

Summer Assignment Part 1: Read the following:

# The search for x: What is Algebra? “AHA, its whole, its seventh, it makes 19.”

This brief and strange sounding sentence is an ancient Egyptian’s 3,600 year-old attempt at making sense of the world around him in order to discover an unknown quantity. His goal was to collect and arrange his known and given quantities in a sequence so that, through a systematic set of ordered procedures, he could arrive at the correct numerical value. Found on the Rhind Papyrus, it poses one of the first algebra problems solved by man.

In ancient times, there was no algebraic notation, and hence, no absolutely general method of solution. Equations had to be written out in words and were presented rhetorically. The Ancient Egyptians’ method for solving them was called “regula falsi,” or “rule of false,” kind of a systematic “guess, check, revise” method—effective, but not entirely efficient.

The word, “AHA,” although it sounds much like an exclamation of discovery, not unlike Archimedes’ “Eureka,” actually translates to the word “heap.” It was used to represent the unknown quantity in the problem.

Today, with our fully-developed algebraic notation, this expression would read as follows:

$$x + \frac{x}{7} = 19$$

Additionally, with our systematic methods for solution, this linear equation can be easily manipulated to discover the unknown quantity, x.

The solution, by the way is 16.625,  $16\frac{5}{8}$ , or  $\frac{133}{8}$ .

Algebra II is designed as a sequel to Basic Algebra I. This show will be an extension of the Algebra I show, “All About Algebra,” with Topics including polynomials, factoring, rational expressions, exponents, radicals, and quadratic equations. We will be looking at different types of functions including exponential, logarithmic, radical, and rational functions. Throughout the year, we will make considerable use of the graphing calculator.

In watching this show, you will build upon the skills acquired in your Algebra I and Geometry classes, with the goal of developing further competencies to enable you to take more advanced math classes, like Precalculus, Calculus and Statistics. In actively working along with me at home, you will further develop your organizational and study skills that support the acquisition of new algebraic skills. Finally, you will develop self-confidence in yourself and in your math abilities, alleviating your feelings of math anxiety, and hopefully coming to grips with just how fun math can be.

## So what is Algebra?

Algebra may be divided into "classical algebra" (equation solving or "find the unknown number" problems) and "abstract algebra", also called "modern algebra" (the study of groups, rings, and fields). Classical algebra has been developed over a period of 4000 years. Abstract algebra has only appeared in the last 200 years. We will focus on the first variety.

The development of algebra has fallen under the following major influences: Egyptian algebra, Babylonian algebra, Greek geometric algebra, Diophantine algebra, Hindu algebra, Arabic algebra, European algebra since 1500, and modern algebra.

Since algebra grows out of arithmetic, recognition of new numbers - irrationals, zero, negative numbers, and complex numbers - is an important part of its history, and will be an important part of this course. The development of algebraic notation progressed through three stages: the rhetorical (or verbal) stage, the syncopated stage (in which abbreviated words were used), and the symbolic stage with which we are all familiar.

### Babylonian Algebra

Preserved in cuneiform written on clay tablets, the mathematics of the Old Babylonian Period (1800 - 1600 B.C.) was more advanced than that of Egypt. Their math utilized a sexagesimal base number system (base 60) which led to a highly developed algebra. Our custom of giving  $360^\circ$  to a circle, 60 seconds in a minute and 60 minutes in an hour are cultural artifacts passed down to us from the Babylonians. They were able to solve quadratic equations and worked with systems of equations with more than one unknown. There was some use of symbols, but not much. Like the Egyptians, their algebra was essentially rhetorical, and they only accepted positive, rational (fractional) solutions. Negative and irrational solutions were rejected.

### Greek Geometric Algebra

The Greeks also rejected irrational numbers and insisted on representing quantities as geometrical magnitudes. They focused more on form, such as triangular and square numbers. Although this period ultimately gave us the Pythagorean Theorem and many great ideas, the geometric approach to algebra was of little practical value and actually slowed the development of symbolic, algorithmic algebra for several centuries.

### Diophantine Algebra

The later Greek mathematician (250 A.D.) is regarded as one of the first to move from geometrical algebra to a treatment which did not depend upon geometry. He is, therefore, regarded as the "father of algebra." Although the rhetorical, verbal style was still in use, he introduced the syncopated style of writing equations, where words were abbreviated and symbols were used.

In his *Arithmetica*, he gives a treatment of indeterminate equations - usually two or more equations in several variables that have an infinite number of rational solutions. Such equations are known today as "Diophantine equations". Although the use of symbols and abbreviations was a major leap from the rhetorical style, Diophantine did not develop

general methods for solving his equations. In fact, each of the 189 problems in the *Arithmetica* is solved by a different method. He, too, only accepted only positive rational roots and ignored all others.

