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The area of study known as the history of mathematics is primarily an investigation into the origin of discoveries in mathematics and, to a lesser extent, an investigation into the mathematical methods and notation of the past.

Such concepts would have been part of everyday life in hunter-gatherer societies. The idea of the "number" concept evolving gradually over time is supported by the existence of languages which preserve the distinction between "one", "two", and "many", but not of numbers larger than two. For example, paleontologists have discovered in a cave in South Africa , ochre rocks about 70, years old, adorned with scratched geometric patterns. Moreover, hunters and herders employed the concepts of one, two, and many, as well as the idea of none or zero, when considering herds of animals. One common interpretation is that the bone is the earliest known demonstration [8] of sequences of prime numbers and of Ancient Egyptian multiplication. The Ishango bone consists of a series of tally marks carved in three columns running the length of the bone. Common interpretations are that the Ishango bone shows either the earliest known demonstration of sequences of prime numbers [7] or a six-month lunar calendar. The First 50, Years, Peter Rudman argues that the development of the concept of prime numbers could only have come about after the concept of division, which he dates to after 10, BC, with prime numbers probably not being understood until about BC. He also writes that "no attempt has been made to explain why a tally of something should exhibit multiples of two, prime numbers between 10 and 20, and some numbers that are almost multiples of Iraqi mathematics Mesoptamian mathematics, or Babylonian mathematics, refers to any mathematics of the people of Mesopotamia modern Iraq , from the days of the early Sumerians , through the Babylonian period, until the beginning of the Parthian period. It is named Babylonian mathematics due to the central role of Babylon as a place of study, which ceased to exist during the Hellenistic period. From this point, Babylonian mathematics merged with Greek and Egyptian mathematics to give rise to Hellenistic mathematics. In contrast to the sparsity of sources in Egyptian mathematics , our knowledge of Babylonian mathematics is derived from more than clay tablets unearthed since the s. Written in Cuneiform script , tablets were inscribed whilst the clay was moist, and baked hard in an oven or by the heat of the sun. Some of these appear to be graded homework. They developed a complex system of metrology from BC. From around BC onwards, the Sumerians wrote multiplication tables on clay tablets and dealt with geometrical exercises and division problems. The earliest traces of the Babylonian numerals also date back to this period. Plimpton Babylonian clay tablet YBC with annotations. The diagonal displays an approximation of the square root of 2 in four sexagesimal figures, which is about six decimal figures. The Babylonian mathematical tablet Plimpton , dated to BC. The Old Babylonian period is the period to which most of the clay tablets on Babylonian mathematics belong, which is why the mathematics of Mesopotamia is commonly known as Babylonian mathematics. Some clay tablets contain mathematical lists and tables, others contain problems and worked solutions. The majority of recovered clay tablets date from to BC, and cover topics which include fractions, algebra, quadratic and cubic equations, and the calculation of Pythagorean triples see Plimpton Babylonian mathematics were written using a sexagesimal base numeral system. From this we derive the modern day usage of 60 seconds in a minute, 60 minutes in an hour, and 60 x 6 degrees in a circle. Babylonian advances in mathematics were facilitated by the fact that 60 has many divisors. Also, unlike the Egyptians, Greeks, and