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JoAnne S. Growney  
*Bloomsburg University*

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## MATHEMATICS AND POETRY: ISOLATED OR INTEGRATED?

People Don't Want to Study Mathematics:  
Some Illuminations on the Status Quo and How to Change It

JoAnne S. Growney

Department of Mathematics and Computer Science  
Bloomsburg University, Bloomsburg, PA 17815

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**Basic Premise:** All Life is Art.

... the whole universe was a work of art created by some Supreme Artist, in the way of artists, out of material that was practically nothing, ... a method which, as children sometimes instinctively feel, is a kind of creative art.

— Havelock Ellis, *The Dance of Life*

Every child is an artist. The problem is how to remain an artist once he grows up.

— Pablo Picasso

**Observation 1A:** Mathematics is a major Art Form.

**Observation 1B:** Poetry is a major Art Form.

**Observation 1C:** Mathematics and poetry are similar.

**Observation 2:** Major Art Forms in a culture each give clues to the key aspects of the culture as a whole.

**Observation 3:** In the United States today, people reject both mathematics and poetry as true Art Forms, i.e., as aspects of the Essence of Life.

**Unsolved Problem:** How to convince people that mathematics can be vital in their lives.

**Partial Answers:** slow down; open up; allow silence; open up; allow inconsistency; open up.

Is truth (a) logical or (b) episodic; is it (c) consistent or (d) inconsistent? Readers who strongly prefer (a) to (b) and (c) to (d) may dislike the manner of this article, outlined above. Herein I do not present a logical argument but an eclectic collection of statements, sometimes unsubstantiated yet real, sometimes contradictory, yet in their very contradictoriness hinting at truth. Consider, if you will, their bearing on a very large problem that faces mathematicians today: few people wish to study our subject in depth and succeed as mathematicians and,

moreover, few people want to study our subject at all, perhaps paying lip-service to the value of "quantitative literacy" but seeing no genuine benefit in it for themselves.

Some months ago I began an investigation into the similarities between mathematics and poetry, hoping to gain insights that would help me to reach reluctant students — English majors, elementary education majors, majors in studio art, and other assorted math-avoiders — who enroll in Math 101 ("Mathematical Thinking") at Bloomsburg University because they must fulfil a "quantitative reasoning" requirement to graduate. By pointing out analogies between mathematics and poetry, I would help students to see the beauty and power of mathematics. That investigation continues; this article is a by-product.

### All life is art

Concerning this basic premise, there is little that I wish to say. It is a point of view that one may adopt or reject. However, as you read on, you will be more ready to consider my words if you can temporarily envision life as art: as a painting, a poem, a theory, or a dance — fashioned by the self, responsive both to the inner spirit and the outer world, striving for beauty while expressing old truths and new insights. Gathered in Appendix A are a variety of quotations that refer to the nature and purposes of art and artists, of mathematics and poetry. Several of the cited references address the basic premise at length.

Whether mathematics is, like poetry, a major Art Form may deserve debate, but this article will avoid that controversy. There are significant similarities between mathematics and poetry. Consider:

Both mathematics and poetry are abstract languages that practitioners use in an attempt to express truth precisely and concisely.



Both mathematicians and poets identify key ideas and express them symbolically. A poet may, for example, use deep water to symbolize death and its surrounding mysteries. A mathematician uses the derivative to symbolize a rate of change and its surrounding mysteries.

Both mathematics and poetry are feared and shunned by most of the populace:

they have no meaning,  
no relevance,  
no usefulness.

Both mathematicians and poets are often regarded as isolated and peculiar.

Which has the greater beauty, the greater symmetry, a sonnet or the expansion of a binomial? Dante's Divine Comedy or Pascal's triangle? Have we any more or any less wonder when we contemplate the convergence of the infinite series

$$1 + \frac{1}{2^1} + \frac{1}{2^2} + \dots + \frac{1}{2^n} + \dots$$

than when we envision "a host of golden daffodils?" Was Lord Byron thinking of mathematics or poetry when he wrote:

The power of  
Thought — the magic of the mind.

The search for truth that pervades both mathematics and poetry gives each an uplifting quality. In the words of Sir Francis Bacon, "No pleasure is comparable to the standing upon the vantage ground of truth."