## **Hindu Algebra**

The successors of the Greeks in the history of mathematics were the Hindus of India. The Hindu civilization dates back to at least 2000 B.C. Their record in mathematics dates from about 800 B.C., but became significant only after influenced by Greek achievements. Most Hindu mathematics was motivated by astronomy and astrology. A base ten, positional notation system was standard by 600 A.D. They treated zero as a number and discussed operations involving this number.

The Hindus introduced negative numbers to represent debts. The first known use is by Brahmagupta about 628. They recognized that a positive number has two square roots. The Hindus also developed correct procedures for operating with irrational numbers. They made progress in algebra as well as arithmetic. They developed some symbolism which, though not extensive, was enough to classify Hindu algebra as almost symbolic and certainly more so than the syncopated algebra of Diophantus.

## **Arabic Algebra**

While much of Europe was in the dark ages, the Arabs preserved the Greek learning and flourished in the study of arts and sciences. They took over and improved the Hindu number symbols and the idea of positional notation. These numerals (the Hindu-Arabic system of numeration) and the algorithms for operating with them were transmitted to Europe around 1200 and are in use throughout the world today.

In algebra, the Arabs contributed first of all the name. The word "algebra" come from the title of a text book in the subject, *Hisab al-jabr w'al muqabala*, written about 830 by the astronomer/mathematician Muhammad ibn Mūsā al-Khwārizm. The book was a systematic exposé of the basic theory of equations, with both examples and proofs. It is interesting that our word "algorithm" comes from a corruption of al-Khwārizm 's name. While ancient civilizations wrote out algebraic expressions using only occasional abbreviations, by medieval times Islamic mathematicians were able to talk about arbitrarily high powers of the unknown  $x$ , and work out the basic algebra of polynomials (without yet using modern symbolism.)

## **European Algebra after 1500**

At the beginning of this period, zero had been accepted as a number and irrationals were used freely although people still worried about whether they were really numbers. Negative numbers were known but were not fully accepted. Complex numbers were as yet unimagined. Full acceptance of all components of our familiar number system did not come until the 19th century. Algebra in 1500 was still largely rhetorical. Renaissance mathematics was to be characterized by the rise of algebra.

In the 16th century, the main focus was on solving polynomial equations. During this time, there were great advances in technique, namely the general solutions to cubic equations. There were also at this time many important improvements in symbolism which made

possible a science of algebra as opposed to the collection of isolated techniques ("bag of tricks") that had been the content of algebra up to this point.

Publication of many of these results in 1545 in the *Ars Magna* by Italian Renaissance mathematician, physician, astrologer, and gambler Girolamo Cardano is often taken to mark the beginning of the modern period in mathematics.

The landmark advance in symbolism was made by François Viète (French, 1540-1603) who used letters to represent known constants (parameters). This advance freed algebra from the consideration of particular equations and thus allowed a great increase in generality. Viète's algebra, however, was still syncopated rather than completely symbolic. Symbolic algebra reached full maturity with the publication of French mathematician and philosopher René Descartes' *La Géométrie* in 1637. This work gave the world the wonderfully fruitful marriage of algebra and geometry that we know today as analytic geometry.

Work continued through the 18th century on the theory of equations, but not until 1799 was the proof published, by the German mathematician Carl Friedrich Gauss, showing that every polynomial equation has at least one root in the complex plane. This was to be known as the Fundamental Theorem of Algebra.

By this time, algebra had entered its modern phase. Attention shifted from solving polynomial equations to studying the structure of abstract mathematical systems whose axioms were based on the behavior of mathematical objects that were encountered when studying polynomial equations, such as complex numbers.

This year, we will retrace the historical development of this great branch of mathematics. We will be learning the symbols, applying the proven systematic methods, finding the roots of polynomial equations, and learning all the skills required to do this that have been developed and discovered by real people who devoted their lives to the subject that now fill the pages of your textbook.

I hope you will join me each week as we venture into the great "unknown" in search of  $x$ , and as you do, you will hopefully get more comfortable and will develop a distinct sense of familiarity with the syntax, symbols, and structure involved. In essence, you'll feel a sense of déjà vu for Algebra 2.

## Summer Assignment Part 2:

- 1) Go to website [www.wileyplus.com/class/520616](http://www.wileyplus.com/class/520616)
- 2) Verify that you see the course shown below and click create an account.

The screenshot shows the WileyPLUS website interface. At the top, there is a toolbar with various icons and text. Below the toolbar, the WileyPLUS logo is displayed. The main content area is titled "Log in" and contains a "Class Details" section. The class details include the course ID "3051-3052: Algebra II, Algebra II Plus - Ellis", the instructor "Crista Ellis", and the dates "2016-17 2016". To the right of the class details is a book cover for "Young, Intermediate Algebra, 2/e" by Young. Below the class details, there are two columns. The left column is titled "Already have a WileyPLUS account?" and contains a login form with fields for "E-mail Address" and "Password", a "Forgot password?" link, and a "Log In" button. The right column is titled "Don't have a WileyPLUS account?" and contains a "Get started here" link and a "Create Account" button. A red circle highlights the "Don't have a WileyPLUS account?" text, and a red arrow points to the "Create Account" button. At the bottom of the page, there is a footer with links for "Home", "Course Catalog", "About", "Contact Us", "Resources & Support", "Privacy Policy", and "© 2000-2016 John Wiley & Sons, Inc. All Rights Reserved A Division of John Wiley & Sons, Inc." and the version number "Version 4.18.1.4".