Romans, the Babylonians had a true place-value system, where digits written in the left column represented larger values, much as in the decimal system. They lacked, however, an equivalent of the decimal point, and so the place value of a symbol often had to be inferred from the context. They are particularly known for pioneering mathematical astronomy. In the Hellenistic world, Babylonian astronomy and mathematics exerted a great influence on the mathematicians of Alexandria , in Ptolemaic Egypt and Roman Egypt. This is particularly apparent in the astronomical and mathematical works of Hipparchus , Ptolemy , Hero of Alexandria , and Diophantus. Ancient Egyptian mathematics c. Egyptian mathematics Egyptian mathematics refers to mathematics written in the Egyptian language. From the Hellenistic period , Greek replaced Egyptian as the written language of Egyptian scholars, and from this point Egyptian mathematics merged with Greek and Babylonian mathematics to give rise to Hellenistic mathematics. Mathematical study in Egypt later continued under the Arab Empire as part of Islamic mathematics , when Arabic became the written language of Egyptian scholars. Early Dynastic Period to Old Kingdom c. These labels appear to have been used as tags for grave goods and some are inscribed with numbers. The problem includes a diagram indicating the dimensions of the truncated pyramid. The earliest true Egyptian mathematical documents date to the Middle Kingdom period, specifically the 12th dynasty c. The Rhind Mathematical Papyrus which dates to the Second Intermediate Period ca BC is said to be based on an older mathematical text from the 12th dynasty. Like many ancient mathematical texts, it consists of what are today called "word problems" or "story problems", which were apparently intended as entertainment. One problem is considered to be of particular importance because it gives a method for finding the volume of a frustum: A truncated pyramid of 6 for the vertical height by 4 on the base by 2 on the top. You are to square this 4, result You are to double 4, result 8. You are to square 2, result 4. You are to add the 16, the 8, and the 4, result You are to take one third of 6, result 2. You are to take 28 twice, result See, it is You will find it right. In addition to giving area formulas and methods for multiplication, division and working with unit fractions, it also contains evidence of other mathematical knowledge see [3] , including composite and prime numbers ; arithmetic , geometric and harmonic means ; and simplistic understandings of both the Sieve of Eratosthenes and perfect number theory namely, that of the number 6 [4]. It also shows how to solve first order linear equations [5] as well as arithmetic and geometric series [6]. Also, three geometric elements contained in the Rhind papyrus suggest the simplest of underpinnings to analytical geometry: Finally, the Berlin papyrus c. Indian mathematics Harappan mathematics c. This civilisation developed a system of uniform weights and measures that used the decimal system, a surprisingly advanced brick technology which utilised ratios , streets laid out in perfect right angles , and a number of geometrical shapes and designs, including cuboids , barrels , cones , cylinders , and drawings of concentric and intersecting circles and triangles. Mathematical instruments included an accurate decimal ruler with small and precise subdivisions, a shell instrument that served as a compass to measure angles on plane surfaces or in horizon in multiples of 40â€" degrees, a shell instrument used to measure 8â€"12 whole sections of the horizon and sky, and an instrument for measuring the positions of stars for navigational purposes. The Indus script has not yet been deciphered; hence very little is known about the written forms of Harappan mathematics. The religious texts of the Vedic Period provide evidence for the use of large numbers.

