Wednesday, September 26, 2012

Education

The Learning Network

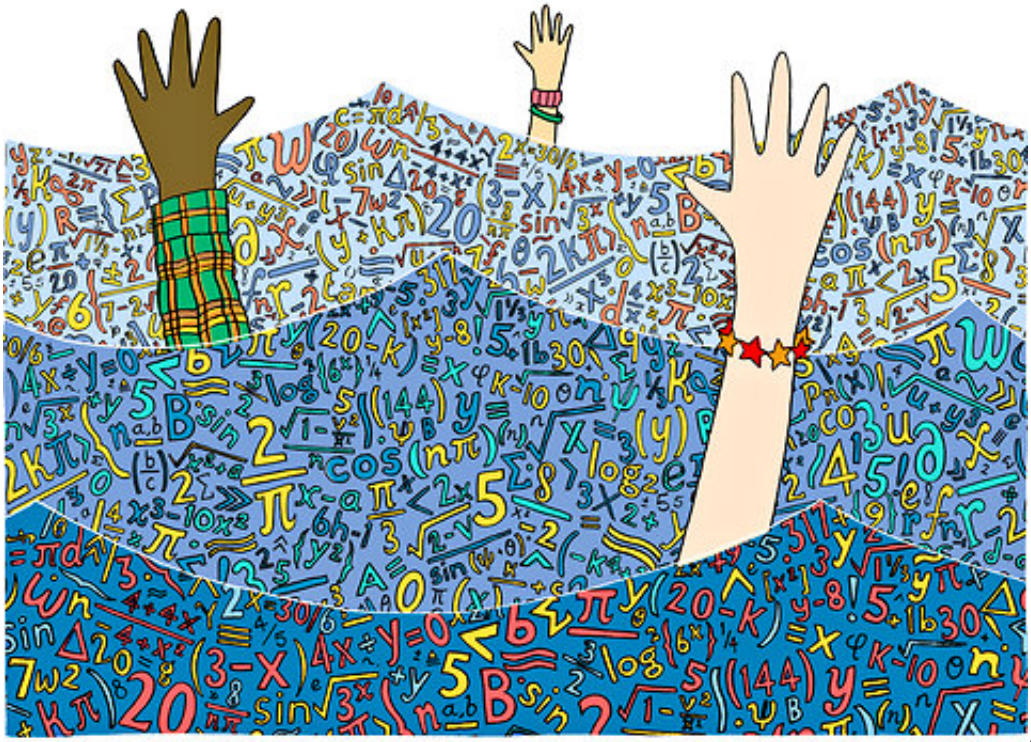
Teaching & Learning With The New York Times

September 26, 2012, *11:02 am*14 Comments

N Ways to Apply Algebra With The New York

Times

By PATRICK HONNER



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This summer, the political scientist Andrew Hacker's New York Times Op-Ed essay "Is Algebra Necessary?" set off a national debate on mathematics education. Here is how the essay begins:

> A typical American school day finds some six million high school students and two million college freshmen struggling with algebra. In both high school and college, all too many students are expected to fail. Why do we subject American students to this ordeal? I've found myself moving toward the strong view that we shouldn't.

The debate inspired us to suggest several algebraic opportunities right here in the pages of The Times. After considering them, and reading Mr. Hacker's essay in full, we invite you to tell us what you think. Is algebra necessary?

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1. Mathematically Modeling Mortgages

Use algebra to evaluate the housing market. Find some homes for sale in your area (for example in Atlanta), research current interest rates for mortgages and apply this formula to determine the required monthly mortgage payment.

Experiment with different home prices, different interest rates and different mortgage lengths to explore the impact of each variable on the resulting monthly mortgage payment. Use the Real Estate section's built-in mortgage calculator to check your work.

For a given house, explore questions like "How much would you end up paying over the entire term of the mortgage, and how does this compare to the value of the house?" and "How big is the difference in monthly

payments between a 15-year mortgage and a 30-year mortgage?"

Do you think it is more cost effective to rent an apartment or buy a house? Read this article and play around with this Times Interactive to explore the answer.