Mathematics and poetry are more than their objects of formula or stanza, proof or poem. Each has become a mind — not just a product of mind but a mind on its own — a mind that approaches omniscience as an ideal. Each goes on with endless invention, hungry and restless for more.

Appendix B contains a list of quotations in which a key word — *mathematics* or *poetry* or *mathematician* or *poet* or a variation of one of these — has been left out. If you do not use the name of a quotation's author as a clue, you will find difficulty in deciding whether it is *mathematics*

or poetry to which the quotation refers. Upon all of this evidence, then, let us rest the hypothesis that mathematics and poetry are fundamentally similar.

Is mathematics, like poetry, properly (today, as well as in the past) one of the Humanities?

A powerful argument for this placement of mathematics is given by Cassius J. Keyser [7]. He points out that the identification of mathematics with science is too limiting: we are thinking not of mathematics but of its application to a particular subject matter. Mathematics, after all, is a way of thinking; it has an individuality of its own. *Mathematics discloses the essential nature of man* by revealing, more than any other subject, man's ability to pass on achievements of one generation to the next, providing living capital for the production of ever-greater achievements. *Mathematics is a guide to human life* in its role as a keeper of ideals: number systems, geometries, logical thinking — these and more are ideals that are kept by mathematics and guide human life. Mathematics also sheds light on the nature of an ideal: like a mathematical limit, it can be approached by an endless sequence of closer and closer approximations and yet (unless it is a specious ideal) is incapable of actually being attained.

### Art forms are culture clues

Any major Art Form produced by a culture is a valuable clue to the key aspects of the culture. Keyser illustrates the application of this idea by using mathematics to identify significant differences between the Greek, or Classical, Culture and the Modern, or Western Culture [7]. The Greek mathematics was finite and bound to the concrete. Numbers were positive integers and were bound to geometric things; they counted finite groups of objects or were the lengths of line segments. Geometry was a highly developed study of the properties of finite figures but was not an exploration of Space. This is in accord with the Classicists' lack of consideration of perspective in their arts of painting, city planning, and garden designing. Their mathematics was functionless: objects without relations. Likewise, their physics was nothing but statics; their music had rhythm and melody but no harmony. Modern mathematics, on the other hand, is dynamic, relational, and includes the infinite. We can see similar characteristics in modern science, drama, religion, art, . . .



Next, let us consider the role of poetry in our culture and to use this information for clues about mathematics.

### Today, both mathematics and poetry are rejected

I think that one possible definition of our modern culture is that it is one in which nine-tenths of our intellectuals can't read any poetry.

— Randall Jarrell

For most Americans, poetry is not vital, and they may scoff, "Why should it be?" Likewise, most envision no benefit from knowing mathematics. The people we meet at social gatherings are not interested in talking about our subject. Mathematics is not popular and even those who like it frequently see it as non-useful. Few people see value in mathematics beyond the arithmetic of the check-book. Despairingly smaller numbers of Americans choose it as a field for graduate study and a career.

The unpopularity of poetry is similar to that of mathematics. Although some of us have sought and found poets whose work inspires us, members of the general public find little time for poetry, and place little value on the role it might play in a full and happy life.

If we were to speak to poets and to learn of their distress about the exclusion of their art, how would we advise them to connect with essentiality once again? How would we react to their claims that it was our early schooling — and not the present nature of poets and poems — that had turned us off to poetry? How would they react to our complaints that we find much of modern poetry without meaning: we cannot understand or approach poetry directly; a teacher or reviewer must go between as a translator. How would they or we explain the lack of status accorded to the new voices in poetry — the black voices, the female voices, the third world voices — many of whose words are not shared with large audiences, whose works are "minor" poetry, perhaps only because their images are different and because they speak with simplicity and clarity.

As I write, I can hear echoes of friends' voices scoffing at these comparisons between mathematics and poetry and at the view that both are vital to human life:

*One-third of them scoff at the notion that poetry ought to be as useful as mathematics. (I use "useful" broadly: that which inspires or gives pleasure is "useful.")*

*One-third of this first third actually use some mathematics.*

*A different one-third scoff at the notion that mathematics ought to be as useful as poetry: poetry, after all, appeals to the emotions, making it real, whereas mathematics is merely a mind-game.*

*One-third of this second third actually read poetry as a habit, at least once a month. Some of them even write poetry although they would not call themselves "poets" for that is an elitist designation.*

Left over are a *final one-third* who scoff at both mathematics and poetry — both are abstract, esoteric; neither applies to the real world.