Chapter 2 : The Story of Mathematics - A History of Mathematical Thought from Ancient Times to the Mode

The main Story of Mathematics is supplemented by a List of Important Mathematicians and their achievements, and by an alphabetical Glossary of Mathematical Terms. You can also make use of the search facility at the top of each page to search for individual mathematicians, theorems, developments, periods in history, etc.

Because much of genetics is based on quantitative data, mathematical techniques are used extensively in genetics. The laws of probability are applicable to crossbreeding and are used to predict frequencies of specific genetic constitutions in offspring. Geneticists also use statistical methods to determineâ€¦ Ancient mathematical sources It is important to be aware of the character of the sources for the study of the history of mathematics. The history of Mesopotamian and Egyptian mathematics is based on the extant original documents written by scribes. Although in the case of Egypt these documents are few, they are all of a type and leave little doubt that Egyptian mathematics was, on the whole, elementary and profoundly practical in its orientation. For Mesopotamian mathematics, on the other hand, there are a large number of clay tablets, which reveal mathematical achievements of a much higher order than those of the Egyptians. The tablets indicate that the Mesopotamians had a great deal of remarkable mathematical knowledge, although they offer no evidence that this knowledge was organized into a deductive system. Future research may reveal more about the early development of mathematics in Mesopotamia or about its influence on Greek mathematics, but it seems likely that this picture of Mesopotamian mathematics will stand. This stands in complete contrast to the situation described above for Egyptian and Babylonian documents. Although, in general outline, the present account of Greek mathematics is secure, in such important matters as the origin of the axiomatic method , the pre-Euclidean theory of ratios, and the discovery of the conic sections , historians have given competing accounts based on fragmentary texts, quotations of early writings culled from nonmathematical sources, and a considerable amount of conjecture. Many important treatises from the early period of Islamic mathematics have not survived or have survived only in Latin translations, so that there are still many unanswered questions about the relationship between early Islamic mathematics and the mathematics of Greece and India. In addition, the amount of surviving material from later centuries is so large in comparison with that which has been studied that it is not yet possible to offer any sure judgment of what later Islamic mathematics did not contain, and therefore it is not yet possible to evaluate with any assurance what was original in European mathematics from the 11th to the 15th century. In modern times the invention of printing has largely solved the problem of obtaining secure texts and has allowed historians of mathematics to concentrate their editorial efforts on the correspondence or the unpublished works of mathematicians. However, the exponential growth of mathematics means that, for the period from the 19th century on, historians are able to treat only the major figures in any detail. In addition, there is, as the period gets nearer the present, the problem of perspective. Mathematics, like any other human activity, has its fashions, and the nearer one is to a given period, the more likely these fashions will look like the wave of the future. For this reason, the present article makes no attempt to assess the most recent developments in the subject. Berggren Mathematics in ancient Mesopotamia Until the s it was commonly supposed that mathematics had its birth among the ancient Greeks. What was known of earlier traditions, such as the Egyptian as represented by the Rhind papyrus edited for the first time only in , offered at best a meagre precedent. This impression gave way to a very different view as historians succeeded in deciphering and interpreting the technical materials from ancient Mesopotamia. Existing specimens of mathematics represent all the major erasâ€"the Sumerian kingdoms of the 3rd millennium bce, the Akkadian and Babylonian regimes 2nd millennium , and the empires of the Assyrians early 1st millennium , Persians 6th through 4th century bce , and Greeks 3rd century bce to 1st century ce. The level of competence was already high as early as the Old Babylonian dynasty , the time of the lawgiver-king Hammurabi c. The application of mathematics to astronomy, however, flourished during the Persian and Seleucid Greek periods. The numeral system and arithmetic operations Unlike the Egyptians, the mathematicians of the Old Babylonian period went far beyond the immediate challenges of their official accounting duties. For example, they introduced a versatile numeral system, which, like the modern system, exploited the notion of place value, and they developed computational methods that took advantage of this means of expressing numbers; they solved linear and quadratic problems by methods much like those now used in algebra ; their success with the study of what are now called Pythagorean number triples was a remarkable feat in number theory. The scribes who made such discoveries must have believed mathematics to be worthy of study in its own right, not just as a practical tool. The older Sumerian system of numerals followed an additive decimal base principle similar to that of the Egyptians. But the Old Babylonian system converted this into a place-value system with the base of 60 sexagesimal. The reasons for the choice of 60 are obscure, but one good mathematical reason might have been the existence of so many divisors 2, 3, 4, and 5, and some multiples of the base, which would have greatly facilitated the operation of division. For numbers from 1 to 59, the symbols for 1 and for 10 were combined in the simple additive manner e. But to express larger values, the Babylonians applied the concept of place value. For example, 60 was written as , 70 as , 80 as , and so on. In fact, could represent any power of The context