited enormously from my conversations with Carol S. Gould, Jennifer Low and Rachel McDermott at Florida Atlantic University and S. P. O'Brien at Dublin City University, and from the editor's and anonymous reviewer's comments. Allan J. Silberger at Cleveland State University provided valuable criticism of an early draft of the argument.

I discuss in section I the distinction between literary and minimally literary properties, and the motivation for my claim that mathematical texts possess the latter rather than the former. In section II, I turn to my positive account of what minimally literary properties some mathematical texts possess. Having thus established a basis for productive paired readings of mathematical and literary texts—the minimally literary properties of mathematical texts—I illustrate in section III the interest of the positive account through a sample reading of a pair of mutually enriching texts, one mathematical and one literary. The balance of the paper is then taken up with objections to the positive account and its illustration.

I. LITERARY AND MINIMALLY LITERARY QUALITIES

If there is to be any possibility of reading mathematical and literary texts in productive conjunction, it must be established that there is some quality that both kinds of texts possess but that non-literary, non-mathematical texts do not possess. For if one cannot point to any quality, beyond the mere fact of being texts, possessed by both mathematical and literary texts, then there will no reason to think mathematical and literary texts any more complementary than are literary texts when paired with, for example, road signs or cereal boxes. A straightforward way of meeting the requirement just exposed would be to claim that mathematical texts possess literary qualities. If that could be established, then, clearly, the possibility of paired readings of literary and mathematical texts would immediately follow—just as much as it is possible to read any literary texts together in a mutually enriching way.

There are two reasons, however, to think that the strategy just proposed is misguided. The first reason is the striking dissimilarities between mathematics and literature. The two dominant positions in philosophy of mathematics, for instance, provide reasons to think mathematics an enterprise quite removed from literature. On the Platonic view of mathematics, mathematical work is more akin to science than to literature, insofar as mathematicians theorize and try to discover truths about mathematical objects that have an existence independent of the mathematician, much as scientists theorize and try to discover truths about the empirical world. On the formalist view of mathematics, the mathematician does not have, what the writer of literature does, free creative licence over mathematical objects, being bound by the formal conventions of inference. In the face of such dissimilarities, to say that mathematical texts have literary qualities would seem to betray a misunderstanding of mathematics or literature or both.

Recent work in philosophy of literature provides a second reason to think it a misguided strategy to argue that mathematical texts have literary qualities. Peter Lamarque and Stein Olsen, for instance, have compellingly argued that "one central, characteristic purpose … served by the literary work is to develop in depth, through subject and form, a theme which is in some sense central to human concerns and which can therefore be recognized as of more or less universal interest".[2] It seems hard to see how one could argue that the objects of mathematical inquiry are central human concerns, especially since the dominant views of mathematics canvassed in the previous paragraph suggest that abstract mathematical objects are paradigmatic examples of the non- or extra-human. Therefore, it seems that any attempt straightforwardly to describe mathematics as literary will face a strong Lamarque/Olsen-ian objection. David Davies has recently presented an account of the nature of literature that may appear more congenial to the present project: "what makes something an artwork is … how the assemblage of elements that make up the artistic vehicle is intended to function in the articulation of content."[3] The quoted description might encompass many mathematical proofs, for instance, insofar as they employ an intricate assembly of elements (lemmas, specially defined functions, etc.) to articulate their mathematical content. However, an attempt to ground a defence of the literary interest of mathematics on Davies' account of literature also faces difficulties. It is an important element of Davies' account of literature, as the quoted material indicates, that there be artistic intent: Davies does not wish to suggest that "we have art wherever we have articulation of content in an 'aesthetic' way".[4] But artistic intent is a feature that seems to be strikingly lacking in the case of mathematics: mathematical texts are not essentially, if they are at all, produced with an eye to their aesthetic qualities.[5]