For the time being, ignore the scoffing. Imagine, if you will, that you are willing to be convinced of the hypothesis that poetry is a vital source of the energy and insight that give meaning to daily life; merely allow yourself to ever-so-slightly consider this notion and to accept it only if sufficient reason is given. What evidence would you require?

Here, then, is a full statement of our question: *What evidence would you require before you would accept the hypothesis that poetry is vital for the full living of daily life?* Would you require changes in schooling, in the attitudes of teachers? Might they show you tools for experiencing poetry directly rather than first trying to translate it into prose? Would you wish to see demonstration of how others use poetry as a guide and find it significant? Would you wish to find poetry readily available in the popular media? Would you like to be able to approach good poetry directly and to discover its beauty and meaning on your own, without the aid of a teacher-translator? Would you like to be shown how poetry is a process and not just a product?

Suppose we now have a few criteria for poetry and poets. Turn them around toward mathematics. If mathematics and mathematicians met these same criteria, mightn't people find them also vital?

### Convincing people that mathematics is vital

When I apply my own criteria for acceptance of poetry as vital to the problem of convincing people that mathematics is vital, I come up with the following:

#### SLOW DOWN

Many voices have said,  
we must slow down,  
we must allow time to let students learn,



Forces seemingly beyond our control make this change a difficult one to implement, and our course syllabi are packed with long lists of topics that must be covered to prepare students for other courses that offer more of the same. Too many of our students do not see mathematics as a process as well as a product. Might we not envision mathematics as rather like the complex mind of a friend. If we would consider how we get to know a friend, how we come to understand the depths of that other, we see a suggestion for how one may learn mathematics. Facts and techniques are not sufficient; context and meaning must accompany them.

As George Cobb observes in [3], "the more attention you pay to technique, the less you have left for meaning . . . . To learn technique quickly, you have to treat it abstractly; context and meaning just get in the way and slow you down."

Howard Nemerov in "Poetry and Meaning," an essay included in [10], characterizes poetry as "getting something right in language." He goes on to express his observation that there has been in poetry in this century "a slow collapse in the idea of meaning which progressed simultaneously with an imposing acceleration of the rate at which knowledge was accumulated . . . the slow collapse in the idea of meaning . . . did not happen in poetry alone. It happened even more conspicuously and at about the same time in physics, in painting, in music. The whole world suddenly became frightfully hard to understand."

If speed and emphasis on technique drive out meaning, then it is clear that if we want to bring meaning back, to mathematics or to poetry, we must slow down.

Slowness is beauty.

— Auguste Rodin

#### open up

In general the teacher of mathematics has been the high priest of an occult ritual, the keeper in many senses of an esoteric doctrine which only his superiors or predecessors have understood.

— Scott Buchanan [1], 35.

How do mathematicians react to remarks like those of Buchanan? Do some show scorn for those who cannot or will not appreciate the beauty of pure mathematics? Do some level contempt at those who have not the discipline to master obscurities? Does laughter deride

the unfortunate student who dares to wonder, "When are we going to use this?" Sometimes the unpopularity of mathematics is taken by mathematicians to suggest that there are deficiencies in others but not in themselves. Is it possible that our dissatisfied customers (i.e., our reluctant students) are correct: they have not been given sufficient evidence that our product is worthy.

In [4], in an essay entitled "The Ideal Mathematician," Philip Davis and Reuben Hersh endeavor to describe the most mathematician-like mathematician:

He rests his faith on rigorous proof . . . He is labeled by his field, by how much he publishes . . . He finds it difficult to establish meaningful conversation with that large portion of humanity that has never heard of [his research topic] . . . His writing follows an unbreakable convention: to conceal any sign that the author or the intended reader is a human being . . .

Is this Davis-Hersh creature an attractive one? How can the general public appreciate mathematics if it emerges from such sterility?