determined which power was intended. By the 3rd century bce, the Babylonians appear to have developed a placeholder symbol that functioned as a zero , but its precise meaning and use is still uncertain. Furthermore, they had no mark to separate numbers into integral and fractional parts as with the modern decimal point. The four arithmetic operations were performed in the same way as in the modern decimal system, except that carrying occurred whenever a sum reached 60 rather than Multiplication was facilitated by means of tables; one typical tablet lists the multiples of a number by 1, 2, 3,â€¦, 19, 20, 30, 40, and To multiply two numbers several places long, the scribe first broke the problem down into several multiplications, each by a one-place number, and then looked up the value of each product in the appropriate tables. He found the answer to the problem by adding up these intermediate results. These tables also assisted in division, for the values that head them were all reciprocals of regular numbers. Regular numbers are those whose prime factors divide the base; the reciprocals of such numbers thus have only a finite number of places by contrast, the reciprocals of nonregular numbers produce an infinitely repeating numeral. In base 10, for example, only numbers with factors of 2 and 5 e. In base 60, only numbers with factors of 2, 3, and 5 are regular; for example, 6 and 54 are regular, so that their reciprocals 10 and 1 6 40 are finite. To divide a number by any regular number, then, one can consult the table of multiples for its reciprocal. An interesting tablet in the collection of Yale University shows a square with its diagonals. The scribe thus appears to have known an equivalent of the familiar long method of finding square roots. They also show that the Babylonians were aware of the relation between the hypotenuse and the two legs of a right triangle now commonly known as the Pythagorean theorem more than a thousand years before the Greeks used it. A type of problem that occurs frequently in the Babylonian tablets seeks the base and height of a rectangle, where their product and sum have specified values. In the same way, if the product and difference were given, the sum could be found. This procedure is equivalent to a solution of the general quadratic in one unknown. In some places, however, the Babylonian scribes solved quadratic problems in terms of a single unknown, just as would now be done by means of the quadratic formula. Although these Babylonian quadratic procedures have often been described as the earliest appearance of algebra , there are important distinctions. The scribes lacked an algebraic symbolism; although they must certainly have understood that their solution procedures were general, they always presented them in terms of particular cases, rather than as the working through of general formulas and identities. They thus lacked the means for presenting general derivations and proofs of their solution procedures. Their use of sequential procedures rather than formulas, however, is less likely to detract from an evaluation of their effort now that algorithmic methods much like theirs have become commonplace through the development of computers. If one selects values at random for two of the terms, the third will usually be irrational , but it is possible to find cases in which all three terms are integers: Such solutions are sometimes called Pythagorean triples. A tablet in the Columbia University Collection presents a list of 15 such triples decimal equivalents are shown in parentheses at the right; the gaps in the expressions for h, b, and d separate the place values in the sexagesimal numerals: The entries in the column for h have to be computed from the values for b and d, for they do not appear on the tablet; but they must once have existed on a portion now missing. In the table the implied values p and q turn out to be regular numbers falling in the standard set of reciprocals, as mentioned earlier in connection with the multiplication tables. Scholars are still debating nuances of the construction and the intended use of this table, but no one questions the high level of expertise implied by it. Mathematical astronomy The sexagesimal method developed by the Babylonians has a far greater computational potential than what was actually needed for the older problem texts. With the development of mathematical astronomy in the Seleucid period, however, it became indispensable. Astronomers sought to predict future occurrences of important phenomena, such as lunar eclipses and critical points in planetary cycles conjunctions, oppositions, stationary points, and first and last visibility. The results were then organized into a table listing positions as far ahead as the scribe chose. Although the method is purely arithmetic, one can interpret it graphically: While observations extending over centuries are required for finding the necessary parameters e. Within a relatively short time perhaps a century or less , the elements of this system came into the hands of the Greeks. Although Hipparchus 2nd century bce favoured the geometric approach of his Greek predecessors, he took over parameters from the Mesopotamians and adopted their sexagesimal style of computation. Through the Greeks it passed to Arab scientists during the Middle Ages and thence to Europe, where it remained prominent in mathematical astronomy during the Renaissance and the early modern period. To this day it persists in the use of minutes and seconds to measure time and angles. Aspects of the Old Babylonian mathematics may have come to the Greeks even earlier, perhaps in the 5th century bce, the formative period of Greek geometry. There are a number of parallels that scholars have noted. Further, the Babylonian rule for estimating square roots was widely used in Greek geometric computations, and there may also have been some shared nuances of technical terminology. Although details of the timing and manner of such a transmission are obscure because of the absence of explicit documentation, it seems that Western mathematics, while stemming largely from the Greeks, is considerably indebted to the older Mesopotamians. Page 1 of 6.