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2 Lamarque and Olsen (1994), p. 450.
3 Davies (2007), p. 13.
4 *Ibid*, p. 13.
5 It is, however, sometimes said that mathematical proofs do have a particular kind of beauty. That is a claim about the aesthetics of mathematics texts *qua* mathematics: a proof is thought beautiful in virtue of the proof reflecting, or expressing, a kind of beauty possessed by mathematical objects. The proof that $e^{i.pi} = -1$, for instance, is often cited as an example of a beautifully simple relation between not-obviously-related mathematical objects. G. H. Hardy's aphorism that "[b]eauty is the first test: there is no permanent place in the world for ugly mathematics", (Hardy, 1940), p. 14, is perhaps the high point of such a view. If a precise account of such distinctively mathematical aesthetic qualities could be

The just-canvassed difficulties with the claim that mathematical texts have literary qualities motivate my different approach to defending the literary interest of mathematical texts. Instead of entering the debate about what constitutes a literary work, I shall identify (what I shall call) minimally literary properties in mathematical texts, and argue that possession of minimally literary properties is sufficient to endow mathematical texts with literary interest.

A textual property is minimally literary if it is (i) not sufficient for a text to be considered literary but (ii) partially constitutive of a text's literary value. So, for example, the fact that a text is a text, while a necessary condition for its being a literary text, is not a minimally literary property, since condition (ii) is not fulfilled (except on the view that all texts have literary value, in which case the property of literariness fails to pick out a significant feature of texts). Or again, if one takes a Lamarque/Olsen view of literature, then the fact that a text artistically develops a theme that is of distinctively human interest is not a minimally literary property, because, on the Lamarque/Olsen view, a text's developing a theme of a distinctively human interest is sufficient for the text to be considered literary. By contrast with those two different ways in which a property can fail to be minimally literary, consider a text which has the property that the meaning of one of its elements is transformed in a surprising way. Having such a property may not be sufficient for the text to be considered literary, but such reversals of reader expectation are commonly thought to at least partially constitute a text's literary value. Davies, for instance, thinks it is a distinctive part of the experience of reading poetry that we "take account of what a given string of words can be taken to exemplify, qua string, and not merely what the words mean",[6] a property which seems to encompass surprising transformations of meaning of the sort just mentioned. However, as we have seen, since Davies also thinks that an artwork—and therefore in particular a literary text—must be the product of someone's artistic intent, a text's containing surprising transformations of meaning is not sufficient for it to count as literary. On Davies' view

given, it might suggest another route to defending the literary interest of mathematics. One might argue that the properties shared by mathematics and literature, which justify mathematics' literary interest, are the different but complementary kinds of beauty seen in mathematics and literature. Although that is not the present approach to the question of how mathematics and literature are related, my approach is not inconsistent with—in fact, is agnostic about—such a Hardy-inspired strategy. (The motivation for my different strategy is given in the paragraph following this note.)

[6] Davies (2007), p. 15.

of literature, then, surprising transformations of meaning in a text would count as what I have termed a minimally literary quality.

Now if it can be shown that mathematical texts have such minimally literary qualities, then the requirement identified earlier as necessary for a defence of the literary interest of mathematics—that literary and mathematical texts both possess qualities not also possessed by all texts—will be satisfied. I turn in section 2 to the demonstration that mathematical texts do possess such minimally literary properties. Demonstrating that mathematical texts possess minimally literary qualities, however, only discharges part of my burden. I have said that minimally literary properties can serve as the basis for productive pairing of mathematical and literary texts, but I have not yet shown that such paired readings exist. Therefore, I next turn in section 3 to show the interest of my thesis by presenting a sample paired reading of a mathematical and a literary text. So my argument establishes and explains the possibility of paired readings of mathematical and literary texts, while largely avoiding contested questions about the nature of mathematics and literature. (I say only that those questions are largely avoided because it might still be objected to the subsequent account of minimally literary properties of mathematical texts that a given property is not minimally literary because it is not literary at all. Hence I try to rely, in that account, on textual properties that are uncontroversially thought to be literary.)