2. Evaluating Colleges

Check out how algebra is used to rank colleges. Read this article about the history of the Academic Index and then check out this informational graphic detailing the formulas that are used to create college rankings.

Calculate and compare the Academic Index of colleges like SUNY Binghamton and the University of Southern California by finding the appropriate data here. Are your results consistent with those of the U.S. News & World Report rankings, or those of The Princeton Review?

Use other available data — like tuition, acceptance rates and faculty information — to create your own algebraic formula for evaluating colleges. Can you create a ranking system that puts SUNY Binghamton ahead of U.S.C.? Can you create a different ranking that puts U.S.C. ahead of SUNY Binghamton? Can you create a ranking that puts your favorite college at the top of the list?

3. Calculating Car Costs

Use data from The Times's Automobiles section to create a model for how quickly cars lose their value.

Use the Used Car Search to collect price information on specific makes and models of cars. Select your automobile, get your list of prices (for example, there are nearly 20,000 Ford Explorers for sale nationwide), and create a scatter plot with "year" on the horizontal access and "price" on the vertical access.

Use the graph and your data to explore questions like "How much value does a used car lose per year?" and "When does an automobile depreciate fastest?" Use technology like a graphing calculator or a computer spreadsheet to generate a possible function that models this data. Use the model to project the value of a new car two, three or 10 years from now. Set up equations to solve questions like "After how long will the car be worth 50 percent of its original value?"

Ratchet up the reality and complexity by compensating for the differences in new car prices and inflation. Go deeper by exploring questions like "Do SUVs lose value faster than sedans?" and "Which cars are the best long-term investments?"

4. Algebra of the Election

To win the presidency, a candidate must secure more than half of the 538 electoral votes. Take a look at the current breakdown of electoral votes by state, and find combinations of states that add up to 270 (or more) electoral votes. Each solution to this equation (or inequality) represents a potential path to the presidency.

Compare your possibilities to those demonstrated in this Electoral Map informational graphic. Take a look at some possible situations and interact with the mathematics by moving states around and exploring other solutions to this equation. If you were running for president, where would you focus your campaign resources?

5. Do the MetroCard Math

Is it better to buy a card that gives you unlimited access to public transit, or should you just pay ride by ride? Check out this article on the mathematics of New York City MetroCards. Currently, a seven-day unlimited

MetroCard costs $29 and a 30-day unlimited MetroCard costs $104. If a single ride costs $2.25, under what circumstances would you be better off buying the weekly unlimited? The monthly unlimited? Set up simple linear equations and inequalities to answer these questions. Who should buy the 30-day unlimited?

Transfer over to some harder problems by factoring in the 7 percent bonus you get when you prepay for a pay-per-ride card. How does this discount affect the above calculations? And for even more real-world complexity, consider the effect that pretax commuter benefits can have on the equation. Check your numbers against the Metropolitan Transportation Authority.'s own comparisons here, and research the commuter cards in your area to find your best local options.

6. Olympic Algebra

Use mathematics to explore the wealth of Olympic data The Times has to offer. Take a look at the world records set this year in London, and check out the history of world records for events in track, field, swimming and more at the bottom of the page. Use simple formulas like Distance = Rate * Time to compare and contrast the average speeds of athletes over time, across events and even by gender. How much faster is the fastest sprinter now than 50 years ago? How much faster is the fastest sprinter than the fastest long-distance runner? How do swimmers, runners and cyclists compare in speed?

Pick an event, like the 100-meter freestyle swim, and take a look at the history of the world-record times. Create a scatter plot of the data with the horizontal axis representing the year and the vertical axis representing the world-record time. Experiment with some simple linear equations to find a line that fits the data, and use this equation to project the possible world-record times in 2016, or to hypothesize when the fastest time might drop below 43 seconds. If appropriate, use computing technologies to generate regression equations to compare to your own work.

Be sure to check out how beautifully mathematical results can be visualized and presented by watching this amazing video showing the Jamaican sprinter Usain Bolt running against every other Olympic medalist in history.