William Benjamin Smith — scholar, poet, mathematician and master teacher — wrote "The Merman and the Seraph," a poem that won the Poet Lore competition of 1906. In it he sings sadly of the separation between the Merman — perhaps a mathematician, isolated in his sterile world of thought, and separated from beauty, from feeling and desire — and an angel or Seraph, who represents the world of whatsoever is good. Here are the opening stanzas of Smith's poem, reviewed by Keyser in [7].

#### THE MERMAN AND THE SERAPH

Deep the sunless seas amid,  
Far from Man, from Angel hid,  
Where the soundless tides are rolled  
Over Ocean's treasure-hold,  
With dragon eye and heart of stone,  
The ancient Merman mused alone.

And aye his arrowed Thought he wings  
Straight at the inmost core of things —  
As mirrored in his Magic glass  
The lightning-footed Ages pass, —  
And knows nor joy nor earth's distress,  
But broods on Everlastingness.  
"Thoughts that love not, thoughts that hate not,  
Thoughts that Age and Change await not,



All unfeeling,  
All revealing,  
Scorning height's and depth's concealing,  
These be mine — and these alone!" —  
Saith the Merman's heart of stone.

As the poem unfolds, the Merman dreams of a beautiful angel who visits him, offering love and all that is good. Too soon she is driven to retreat, to leave him in his dark world of sterile thought.

Along with his consideration of Smith's poem, Keyser expresses his concern about "the narrow canalising of their mental energies" which he sees as prevalent among mathematicians. He introduces his concerns with a quote from David Swing, noted Chicago clergyman and author:

Men trained in a profession come by degrees into the profession's channel, and flow only in one direction, and always between the same banks. The master of a learned profession at last becomes its slave. He who follows faithfully any calling comes at length to wear a soul of that calling's shape . . . We are all clay in the hands of that potter which is called a pursuit. A pursuit is seldom an ocean of water; it is more commonly a canal.

Although Swing believed that the lawyer was least likely to escape the influence of his pursuit, Keyser gave this honor to "those who addict themselves long and assiduously to the study and teaching of mathematics." He wondered if this is why the world in general regards mathematicians as a bit peculiar, admirable for their intelligence and knowledge, but very narrow in their interests and feelings. While "canalising" is not a bad or wrong choice for any individual, its prevalence in a profession may cause the profession to be unattractive to newcomers. In short, canalising by mathematicians may cause students not to be attracted to mathematics.

One of Keyser's antidotes to canalising in his own life was the reading and rereading of *The Dance of Life* by Havelock Ellis [6]. He ranked Ellis's book "among those rare ones that are to be honored and revered as emancipators of the human mind." Keyser compares mathematics to the art and natural human activity of dancing and, by so doing, enriches his conception of the nature of mathematics. If our students would see mathematics as a dance, i.e., as an art in which freedom of expression joins with responsiveness to surroundings and to disciplined training to create beauty, how might they respond differently?

Cecil Day-Lewis, professor of poetry at Oxford, in his 1951 inaugural address, *The Poet's Task*, offered the following views:

Describing the present position of poetry:

. . . poetry is not primarily a vehicle of extrinsic truth but the generator of a kind of truth peculiar to itself.

. . . the function of poetry as a game with words [looms] larger than its function as a search for truth, and the tendency be toward pure poetry.

Day-Lewis asserted:

Poetry has a moral function; it has the duty to give pleasure. A poet has a duty to love and to praise, to be serious and honest, to be dissatisfied with past attempts and alive to what the future holds.

A task that is badly needed for the poet to take up today is to incline our hearts toward what is lovable and admirable in mankind.

If poetry is a culture clue that reveals some truth about the nature of mathematics, then we might take the words of Day-Lewis to heart: it is badly needed for the mathematician to take as his or her task to point mankind toward what is lovable and admirable. Consider what great satisfaction we feel when one of our students experiences direct pleasure from mathematical thinking; let us get greedy for more of this feeling.

That the poet's task is shared by the mathematician is a conviction that is found in [12], in the writings of David Eugene Smith, American mathematician and a president of the Mathematical Association of America (1920).

. . . the call of mathematics is something beyond the physical; it is the call of the soul, precisely as in the case of music, of painting, and of other fine arts, or of science, or of letters. It is this call that must be answered if mathematics, the fine arts, the sciences, and letters are to advance and make the world a better place in which each succeeding generation is to play its part in the progress of the race.