II. WHAT MINIMALLY LITERARY QUALITIES DO MATHEMATICS TEXTS POSSESS?

In face of the prima facie dissimilarities between mathematics and literature discussed in section I, it is worth beginning the investigation of minimally literary properties in mathematical texts with some simple observations about mathematical practice. Mathematicians must make decisions as to how to present a view of mathematical objects. They must choose which mathematical objects to select for consideration. They must decide how those objects are to be manipulated in the course of a proof. They must make such decisions and choices within the constraints of mathematical practice. Since decisions, choices and constraints—albeit of a quite different order—also face the writer of literature, those elements of mathematical practice seem to be an auspicious starting point for investigating the relationship of mathematical and literary texts. I now turn to consider three minimally literary properties that I believe are possessed by mathematical texts in virtue of the manipulations performed therein.

It is characteristic of poetry that it reveals, with each successive line, unexpected shades of meaning, modifying what has come before. A self-contained image is brought into juxtaposition with an unforeseen new image, and thereby literary work is done. Shakespeare's characterization of the unwed youth, for instance—"[thou] feed'st thy light's flame with self-substantial fuel/Making a famine where abundance lies"[7] — seamlessly transforms the self-contained antecedent image into a moral outrage by juxtaposing the image on the following line. The literary properties of the quoted lines are not, of course, exhausted by the choice of images; clearly, for instance, one will also want to talk of the lines' prosody, and so forth. But the choice of images to be juxtaposed constitutes at least a part of the literary value of the sonnet.

Compare the foregoing with a manoeuvre performed in the course of the proof of the fundamental theorem of arithmetic. Part of the theorem's claim is that every integer may be expressed as a product of primes. The first part of a proof of that claim is:

> Let S denote the set of integers greater than 1 than cannot be written as a product of primes … [W]e must show that S is empty. Assume otherwise. Then, by the least integer principle, S contains a least element, which we denote by n. [8]

Ignoring now the mathematical content of the lines, notice the move made after the assumption that S is non-empty. The set's non-emptiness allows the introduction into the text of a new result, the least integer principle, allowing the identification of a member, n, of the set. From a literary point of view, the previously non-empty set is thereby transformed into a new image: from its hazy depths emerging the definite entity n, which will later serve to demonstrate the falsity of the assumption that S is non-empty. In proof as in sonnet, then, textual elements are transformed from line to line in the service of an overarching purpose. Since the mathematical text and its poetic cousin thus exhibit the same property, and since it is a commonplace that in the literary text the property contributes to its literary value, I conclude that the mathematical text possesses a minimally literary property. (Some might feel uneasy about that conclusion because, in mathematics texts, such transformations have unique, truth-preserving properties. But their possession of such mathematical

7 Shakespeare (2007), p. 265.
8 Durbin (1992), p. 75.

properties provides no reason to think they do not also possess minimally literary properties.)

A not unrelated feature of poetry is the suggestive transformation of the meaning of a word, often the final word of a line, by the poem's next line, with the richness of suggestion constituting (at least part of) the literary value of the poem. For a paradigmatic example in literature, consider the opening lines of Milton's *Paradise Lost*: "Of man's first disobedience, and the fruit/Of that forbidden tree … [s]ing, heav'nly Muse."[9] "Fruit," within the confines of the first line, naturally suggests the consequences of man's disobedience. That meaning is retained, but modified, by the second quoted line, where the metaphorical fruit (or consequences) of disobedience takes literal form as the image of the fruit that motivated the disobedience.[10]

Mathematical proofs are replete with such modifications. One might express a quantity as $n^2 + 2n + 1$ on one line, suggesting its quadratic character, before factorizing it as $(n+1)^2$ on the next to suggest its form as a perfect square. Again, I do not mean to suggest that such a modification of a mathematical expression is simply the literary equivalent of the quoted material from *Paradise Lost*. The point is merely that such modifications exist in mathematical texts, shading new suggestions of meaning and providing new valences to mathematical expressions. The example given might perhaps seem a spare modification of meaning. But richness of suggestive power will vary with the particular modification in question: modifications of mathematical expressions can be more or less surprising, more or less revealing, more or less helpful to the demonstrandum of the proof. Again, since the property occurs in both literary and mathematical texts, and contributes to the literary value of Milton's poem, I conclude that it is a minimally literary property of the mathematical text.