Chapter 3 : History of mathematics - Wikipedia

Arguably the most famous theorem in all of mathematics, the Pythagorean Theorem has an interesting www.nxgvision.com to the Chinese and the Babylonians more than a millennium before Pythagoras lived, it is a "natural" result that has captivated mankind for years.

The decimal system is no accident. Ten has been the basis of most counting systems in history. When any sort of record is needed, notches in a stick or a stone are the natural solution. In the earliest surviving traces of a counting system, numbers are built up with a repeated sign for each group of 10 followed by another repeated sign for 1. Arithmetic cannot easily develop until an efficient numerical system is in place. This is a late arrival in the story of mathematics, requiring both the concept of place value and the idea of zero. As a result, the early history of mathematics is that of geometry and algebra. At their elementary levels the two are mirror images of each other. A number expressed as two squared can also be described as the area of a square with 2 as the length of each side. Equally 2 cubed is the volume of a cube with 2 as the length of each dimension. Of the two Babylon is far more advanced, with quite complex algebraic problems featuring on cuneiform tablets. A typical Babylonian maths question will be expressed in geometrical terms, but the nature of its solution is essentially algebraic see a Babylonian maths question. Since the numerical system is unwieldy, with a base of 60, calculation depends largely on tables sums already worked out, with the answer given for future use , and many such tables survive on the tablets. Egyptian mathematics is less sophisticated than that of Babylon; but an entire papyrus on the subject survives. Known as the Rhind papyrus , it was copied from earlier sources by the scribe Ahmes in about BC. It contains brainteasers such as problem A leading figure among the early Greek mathematicians is Pythagoras. There he establishes a philosophical sect based on the belief that numbers are the underlying and unchangeable truth of the universe. He and his followers soon make precisely the sort of discoveries to reinforce this numerical faith. The Pythagoreans can show, for example, that musical notes vary in accordance with the length of a vibrating string; whatever length of string a lute player starts with, if it is doubled the note always falls by exactly an octave still the basis of the scale in music today. The followers of Pythagoras are also able to prove that whatever the shape of a triangle, its three angles always add up to the sum of two right angles degrees. The most famous equation in classical mathematics is known still as the Pythagorean theorem: It is unlikely that the proof of this goes back to Pythagoras himself. But the theorem is typical of the achievements of Greek mathematicians, with their primary interest in geometry. This interest reaches its peak in the work compiled by Euclid in about BC. No details of his life are known, but his brilliance as a teacher is demonstrated in the Elements, his thirteen books of geometrical theorems. Archimedes is a student at Alexandria, possibly within the lifetime of Euclid. He returns to his native Syracuse, in Sicily, where he far exceeds the teacher in the originality of his geometrical researches. The fame of Archimedes in history and legend derives largely from his practical inventions and discoveries, but he himself regards these as trivial compared to his work in pure geometry. He is most proud of his calculations of surface area and of volume in spheres and cylinders. He leaves the wish that his tomb be marked by a device of a sphere within a cylinder. A selection of titles from his surviving treatises suggests well his range of interests: The circumference of the earth: He is making a map of the stars he will eventually catalogue nearly , and he is busy with his search for prime numbers; he does this by an infinitely laborious process now known as the Sieve of Eratosthenes. But his most significant project is working out the circumference of the earth. Eratosthenes hears that in noon at midsummer the sun shines straight down a well at Aswan, in the south of Egypt. He finds that on the same day of the year in Alexandria it casts a shadow 7. If he can calculate the distance between Aswan and Alexandria, he will know the circumference of the earth degrees instead of 7. It gives him a figure of about 46, km for the circumference of the earth. Greek algebra in its turn spreads to India, China and Japan. But it achieves its widest influence through the Arabic transmission of Greek culture. In this the most significant event is a book written in Baghdad in about AD by al-Khwarizmi. But there are still no standard symbols. These emerge during the next century. In the 17th century Descartes introduces the use of x, y and z for unknown quantities, and the convention for writing squared and cubed numbers. This

History is as yet incomplete.

Chapter 4 : BBC Radio 4 - A Brief History of Mathematics - Downloads

As a result, the early history of mathematics is that of geometry and algebra. At their elementary levels the two are mirror images of each other. A number expressed as two squared can also be described as the area of a square with 2 as the length of each side.