The call of mathematics is, then, to our physical well being, and this is always recognized; but it is also to our spiritual well-being, and this we must not fail to recognize if our labors are not to be in vain.



## allow silence

Many mathematicians are good teachers. Our students like us, like our classes, and seem to learn a lot. But the facts remain that many Americans are quantitatively illiterate and eschew mathematical thinking, that too few of our students go on to become mathematicians. Perhaps good teaching needs to change.

The poet Howard Nemerov has some thought-provoking suggestions about teaching [10]; he, of course, is referring to teaching poetry but, if we consider mathematics in its role as a language, his ideas apply to teaching mathematics as well.

The method I suspect we all use exclusively, or almost so, may be called analytic, and has to do broadly with finding out the meanings of poems; if one wanted to be critical of that method one could call it, as a friend of mine did, 'how to turn poems into prose,' . . .

The method I am going to propose as the complement to the first is both simple and difficult, though I hope not impossible. It has to do less with 'teaching poetry' than with 'being taught by poetry' . . .

In short, given that poetry is a language, our way of showing pupils how to deal with it is to translate it out of that language into our own more familiar one. Suppose, however, another object, the one we ordinarily have in studying any language: to learn to speak it, and at last to learn to think in it.

It is not hard to see why we teach as we do, analytically; and seeing to sympathize with our plight. For the teacher, as Ezra Pound tersely defined him, is a man who must talk for an hour.

For if you have to talk for an hour, you concentrate naturally enough on what is sayable . . .

In conclusion, I stress once again that I am trying to picture our situation, not to criticize it. For the first move of the understanding ought to be the silent contemplation of what is, and of how it got to be the way it is. No doubt the teacher of English will always be 'a man who must talk for an hour.' But if his talk is really to do its work, if

his pupils are truly to become possessed of some sense of what poetry is and why it is, his speech itself will have to contain much silence.

Nemerov has observed [10] that an implicit message often is given by the teacher of poetry who translates poetry for students; this message is, "Look how sensitive I am." One key difference between the teacher of mathematics and the poetry teacher is that the former's implicit message is likely to be, instead, "Look how smart I am!" We will not have got it right until the implicit message to our students is, "Look how smart you are!"

Dorothy Buerk has written of some high school students who have contemplated mathematics in a direct and personal way. Consider the following response of a student in an advanced placement mathematics course, when asked to complete the phrase, "For me math is like a . . ." [2]

For me math is kind of like an incredible book that you have to read through an infinite number of times. The first time you get the general idea, but until you reach the end you really have no idea what's going on in relation to anything else. Each successive reading brings out more meaning and . . .

Thomas Rishel [11] encourages his students to use their intuitive knowledge of geometry to help them to understand a difficult poem without the aid of a teacher-translator. He gives them Wallace Stevens' poem, "The Idea of Order at Key West," and asks them to complete the following assignment:

Read the poem through thoroughly twice.

After the second reading, underline any geometric words you find, especially concentrating on the penultimate stanza.

Then, perhaps in a group, draw a picture based on the geometric words chosen.

Finally, consider what the picture may have to do with the poem's final stanza.

Rishel's assignment not only provides students with a framework for letting a poem speak to them; it also allows them to discover something of the aesthetic nature of geometry.



open up

### OUTWITTED

He drew a circle that shut me out —  
Heretic, rebel, a thing to flout.  
But Love and I had the wit to win:  
We drew a circle that took him in!

— Edwin Markham

Two of my three best teachers from graduate school were women; the third was a Japanese man. Among the most successful mathematics teachers are Jaime Escalante (Los Angeles high school teacher made famous by the movie, "Stand and Deliver") who is Hispanic and Clarence F. Stephens (under whose leadership the State University of New York at Potsdam has a highly successful mathematics program) who is black. Are gender, race, or ethnic background relevant in these cases? Perhaps so.

Perhaps the traditional mold of mathematician as researcher — who cares not a fig about the connections of his theories to the humanities, who worries not about his pedagogy — needs to be recast. Our own initiation into the mysteries and magic of mathematics may have involved the same tough challenges to the intellect that we now provide for our followers:

the details are left to the student;  
all mathematics has applications — it is up to you  
to find them;  
all knowledge is interrelated — discover these  
interrelationships for yourself, or accept this  
on faith.