7. Redo Those Recipes

Search this Times Topics page for some tasty recipes with your favorite ingredients like chicken with lemon and rosemary or midnight pasta. Suppose you had twice as many people coming for dinner: what would the new recipe look like? Turn your recipe into an algebra problem by converting all amounts into some standard measure (like grams) and creating expressions that tell you exactly how much you need for *any* number of people. How many grams of chicken will you need if *N* guests show up for dinner?

Use a calorie counter to determine the number of calories per serving of your dishes. Using this United States Department of Agriculture guide, plan out meals for breakfast, lunch and dinner that keep you in the healthy range for caloric intake. Or list the 10 foods you most like to eat and find out how many calories are in each of them. Set up inequalities to figure out how many you should, or shouldn't, consume to keep within your healthy range.

8. Solve for Stocks

Choose some of your favorite companies and use Times resources to collect historical stock price information: for example, check out Ford Motor Company, Apple or Amazon.com. Look at the prices over some fixed period of time, say the past two years, and determine the growth of the value of the stock over that period. If you had invested $1,000 at the beginning of that time period, how much would you have at the end?

Using the formula for compound interest, $A = P(1+(r/n))^{nt}$, run the numbers on some hypothetical investments of the same principle investment over the same time period, and compare the results to the performance of the stock. Did the stock do better than a 5 percent annual rate of return? How about 8 percent? Set A equal to the final value of the stock, and solve for the rate, r, to figure out the exact rate of growth of your chosen stock.

Find the rates of return for several stocks, and put together a hypothetical investment portfolio for the school year. Watch your stocks through the year and compare their performance to your calculations. Does past performance guarantee future returns?

9. Population Growth, Football, the Economy and More

Use existing Learning Network resources to apply algebraic tools to rank sports teams, chart population growth analyze economic measures or even succeed in fantasy football.

10. Is Algebra Necessary?

Read Mr. Hacker's original essay and decide for yourself. Do you use internal equations to help plan out your schedule? Or inequalities when you're spending your money? Or graphs when you are plotting your performance? Or maybe you use algebra to figure out if that frequent shopper program is worth sticking to.

Find the algebra that's around you and write a response to Professor Hacker. Maybe algebra isn't necessary, but it sure can be useful.

This lesson addresses the following Common Core domains, standards and practices under Algebra:

Domains
Create equations that describe numbers or relationships.
Solve equations or inequalities in one variable.
Represent and solve equations graphically.
Interpret the structure of expressions.

Standards

Seeing Structure in Expressions
1. Interpret expressions that represent a quantity in terms of its context.
4. Derive the formula for the sum of a finite geometric series and use the formula to solve problems. For example, calculate mortgage payments.

Creating Equations
1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.

Reasoning With Equations and Inequalities

3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

C.C.S.S. Practices

Mathematical Practices
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Algebra, Lesson Plans, Mathematics, algebra, Mathematics

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14 Comments

1. 1. September 26, 2012 11:29 am Link

   Gas mileage. We give gas mileage in mpg, and use algebra to figure out our gas mileage when we buy gas (those of use with old cars) and to figure out how much we have to buy to make it when driving cross country and stopping somewhere with brutal gas prices.

   — *john*

2. 2. September 26, 2012 12:09 pm Link

   These examples are pretty awful. No one would ever calculate mortgage payments using the actual formula. No one.

   That level of algebra is so tedious that it amounts to little more than an accounting problem. Plugging numbers into an algebraic formula requires absolutely no understanding. It is the mathematical equivalent of "painting by numbers."

   — *Hari*
3. 3. September 26, 2012 12:44 pm Link

   I do not believe algebra should be mandatory in our high schools. Many kids my age do not even know their multiplication tables and other simple math. Why should we teach the students algebra when 90% of jobs do not even require it in that field. I feel that there is better classes to teach in that time, that will educate us in a superior way that will help us in the near future.
   I feel we subject our students through this ordeal to make things in life more difficult. But lets face it colleges would rather see a high school kid take algebra class than multiplication studies.