A third characteristic commonly thought to be part of a poem's literary value is its creation of a distinct poetic lexicon, through which new possibilities of meaning are engendered. One might think of Gerard Manley Hopkins as exemplar of this phenomenon: "Shivelights and shadowtackle in long lashes lace, lance, and pair."[11] The portmanteaux in the quoted line, as well as generating complex interplays of connotation in the yoking together of their component words, exemplify the abstract

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9 Milton (1674), p. 293.

10 My interpretation of Milton's opening lines is in no way novel. As with the Shakespearean lines quoted earlier, the gloss I have given is a critical commonplace. As discussed in section 1, I argue from commonly accepted literary features of poetry to the existence of similar phenomena in mathematical texts.

11 Hopkins (1888), p. 105.

movements imagined in the line's verbs. That is, the meanings of the portmanteaux lace together and lance each other in pairs. Hopkins' terminology, in short, allows the poem access to new forms of meaning and suggestion.

Are there similar phenomena in mathematics texts? Clearly, stipulative definitions abound: one often finds, for instance, a function defined for a special purpose within a proof. But perhaps such definitions do not rise to Hopkins' level, the introduction of something that allows meaning beyond what would otherwise be possible. However, though rarer in mathematics, I believe we can point to such phenomena. The Kronecker delta, for instance, is a formalism that allows complex mathematical functions to be recast in productive new ways, allowing mathematical progress that would not otherwise be possible.[12] Thus the Kronecker delta has a relevantly similar function to Hopkins' new-coined words, allowing the text to express meanings in a way not previously possible. And again, if one thinks Hopkins' device a part of his work's literary value, then the Kronecker delta is a minimally literary property of mathematical texts.

It does not immediately follow from the claim that mathematical texts can possess minimally literary properties—as was seen to be the case in the three representative examples just discussed—that mathematical texts are therefore of literary interest. In other words, I have yet to show the interest of the thesis. I turn now to the task of showing that a mathematical text, by virtue of its minimally literary properties, can enrich one's reading of a literary text. (Note that, on some conceptions of literature—the Russian Formalist view, for instance—minimally literary properties might be enough to make a text count as fully literary. On that view of literature, my argument might be considered complete at this point, since if mathematical texts possess literary qualities, there is no conceptual puzzle about their being read together with literary texts. Since I do not wish to presuppose a Russian Formalist view, however, there is still a reason to demonstrate the interest of the thesis.)

III. AN ILLUSTRATION OF THE INTEREST OF THE THESIS: W. B. YEATS'S "THE GYRES" AND THE PROOF OF THE IRRATIONALITY OF √2

Suppose the argument of sections I and II are accepted. It might yet be objected that, be it that mathematical texts have minimally literary properties, such properties as

[12] One might think also of Einsteinian summation convention, without which tensor analysis would be unmanageably difficult, or of the Levi-Civita symbol, as further examples of terminology that introduces the possibility of new meanings.

they might possess are too minimal to be of practical interest or use to the literary critic, who deals with more richly literary texts. In this section I mount a defence of the interest of my thesis against the stated objection by demonstrating the value of reading a pair of mathematical and literary texts together. It may also be that, whether one accepts or rejects the argument of section I and II, the forthcoming reading provides some independent support for the thesis, insofar as the possibility of paired readings of the kind here proposed is an expected consequence of the thesis defended in sections I and II.

The dominant image of Yeats's poem is its eponymous gyres, spiraling universal forces that dominate and explain human history. Each era of history expands, gyre-like, to its fullest extent, before collapsing and bringing forth in its ruin an epoch of diametrically opposed values, inverting the gyral motion. In our own time, for instance, "thoughts thought too long can be no longer thought," as one gyre's spiral approaches its end, producing "irrational streams of blood … staining earth."[13] These gyres and their action being the poem's central concern, it is therefore a condition of the poem's possessing literary value that the reader be persuaded of the plausibility and the richness of the gyre trope. For if a poem's central conceit or organizing principle is barren or superficial, the poem will to that extent lack literary value.