Historically, it was regarded as the science of quantity, whether of magnitudes as in geometry or of numbers as in arithmetic or of the generalization of these two fields as in algebra. Some have seen it in terms as simple as a search for patterns. During the 19th Century, however, mathematics broadened to encompass mathematical or symbolic logic, and thus came to be regarded increasingly as the science of relations or of drawing necessary conclusions although some see even this as too restrictive. The discipline of mathematics now covers - in addition to the more or less standard fields of number theory, algebra, geometry, analysis calculus , mathematical logic and set theory, and more applied mathematics such as probability theory and statistics - a bewildering array of specialized areas and fields of study, including group theory, order theory, knot theory, sheaf theory, topology, differential geometry, fractal geometry, graph theory, functional analysis, complex analysis, singularity theory, catastrophe theory, chaos theory, measure theory, model theory, category theory, control theory, game theory, complexity theory and many more. The history of mathematics is nearly as old as humanity itself. Since antiquity, mathematics has been fundamental to advances in science, engineering, and philosophy. It has evolved from simple counting, measurement and calculation, and the systematic study of the shapes and motions of physical objects, through the application of abstraction, imagination and logic, to the broad, complex and often abstract discipline we know today. From the notched bones of early man to the mathematical advances brought about by settled agriculture in Mesopotamia and Egypt and the revolutionary developments of ancient Greece and its Hellenistic empire, the story of mathematics is a long and impressive one. The East carried on the baton, particularly China , India and the medieval Islamic empire , before the focus of mathematical innovation moved back to Europe in the late Middle Ages and Renaissance. Then, a whole new series of revolutionary developments occurred in 17th Century and 18th Century Europe, setting the stage for the increasing complexity and abstraction of 19th Century mathematics, and finally the audacious and sometimes devastating discoveries of the 20th Century. Follow the story as it unfolds in this series of linked sections, like the chapters of a book. Read the human stories behind the innovations, and how they made - and sometimes destroyed - the men and women who devoted their lives to This is not intended as a comprehensive and definitive guide to all of mathematics, but as an easy-to-use summary of the major mathematicians and the developments of mathematical thought over the centuries. It is not intended for mathematicians, but for the interested laity like myself. My intention is to introduce some of the major thinkers and some of the most important advances in mathematics, without getting too technical or getting bogged down in too much detail, either biographical or computational. Explanations of any mathematical concepts and theorems will be generally simplified, the emphasis being on clarity and perspective rather than exhaustive detail. It is beyond the scope is this study to discuss every single mathematician who has made significant contributions to the subject, just as it is impossible to describe all aspects of a discipline as huge in its scope as mathematics. The choice of what to include and exclude is my own personal one, so please forgive me if your favourite mathematician is not included or not dealt with in any detail. The main Story of Mathematics is supplemented by a List of Important Mathematicians and their achievements, and by an alphabetical Glossary of Mathematical Terms. You can also make use of the search facility at the top of each page to search for individual mathematicians, theorems, developments, periods in history, etc. Some of the many resources available for further study of both included and excluded elements are listed in the Sources section.

Chapter 5 : History of mathematics | Math Wiki | FANDOM powered by Wikia

The History of Mathematics: An Introduction, Seventh Edition, is written for the one- or two-semester math history course taken by juniors or seniors, and covers the history behind the topics typically covered in an undergraduate math curriculum or in elementary schools or high schools.