   — *Tyler G 8b*
4. 4. September 26, 2012 1:08 pm Link

   @Hari, no one? Not only do I use the formula (and a much more complex version of it), I have been paid $250/hr to do so.

   — *Amy*
5. 5. September 26, 2012 2:35 pm Link

   I think algebra should definitely be taught. I personally love algebra, and I've found algebra really useful to solve real-life problems I would have been stumped on using plain arithmetic. Algebra makes my life so much easier. I may not ever use it in my job, but there is such a thing as life outside of your job, and algebra is really useful there. Calculus on the other hand…

   — *Sarah W.*
6. 6. September 26, 2012 3:55 pm Link

   By all means, remove the requirements for algebra from schools. It will lead to my kids having a vast lead in life over everyone else who can't understand the basics of adult life that algebra helps to define. Just teach them the phrase, "would you like fries with that" instead. It will serve them well.

   — *Jim*
7. 7. September 26, 2012 3:58 pm Link

   It surprises me that in a year of election where dealing with the deficit is of utmost importance, I ask: how can you access the truth behind economic claims?

   Requesting no algebra education is the same as declaring you don't mind having a ignorant society. Because that is what you will get when citizens don't cast their vote based on truth.

   — *Alberto*
8. 8. September 26, 2012 4:09 pm Link

You have missed the point entirely. We do not teach mathematics simply because of its application to daily life. We teach mathematics because mathematics teaches us how to think.
Algebra at its core is symbolic manipulation. Algebra is most students first introduction to abstract thinking, to true, formalized abstraction. You will never mistake a person who has learned the important concept of a variable, from one who has not. You will never mistake a person who is capable of understanding abstractions, for one who is not . Algebra is more than simply solving for x, it is an entirely different, and extremely important way of thinking. This is why it is so difficult, this is why it is so important, .
Algebra is not important simply because it is applicable here or there, in a simple straightforward manner. Algebra is critically important, because algebra truly teaches us the entire concept of abstraction. Algebra teaches us one of the most important paradigms of human thought ever developed, and every single person incapable of grasping this is a detriment to himself and society.

— *Richard Fliam*

9. 9. September 26, 2012 4:21 pm Link

   I love math – got my degree in it – but the argument that math "teaches us to think" and therefore must be part of the curriculum is baloney, used by math-lovers who haven't been in a real h.s. classroom in ages.

   Algebra is the most common reason that intelligent educated people hate math. It clicks with a few kids but turns off far, far more of them, and those never go back.

   That's partly because algebra seems pointless; the above exercises are excellent ways to attach it to reality. This might help kids for whom it doesn't click to stick with algebra long enough to enjoy it.

   Excellent column. I hope teachers around the country are printing it out.

   — *Dave Brooks*

10. 10. September 26, 2012 5:00 pm Link

    Algebra is absolutely needed to understand the sciences and technologies that our civilization is based, and to create public support for solutions to problems that these technologies are creating. To see this we need look no further than the American debate on climate change and how evolution is questioned.

    To prove to themselves that science works, students only need to be able to understand the experiments they typically do in high school chemistry and physics classes. This quantitative understanding is only possible with a firm understanding of algebra and geometry.

    It is a shame that children start with algebraic looking equations
    such as 3 + 5 = 11, and 3 x 5 = 15 and then instead of going to equations like Y = 3X + 5 and Y = X^2.,

    we burden them for years memorizing industrial age calculation routines for adding long columns of numbers and multiplying and dividing large numbers..

    When students finally reach algebra, they are well past their prime language learning period. Children who have been deprived of language during this period never get it quite right, it's how the biology works.

    Algebra, geometry and calculus of high school are so much simpler than the spoken language that it's ridiculous to think students cannot learn them without the pain they've been going through.

The problem cannot be with students since all humans are born to learn languages. The difficulty in learning mathematics is caused more by when it is taught than how .

Today's system of math education works well for those children who are gifted or inherited activated math genes or are introduced to math concepts much earlier than normal.