Yeats' poem multiply fulfils the burden of showing its dominant image to be suggestive and fertile. The poem draws grand lines across history, linking Empedocles' doctrine of eternal cosmic strife and the violent fall of Troy with modern "conduct and work" that "grow coarse," before dismissing with "tragic joy" both historical and contemporary ruin, which are only prelude to the return of the "noble and saint" on the next, contrariwise gyral motion. The poetic skill with which Yeats unites the history of western civilization is, I take it, one way in which he discharges the burden of making plausible and rich his dominant trope, the gyral motion of history. Or again, leaving aside matters of content, the poem's form, too, embodies the gyral mode of thought. Consider its prophecy that "lovers of horses and women shall … [from] any rich dark, nothing disinter/The workman, noble and saint," in which the formal arrangement reflects the lines' meaning. The metaphysical disinterment of the "noble and saint" workman from "rich, dark nothing," that is, is enacted by breaking the poetic line after "disinter." Again, I take it that such a poetic device also helps

13 Yeats (1938), p.131

discharge the burden of making plausible and rich the trope of the gyre, insofar as the reader becomes more deeply attuned to Yeatsian gyral action through both poetic form and content.

Making the trope of the gyre plausible, then, at least partly involves making plausible the notion of disinterment, for it is out of the calamitous end of one gyre that the contrariwise gyral motion is born. But consider once more the lines that I have said both describe and enact that disinterring:

> Those that Rocky Face holds dear,
> Lovers of horses and of women, shall
> From marble of a broken sepulchure
> Or dark betwixt the polecat and the owl,
> Or any rich, dark nothing disinter
> The workman, noble and saint, and all things run
> On that unfashionable gyre again.[14]

The quoted lines feature three images of disinterment, of which the third is the most abstract, the hardest to cash out. I say that the third image is the most abstract, because it is surely not hard to see that the first image, the stone of a collapsed mausoleum, could be a source of disinterring. And perhaps the second image too, the "dark betwixt the polecat and the owl", suggests hidden objects, ripe for disinterment. But what sense can be made of the third image, the apparent contradiction of "rich, dark nothing"? It is, of course, possible that Yeats is, in this line, merely trading in paradox and contradiction. Here, I suggest, is where a mathematical text may be productively read alongside "The Gyres" to provide new richness and suggestiveness to Yeats's apparently contradictory image of "rich, dark nothing".

The mathematical text I have in mind is the familiar proof of the irrationality of $\sqrt{2}$. Recall that rational numbers are defined as the ratio of two non-zero integers. That appeared, to the ancient Greeks, for example, to have exhausted the possibility of number. Indeed, Greek mathematics had an iterative method for approximating $\sqrt{2}$ very precisely in ratios of integers.[15] But the proof of its irrationality shows that no approximation of $\sqrt{2}$ by rational numbers will ever be final. The $\sqrt{2}$ quantity is thus, in

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[14] Yeats (1938), p. 131.
[15] Russell (1961), p. 219.

a sense, shown by the proof to be disinterred from the interstices of the rational numbers. And, so I shall now argue, the proof that 'disinters' √2 from amongst the rational numbers has minimally literary qualities, by virtue of which it gives a concrete, non-contradictory meaning to Yeats's central motif of disinterment, thereby enriching one's reading of Yeats's poem, and thereby also displaying the literary interest of the mathematical proof.