The oldest evidence comes from the Lebombo bone, which is about 37, years old and was found in Swaziland [1]. It has 29 notches carved into it, which could have been used to record numbers, making it a tally stick. Stronger evidence comes from the Ishango bone, which was found on what is now the border between Uganda and the Democratic Republic of the Congo [2]. The Ishango bone is about 20, years old and has a series of notches carved into it in three columns. Patterns in these numbers may show that they were made by someone who understood addition, subtraction, multiplication, division, and prime numbers. Prime numbers are numbers greater than one that are only divisible by themselves and one. The first ten prime numbers are 2, 3, 5, 7, 11, 13, 17, 19, 23, and Sponsored Links Row a of the Ishango bone begins with 3, which is doubled to make 6, 4 is then doubled to make 8. The last two numbers in the row, 5 and 7, are the third and fourth prime numbers. Row b continues with the next four prime numbers, showing all of the prime numbers between 10 and The Sumerians in southern Mesopotamia, which is part of modern-day Iraq, developed a written language in about BCE [3]. This was around the same time that they developed the first school mathematics. People understood geometry and algebra by about BCE, by which time Sumer had become part of Babylon [4]. Both were inspired by the Babylonians and Ancient Egyptians. Pythagoras was fascinated both by the connections between mathematics and nature, and by the certainty that mathematical knowledge provides, especially when compared to sensory knowledge, which is sometimes unreliable. Pythagoras is thought to have been the first to discover that music can be expressed mathematically. He believed that objects in space obey the same physical laws as the Earth, and so suggested that planets create music as they follow trajectories determined by similar mathematical equations [9]. Pythagoreans believed that the whole universe is composed of mathematics, and that numbers are real entities that do not exist in space and time [10]. The Pythagoreans were reportedly shocked to discover irrational numbers. These are numbers that cannot be expressed as a fraction or written down in full because they contain an infinite amount of numbers with no known repeating pattern. They are said to have considered irrational numbers to be a flaw in nature, and had their discoverer killed [11]. The physical world contains imperfect copies of the true forms. Since mathematics could be understood without sensory experience - i. In about BCE, Plato set up an academy in Athens, which became the mathematical centre of the world. Euclid made a number of discoveries in geometry shortly after BCE, and was the first to suggest that there are an infinite amount of prime numbers. The concept of infinity had previously been discussed by Ancient Greek philosopher Zeno of Elea. Zeno was about twenty years older than Socrates, and is said to have visited him in about BCE, when Socrates was about twenty years old. Zeno considered how one infinity could be larger than another - there are twice as many numbers than there are even numbers, for example, but both are infinite. He stated that if you walked across a room, halving the distance you travel with each step, then you would never reach the other side [17]. Indian mathematician Brahmagupta was the first to use zero as a number in CE [19]. An even stranger new number, i, was devised almost one thousand years later. Descartes [22b] and French mathematician Pierre de Fermat [23] independently developed the Cartesian coordinate system that year. This was used to plot points on a graph, which helped English natural philosopher Isaac Newton and German mathematician Gottfried Leibniz develop calculus in the latter half of the century [24]. The sine wave in Cartesian coordinates. It could be the case that only our mind exists, and the external world is like a dream or hallucination [25a]. Like Pythagoras, Galileo believed that the universe is composed in the language of mathematics. In , Galileo stated: But the book cannot be understood unless one first learns to comprehend the language and read the letters in which it is composed. It is written in the language of mathematics, and its characters are triangles, circles, and other geometric figures without which it is humanly impossible to understand a single word of it; without these, one wanders about in a dark labyrinth [26]. Kepler was also inspired by Pythagoras, and believed that the motion of the planets produces music. He used mathematics to show that the planets orbit the Sun in ellipses and, by , he was able to determine the time it takes each planet to orbit and their relative distances from the Sun [27]. In , Newton published his law of universal gravitation [28]. This was groundbreaking because it showed, not just that abstract mathematical principles, such as the newly invented calculus, could be applied to what we observe in nature, but that the laws responsible for the movement of the planets are also responsible for the movement of objects on Earth. Newton also believed that the universe could be understood as a mathematical object, and described God as "skilled in mechanics and geometry" [29]. These are shapes that exhibit the same type of structures on all scales, such as frost, some plants, and coastlines. Twentieth century mathematicians, such as French mathematician Gaston Julia [31] and Polish-French-American mathematician Benoit Mandelbrot [32] , were inspired by Leibniz to create complicated fractals of their own. Part of the Mandelbrot set. As well as independently developing calculus and inspiring the discovery of fractals, Leibniz was also one of the first to consider that a new number, the number e was special [33]. A quantity that increases from 10 to to , for example, uses a base of 10 and so: This was first referred to as the number e by Swiss mathematician Leonhard Euler in [36]. This shows that perfect circles can only exist if space is infinitely divisible. This seemed impossible; primes appear to be completely random. German mathematician Carl Friedrich Gauss was still a teenager in when he discovered that the distribution of prime numbers is related to logarithms [39]. Gauss found that prime numbers are more sparsely distributed the higher you count. Between 1 and , there are only about four numbers between any two primes, if you count up to 10,, however, then this average doubles to 8. This becomes 12 if you count to almost a million, 16 at over ten million, and 20 if you count to over a billion. Average number between two primes. Plot of real and imaginary numbers. Gauss saw that the average amount of numbers between any two primes increases by about 2. This means that they increase on a logarithmic scale to the base of e. Gauss was also responsible for creating a new coordinate system in order to map imaginary numbers.