If our goal is to reach a prosperous, sustainable information age civilization algebra is necessary and no child should be left behind.

— *William Lasley*

11. 11. September 26, 2012 5:13 pm Link

Math is poorly taught.. especialy Algebra.

However, withouth basic Algebra you cannot really move forward with sciences in general. So not exposing the general population to sciences such as Physics, Chemistry, etc.. is a big mistake.

Furthermore, many fields require math. It may be that there are people that get by without it.. but at the same time one could argue that many get by without applying what they learned about English, History or Geography.

The original article is absurd. And if applied it would set the US back way behind many third world countries.

— *Joe Dobson*

12. 12. September 26, 2012 6:30 pm Link

@Dave Brooks:
I am a recent college graduate with a degree in mathematics. I have seen the inside of a high school classroom rather recently.

Algebra certainly does train the way you think. Try explaining a variable to someone who has never taken algebra or had a literary education. It is almost impossible. People who have not had the training to think in abstract ways, often find themselves simply incapable of it. A metaphor and a simile serve the same function, which is why we also teach literature.

Algebra is a core, and fundamental way of instructing people how to decompose a problem and how one solution here is the same as another there. It teaches us abstraction. It is absolutely teaching you to think.

— *Richard Fliam*

13. 13. September 26, 2012 6:45 pm Link

How many students are weeded out of every level of school by the demanding world of mathematics? "Lots" is the statistical term applicable to this question. We need an alternative way to teach these dropouts whatever it is math is supposed to teach. Apart from the obvious career opportunities derived from becoming a certified math wizard what differentiates the wizard from the dullard? Since math departments have failed on a colossal level to get their point across to lots of students, maybe we should try something different? How about a few billion dollars to figure out what can be done to save our math souls? Another enormous thousand page textbook is hardly the answer, we have plenty of these as it is and they only work for a small fraction.

— *Paul Miller*

14. 14. September 26, 2012 6:50 pm Link

    Clearly, it makes no sense teaching algebra. That would show many people how broke they really are and won't get into more debt (buy a new car, pay minimum credit card balances).

    Obviously, math is not useful, we've seen the US is in terrible debt and nothing has collapsed yet. Which clearly supports the idea that numbers mean nothing.

    — *Bankers*

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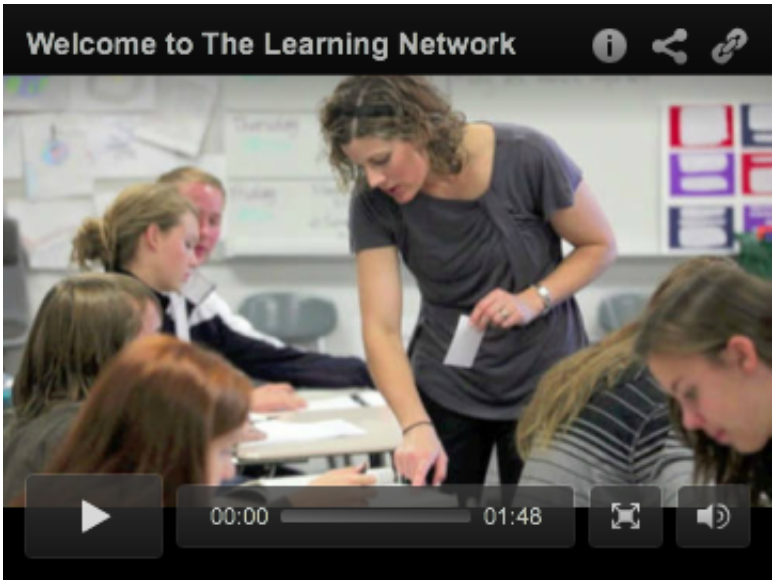

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Teachers can use or adapt our lessons across subject areas and levels. Students can respond to our Opinion questions, take our News Quizzes, learn the Word of the Day, try our Test Yourself questions, complete a Fill-In or read our Poetry Pairings.