Even though we learned joyously under these circumstances, today is not yesterday and we may have participated in a narrowing specialization that has prepared us poorly to reach new adherents. Moreover, those who have achieved the highest status in the elitist group of mathematicians may be the least-well-prepared to aid in reform.

Frequently listed among our best teachers but seldom among our most respected researchers, are humanists, members of minority groups and women. WHY?

In over 4000 categories of mathematics recognized in the list of Mathematics Subject Classification Numbers, none except 00A99, "Miscellaneous Topics," covers mathematics education or mathematics as Art. WHY?

OPEN UP, YOU GUYS!!! A bright future for mathematics may depend on enlarging the definitions of "mathematics" and "mathematician." If we will enlarge the boundaries of the class of mathematicians to include teachers at all levels, students of all cultures, math hobbyists, and anyone who will admit to a liking for mathematics, then perhaps we can start to see ways to work together to reestablish mathematics to a preeminence it deserves.

### allow Inconsistency

If your views differ from mine, must one of us be wrong? May we not both be correct, even though we see things differently? Is it not a long-standing tradition in mathematical thought to embrace paradox as a goad to understanding, rebuilding ideas to encompass apparent inconsistencies?

For example, even though we see that when we crowd course syllabi with more topics and the result is less student learning, must consistency prevent us from experimenting with the paradoxical "less is more"?

What other inconsistencies can we entertain? Can we allow ourselves to consider the value of the opposite of each of our current attitudes and practices? What about mathematics as a humanistic subject as well as a scientific one? What about applications of mathematics to poetry as well as to practical projects? What about mathematics as a way to advance brotherhood as well as technology? What about an inclusive definition of "mathematician" rather than an exclusive one?

No man bathes twice in the same stream . . .

— Heraclitus

The man who consistently — as he fondly supposes 'logically' — clings to an unchanging opinion is suspended from a hook which has ceased to exist . . . We change, and the world change, in accordance with the underlying organization, and inconsistency, so conditioned by truth to the whole, becomes the higher consistency of life.

— H. Havelock Ellis

### open up

Allow that mathematics is an Art and a humanistic endeavor. Perhaps it is also a garden: this thought is suggested to me by "Poetry" by Marianne Moore. Here is a fragment of it; the poem in full [8] deserves your reading.



... things are important not because a high-sounding interpretation can be put upon them but because they are useful ...  
 ... the same thing may be said for all of us, that we do not admire what we cannot understand ...  
 ... [Not until we] can present for inspection, imaginary gardens with real toads in them, shall we have it.

## APPENDIX A

**What Is MATHEMATICS?  
 What Is POETRY? What Is ART?  
 What is the role of the MATHEMATICIAN?  
 The POET? The ARTIST?**

The artist has a special task and duty: the task of reminding men of their humanity and the promise of their creativity.

— Lewis Mumford

Wherever there is number, there is beauty.

— Proclus

The useful and the beautiful are never separated.

— Periander

This, therefore, is mathematics: she reminds you of the invisible form of the soul; she gives life to her own discoveries; she awakens the mind and purifies the intellect; she brings light to our intrinsic ideas; she abolishes oblivion and ignorance which are ours by birth.

— Proclus

It is true that a mathematician, who is not somewhat of a poet, will never be a perfect mathematician.

— Weierstrass

On poetry and geometric truth,  
 And their high privilege of lasting life,  
 From all internal injury exempt,  
 I mused; upon these chiefly: and at length,  
 My senses yielding to the sultry air,  
 sleep seized me, and I passed into a dream.

— Wordsworth

*The Prelude, Book 5*

Does it not seem as if Algebra has attained to the dignity of a fine art, in which the workman has a free hand to develop his conceptions, as in a

musical theme or a subject for painting? It has reached a point in which every properly developed algebraic composition, like a skillful landscape, is expected to suggest the notion of an infinite distance lying beyond the limits of the canvas.

— J. J. Sylvester

We do not listen with the best regard to the verses of a man who is only a poet, nor to his problems if he is only an algebraist; but if a man is at once acquainted with the geometric foundation of things and with their festal splendor, his poetry is exact and his arithmetic musical.