First, a brief outline of the proof and its minimally literary qualities: it is assumed that √2 is in fact a rational quantity, an a/b ratio. By algebraic manipulation, it is then shown that a is an even number, and that established, further manipulation shows that b, too, must be an even number. But if both a and b are even, then the ratio a/b is of the form 2c/2d. If we cancel the common factor, then, we find that √2 is a rational c/d. But the same manipulations can be reapplied to that quantity c/d, which is thus of the form 2e/2f, and so on without end. But it is always possible to express a ratio of integers in lowest forms. Therefore, the original assumption is incorrect, and √2 must be irrational. No rational approximation of it, no matter how precise, can ever be final. From the (minimally) literary perspective, the proof, which begins with familiar rational quantities, through simple manipulations exposes a surprising result: rational quantities, which initially seem to exhaust the concept of number, are radically incomplete. No matter how dense they may seem, from their interstices emerge new, irrational quantities. But in section I just such a surprising transformation of meaning was adduced as an example of a minimally literary quality. Therefore, this proof possesses a minimally literary quality.

Now consider the proof in tandem with Yeats's poem. The proof showed how it could be true that between any two rational approximations of √2, no matter how precise, lies its true, irrational value. From a literal nothing—that is, from an arbitrarily small interval—the proof showed that a new kind of quantity could be disinterred, a quantity that defies description in the pre-existing integer and rational forms. The √2 proof, in other words, in virtue of a minimally literary quality, gives a precise, non-contradictory interpretation to the idea of disinterring something radically new from "rich, dark nothing". The mathematical proof thereby enriches one's reading of Yeats's poem by suggesting a new, non-paradoxical way of understanding Yeats's disinterment motif. Thus, in virtue of its minimally literary qualities, the mathematical proof may be read productively alongside a more obviously literary text.

Let me reiterate the argument of this section. The point has been to show that the minimally literary properties of mathematical texts are not mere curiosities but are enough to qualify mathematical texts as objects of serious literary interest. I defended that position by considering a Yeats poem whose central motif, the gyral motion of history, depends for its plausibility upon the richness of the poem's treatment of disinterment, and I pointed out that the poem's most important image of disinterment appears paradoxical or contradictory. I then showed that the minimally literary qualities of the √2 proof suggest a new, non-paradoxical interpretation of Yeats's image of disinterment. Therefore, since the proof, in virtue of its minimally literary qualities, provides a new richness and plausibility to the central motif of a literary text, I concluded that the mathematical proof is of serious, if adjunctive, literary interest.

IV. REPLIES TO OBJECTIONS

Objections to the thesis just defended, and the illustration of its interest, might take two broad forms. One form of objection directly challenges the arguments made in sections II and III. Another form of objection points to alleged uncomfortable or unpalatable consequences of the thesis. I shall deal with an objection of the second kind first, then answer an objection of the first kind.

a. The thesis entails that mathematics, in turn, is enriched by literature

The discomfort or unpalatability of this consequence of the thesis, I take it, stems from the worry that mathematicians might be urged to become conversant with poetry, in order to be good mathematicians. But, even if the thesis does have the stated consequence, mathematics would not be enriched as mathematics by literature. I do not say that mathematicians, to be good mathematicians, ought to be extensive and careful readers of poetry. In just the same way, I do not claim that poets, to be good poets, ought to be extensive and careful readers of mathematical texts. It is entirely possible that many mathematicians may simply have no interest in the minimally literary properties of mathematics. And it is no part of my argument that the literary properties of mathematics texts exhaust the aesthetic properties of mathematics. Thus, even those mathematicians, such as G. H. Hardy, who have claimed that aesthetic properties of mathematical proofs are conditions of their ultimate acceptance, might consistently accept that mathematics texts have minimally literary properties and that such properties play no part in the ultimate acceptance of proofs as mathematics.

My just-stated reply to the objection does not, however, rule out the possibility that an all-things-considered appreciation of mathematics might not be enriched by literature. If the arguments of sections II and III are accepted, they may indeed provide intuitive grounds for thinking that a numerate education might not be entirely irrelevant to a literate one. I take it that such a consequence, if indeed it is at all unpalatable, is at least not unpalatable in the sense of the stated objection.

b. The example given in section III of compatibility between poem and proof is isolated and not generalizable[16]

There are two ways to interpret this objection. One version of the objection charges that the sample paired reading undertaken in section III is not representative, so that in general it is not true that productive paired readings of literary and mathematical texts are possible. Another sense of the objection proposes that a poem is sui generis in a way that a proof is not. Thus, for instance, the reasoning of the proof outlined in section III applies, too, in the case of the square root of any non-square positive integer. Yeats's poem is not similarly generalizable. So, the objector concludes, there is an important contrast between statements of mathematics and statements of poetry.