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Comments of the Moment

> " I'd add: Believe in what you're writing. Believe in it fiercely. Why? Because that belief in your work will see you/get you through. Through insomnia. Through those "I feel stuck" moments. Through those moments of self-doubt. Through those moments when you feel alone, when you're questioning, when you feel like no one but you believes in your work."

— Vanessa Martir
Writing Rules! Advice From The Times on Writing Well

> " One emoticon I believe would be useful is sarcasm: many times, I try to be sarcastic but people just don't get it. This then just leads the conversation into confusion and a waste of time and awkwardness. This emoji should have rolling eyes, maybe a "pffff" coming out of his mouth. "

— Chadi3emeAnglo2
What New Emoticons Does the World Need?

> " A message I often find myself texting my friends: "watcha doinnn? ". If it were an emoji, it could be a "action emoji" that would move, going from an emoji lifting his shoulders as meaning "what?", to an emoji pointing his finger at you meaning "you" to finally an emoji saying "doing"… It would be pretty long but I think it would be fun and many people will think about other "action emojis" to invent. "

— Emmanuelle3emeAngl2
What New Emoticons Does the World Need?

> " Algebra is the most common reason that intelligent educated people hate math. It clicks with a few kids but turns off far, far more of them, and those never go back.That's partly because algebra seems pointless; the above exercises are excellent ways to attach it to reality. This might help kids for whom it doesn't click to stick with algebra long enough to enjoy it.Excellent column. I hope teachers around the country are printing it out."

— Dave Brooks
N Ways to Apply Algebra With The New York Times

> " If I don't get enough sleep I'm lazy, grouchy, and unfocused. I think naps could help with this. Power naps would give me enough energy to complete tasks throughout my day so I don't completely crash at 1 am when I finally CAN sleep. Unfortunately, my schedule makes this impossible. I love sleeping!"

— Priscilla E. MSMHS English I per 8
What Are Your Sleep Habits?

> " Gas mileage. We give gas mileage in mpg, and use algebra to figure out our gas mileage when we buy gas (those of use with old cars) and to figure out how much we have to buy to make it when driving cross country and stopping somewhere with brutal gas prices."

— john
N Ways to Apply Algebra With The New York Times

> " Students... don't have the right or responsibility to evaluate their teachers. If you're struggling in class and your teacher is no help, it is your responsibility to obtain the materials and skills you need to pass. Students need to grow up and take responsibility for their own actions, and not blame their teachers."

— Rachel L
Should Students Be Able to Grade Their Teachers?

> " Feedback is necessary for improvement. In the same way that students are learning, so are teachers. Our educators are not perfect, no one is, and they always have room to improve. Students can offer a fresh perspective. "

— Eliza
Should Students Be Able to Grade Their Teachers?

> " My sleep schedule goes like this. 1.try to sleep 2.cant sleep 3.just don't sleep. 4.eventually pass

> out and get only 4 hours of sleep ”

— tmlyda@gmail.com
What Are Your Sleep Habits?

> “ I usually wake up at five or six thirty. I never wake up any later. I have been waking up that early for a long time. Some of my hobbies include waking up that early. ”

— pieter k
What Are Your Sleep Habits?

> “ I am happy to live a simple meaningful life, i walk in the forest, listen the birds, river current, oh that gentle wind in the forest where flowers are noodling, birds playing ... this makes me feel happy. then i close my eyes and start meditation. the ultimate desire is go deep in meditation...”

— rayen
Is Trying Too Hard to Be Happy Making You Sad?

> “ My sleep habits are often listening to music or hearing a horror story before I drift to sleep. I believe eight hours of sleep is essential for my health, yet, I do tend to stay awake until one or two o'clock. My lack of sleep only affects the creases I have in my eyes.”

— Isaiah A.
What Are Your Sleep Habits?

> “ Being happy is a natural state for me...The only time I can ever remember being unhappy for more than one hour is when my little brother and I were forced to stay in Kohl's for two whole hours while my mom picked out into a new bathing suit. ”

— Nathan
Is Trying Too Hard to Be Happy Making You Sad?

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