- 3) Read the End User License Agreement – Click I agree to these terms and click continue.

The screenshot shows the WileyPLUS website interface with the "Limited Use End User License Agreement" (EULA) displayed. The top of the page features the WileyPLUS logo. Below the logo, the title "Limited Use End User License Agreement" is prominently displayed. The "Class Details" section is visible, showing the course ID "3051-3052: Algebra II, Algebra II Plus - Ellis", the instructor "Crista Ellis", and the dates "2016-17 2016". To the right of the class details is a book cover for "Young, Intermediate Algebra, 2/e" by Young. Below the class details, the "Limited Use End User License Agreement" section is expanded, showing the text of the agreement. The text includes a statement that this is the John Wiley and Sons, Inc. (Wiley) Limited Use End User License Agreement ("EULA"), which governs the use of Wiley proprietary software products. It also states that the user's use of the Licensed Program indicates their acceptance of the terms and conditions of this EULA. The agreement is divided into sections, with the first section titled "1. License:". Under this section, it states that Wiley grants a non-exclusive and non-transferable license to use the Licensed Program on the following terms and conditions only:

- a. The Licensed Program is for your personal use only.
- b. As the registered user, you may use the Licensed Program for "one concurrent user" on a single computer, or on its temporary replacement, or on a subsequent computer only.

At the bottom of the agreement, there is a checkbox labeled "I agree to these terms" which is checked. A red arrow points to this checkbox. To the right of the agreement, there is a "Continue" button. A red arrow points to this button. The footer of the page is partially visible, showing links for "Home", "Course Catalog", "About", "Contact Us", "Resources & Support", "Privacy Policy", and "© 2000-2016 John Wiley & Sons, Inc. All Rights Reserved A Division of John Wiley & Sons, Inc." and the version number "Version 4.18.1.4".

- 4) Complete the form to create an account. Use your full name (no nicknames) as it will appear on my roll at MLWGS. Write your password down so you don't lose it.

CLASS DETAILS

3051-3052: Algebra II, Algebra II Plus - Ellis  
Crista Ellis  
2016-17, 2016  
[Not the right class? Find a different class](#)

**Young Intermediate Algebra: Advanced High School Edition, 2nd Edition**  
by Young

**Create WileyPLUS Student Account**

First Name  Last Name

Student ID (optional)

E-mail Address (Used to access WileyPLUS)

Confirm E-mail Address

Choose a password  
  
Password must be between 5 and 20 characters

Confirm password

Receive valuable information from Wiley, including cost-savings options, technology updates, career development and more.

[Continue](#)

5) Click on the Assignments Link

WileyPLUS Young, Intermediate Algebra, 2/e

Home Read, Study & Practice **Assignment** Gradebook

System Announcements 1  
Welcome to WileyPLUS

You are logged into:  
**Young, Intermediate Algebra, 2/e**  
Algebra II Plus - Ellis

Notifications [\(edit settings\)](#)

- [System Announcements](#) 1
- [Class Announcements](#) 2
- [Course Materials](#)

[Read, Study & Practice](#)  
Readings and resources for self-guided study, including the entire text of the Wiley book in use for your class.

[Assignments](#)  
See all the assignments available for your class.  
[This class has 1 assignment](#)

[Gradebook](#)  
Shows the scores and statuses for all the assignments you have completed or attempted to date.

[License Agreement](#) | [Privacy Policy](#) | © 2000-2016 John Wiley & Sons, Inc. All Rights Reserved. A Division of John Wiley & Sons, Inc.

6) Complete the Summer Assignment Algebra Review. Use the textbook resources as needed. No calculator.

WileyPLUS Young, Intermediate Algebra, 2/e

Home Read, Study & Practice **Assignment** Gradebook

Assignment  
Your instructor has created the following assignments for this class. To get started, click on the assignment name below. Assignments whose due dates have passed are shown in red. Assignments that are no longer accessible to you are greyed out. For assistance, go to [Assignment List](#).

▼ sort by column

ASSIGNMENT NAME	ASSIGNMENT TYPE	DUE DATE	ACCESSIBLE	DETAILS
<a href="#">Summer Assignment Algebra Review</a>	Questions	7 Sep 2016 at 08:45 AM	Yes	Not Attempted
<a href="#">Textbook Reading Resources</a>	Resources	Unlimited	Yes	0% Read

[License Agreement](#) | [Privacy Policy](#) | © 2000-2016 John Wiley & Sons, Inc. All Rights Reserved. A Division of John Wiley & Sons, Inc. Version 4.18.1.4