— R. W. Emerson

The true spirit of delight, the exaltation, the sense of being more than man, which is the touchstone of the highest excellence, is to be found in mathematics as surely as in poetry.

— Bertrand Russell

It is with mathematics not otherwise than it is with music, painting or poetry. Anyone can become a lawyer, doctor or chemist, and as such may succeed well, provided he is clever and industrious, but not everyone can become a painter, or a musician, or a mathematician: general cleverness and industry alone count here for nothing.

— P. J. Moebius

When you can measure what you are speaking about, and express it in numbers, then you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind.

— Lord Kelvin

Man is the measure of all things.

— Protagoras

While you and I have lips and voices which are kissing and to sing with who cares if some one-eyed son-of-a-bitch invents an instrument to measure spring with.

— e. e. cummings

Mathematicians do not study objects, but relations among objects; they are indifferent to the replacement of objects by others as long as relations do not change. Matter is not important, only form interests them.

— Henri Poincare



The poet's vocation . . . is to discover for use what Shelley called 'the hitherto unapprehended relations' between things.

— C. Day-Lewis

The aim of art is to represent not the outward appearance of things, but their inward significance.

— Aristotle

## APPENDIX B

### Are MATHEMATICS and POETRY fundamentally similar?

If you doubt their intrinsic similarity, consider the following quotations. In each of the following, the key word (*mathematics* or *poetry* or *mathematician* or *poet* or a variation of one of these terms) has been left out, although the name of the author may provide a give-away clue. Can you guess which art form is being described in each case? The missing words are supplied at the end of the quotations.

(1) \_\_\_\_\_ is the art of uniting pleasure with truth.  
— Samuel Johnson

(2) To think the thinkable — that is the \_\_\_\_\_'s aim.  
— Cassius J. Keyser

(3) All \_\_\_\_\_ [is] putting the infinite within the finite.  
— Robert Browning

(4) The moving power of \_\_\_\_\_ invention is not reasoning but imagination.  
— A. DeMorgan

(5) When you read and understand \_\_\_\_\_, comprehending its reach and formal meanings, then you master chaos a little.  
— Stephen Spender

(6) \_\_\_\_\_ practice absolute freedom.  
— Henry Adams

(7) I think that one possible definition of our modern culture is that it is one in which nine-tenths of our intellectuals can't read any \_\_\_\_\_.  
— Randall Jarrell

(8) Do not imagine that \_\_\_\_\_ is hard and crabbed, and repulsive to common sense. It is merely the etherealization of common sense.  
— Lord Kelvin

(9) The merit of \_\_\_\_\_, in its wildest forms, still consists in its truth; truth conveyed to the understanding, not directly by words, but circuitously by means of imaginative associations, which serve as conductors.

— T. B. Macaulay

(10) It is a safe rule to apply that, when a \_\_\_\_\_ or philosophical author writes with a misty profundity, he is talking nonsense.

— A. N. Whitehead

(11) \_\_\_\_\_ is a habit.  
— C. Day-Lewis

(12) . . . in \_\_\_\_\_ you don't understand things, you just get used to them.  
— John von Neumann

(13) \_\_\_\_\_ are all who love—who feel great truths. And tell them.  
— P. J. Bailey  
*Festus*

(14) The \_\_\_\_\_ is perfect only in so far as he is a perfect being, in so far as he perceives the beauty of truth; only then will his work be thorough, transparent, comprehensive, pure, clear, attractive, and even elegant.  
— Goethe

(15) . . . [In these days] the function of \_\_\_\_\_ as a game . . . [looms] larger than its function as a search for truth . . .  
— C. Day-Lewis

(16) A thorough advocate in a just cause, a penetrating facing the starry heavens, both alike bear the semblance of divinity.  
— Goethe

(17) \_\_\_\_\_ is getting something right in language.  
— Howard Nemerov

The words missing are: (1) Poetry, (2) mathematician, (3) poetry, (4) mathematical, (5) a poem, (6) Mathematicians, (7) poetry, (8) mathematics, (9) poetry, (10) mathematician, (11) Poetry, (12) mathematics, (13) Poets, (14) mathematician, (15) poetry, (16) mathematician, (17) Poetry.



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