The answer to the first version of this objection must be empirical investigation. But I do not see why, if the objector grants the validity of the argument in section II or the value of the paired reading in section III, scepticism about the existence of other such readings ought to be assumed. Mathematical proofs vary greatly with respect to demonstrandum, method and presentation. Why should it not be thought that among that variety may be many proofs that might productively be read together with literature? Indeed, even if empirical investigation were to show literary interest to be restricted to a sub-class of 'literary' proofs, that would be consistent with what I have here urged, since I have not suggested that every mathematical proof possesses minimally literary properties.

The second version of the objection is not really an objection to the generalizability of the sample reading in section 3 but to the validity of the argument in section 2, on the grounds of a difference between the properties of mathematics

[16] This objection was suggested to me by a commenter on an early draft of the ideas in this paper, to whom I am grateful for incisive criticism.

texts and literary texts. Mathematics texts are generalizable; literary texts are not. However, the generalizability of a proof's reasoning to other mathematical contexts is a result of its truth-preserving—that is to say, its mathematical—properties, not what I have been describing as its minimally literary properties. So it does not damage my argument to suggest that mathematics texts have the special property of generalizability, unless it is shown that such generalizability precludes those texts from having minimally literary properties. It is true that literary texts are not generalizable,[17] but that no more precludes mathematical texts having minimally literary properties than does the fact that literary texts rarely (if ever?) conclude with the phrase "quod erat demonstrandum".

V. CONCLUSION

I have argued both for the possibility and the value of expanding the range of texts properly considered of literary interest to include mathematical texts. To reiterate my argument: I took as a starting point that the activities of mathematics and literature, whatever else they involve, both involve the production of texts. I then identified some special features of mathematical texts—their minimally literary qualities. Those qualities distinguish mathematical texts from other non-literary texts (road signs or cereal boxes), even if possession of minimally literary qualities does not establish that mathematical texts rise to the level of literature. Having established that mathematical texts reach at least an intermediate level between non-literature and literature, I then argued that minimally literary properties are sufficient to endow mathematical texts with important adjunctive status vis-à-vis literary texts. My argument for that adjunctive status was by way of representative example: I showed how a reading of a mathematical proof together with a W. B. Yeats poem could enrich one's appreciation and understanding of the Yeats poem.

My arguments are limited in three important ways. I have not argued that every mathematical text has an adjunctive literary status, let alone that any mathematical text can be productively paired with any literary text. Establishing which mathematical texts are of literary interest, and with which literary texts they might productively be paired, requires a great deal of further work (as, of course, does any paired reading of different literary texts). My illustrations have, for example, paired

[17] Indeed, it is hard to picture what "generalizable" could mean in the case of literary texts.

mathematical texts with poetry. Perhaps it is only in the case of poetry that productive paired readings are possible—it would be a programme for further work to determine if other kinds of literary texts might be productively read with mathematical texts. A second important restriction: I have not argued for, nor do I endorse, the converse of my argument. While I have urged that the range of texts properly considered to be of literary interest should expand to include the mathematical, I do not similarly exhort that the range of texts properly considered of mathematical interest ought to include the literary. Nor, finally, do I wish to foreclose on the possibility of entirely different ways of showing mathematics to be of literary interest. Perhaps, as mentioned at 5n supra, mathematical texts have other, non-literary, aesthetic qualities that are themselves sufficient justification to think mathematics of literary interest. My approach stands in contrast to those (perhaps more controversial) accounts of the relationship between mathematics and literary texts. Instead, I have sought to give a basis for, and outline, a way in which mathematical and literary texts might productively be paired, while avoiding contested questions about the nature of mathematics and literature.

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