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Chapter 6 : The History of Mathematics: An Introduction by David M. Burton

Mathematics starts with counting. It is not reasonable, however, to suggest that early counting was mathematics. Only when some record of the counting was kept and, therefore, some representation of numbers occurred can mathematics be said to have started. In Babylonia mathematics developed from.

Babylonian mathematics refers to any mathematics of the peoples of Mesopotamia modern Iraq from the days of the early Sumerians through the Hellenistic period almost to the dawn of Christianity. The first few hundred years of the second millennium BC Old Babylonian period , and the last few centuries of the first millennium BC Seleucid period. Later under the Arab Empire , Mesopotamia, especially Baghdad , once again became an important center of study for Islamic mathematics. In contrast to the sparsity of sources in Egyptian mathematics , our knowledge of Babylonian mathematics is derived from more than clay tablets unearthed since the s. Some of these appear to be graded homework. They developed a complex system of metrology from BC. From around BC onwards, the Sumerians wrote multiplication tables on clay tablets and dealt with geometrical exercises and division problems. The earliest traces of the Babylonian numerals also date back to this period. It is likely the sexagesimal system was chosen because 60 can be evenly divided by 2, 3, 4, 5, 6, 10, 12, 15, 20 and The problem includes a diagram indicating the dimensions of the truncated pyramid. Egyptian mathematics refers to mathematics written in the Egyptian language. From the Hellenistic period , Greek replaced Egyptian as the written language of Egyptian scholars. Mathematical study in Egypt later continued under the Arab Empire as part of Islamic mathematics , when Arabic became the written language of Egyptian scholars. The most extensive Egyptian mathematical text is the Rhind papyrus sometimes also called the Ahmes Papyrus after its author , dated to c. In addition to giving area formulas and methods for multiplication, division and working with unit fractions, it also contains evidence of other mathematical knowledge, [27] including composite and prime numbers ; arithmetic , geometric and harmonic means ; and simplistic understandings of both the Sieve of Eratosthenes and perfect number theory namely, that of the number 6. One problem is considered to be of particular importance because it gives a method for finding the volume of a frustum truncated pyramid. Finally, the Berlin Papyrus c. Greek mathematics The Pythagorean theorem. The Pythagoreans are generally credited with the first proof of the theorem. Greek mathematics of the period following Alexander the Great is sometimes called Hellenistic mathematics. All surviving records of pre-Greek mathematics show the use of inductive reasoning, that is, repeated observations used to establish rules of thumb. Greek mathematicians, by contrast, used deductive reasoning. The Greeks used logic to derive conclusions from definitions and axioms, and used mathematical rigor to prove them. Although the extent of the influence is disputed, they were probably inspired by Egyptian and Babylonian mathematics. According to legend, Pythagoras traveled to Egypt to learn mathematics, geometry, and astronomy from Egyptian priests. Thales used geometry to solve problems such as calculating the height of pyramids and the distance of ships from the shore. As a result, he has been hailed as the first true mathematician and the first known individual to whom a mathematical discovery has been attributed. The Pythagoreans are credited with the first proof of the Pythagorean theorem , [38] though the statement of the theorem has a long history, and with the proof of the existence of irrational numbers. The diagram accompanies Book II, Proposition 5. Though he made no specific technical mathematical discoveries, Aristotle â€”c. Although most of the contents of the Elements were already known, Euclid arranged them into a single, coherent logical framework. Euclid also wrote extensively on other subjects, such as conic sections , optics , spherical geometry , and mechanics, but only half of his writings survive. Around the same time, Eratosthenes of Cyrene c. AD 90â€” , a landmark astronomical treatise whose trigonometric tables would be used by astronomers for the next thousand years. His main work was the Arithmetica, a collection of algebraic problems dealing with exact solutions to determinate and indeterminate equations. He is known for his hexagon theorem and centroid theorem , as well as the Pappus configuration and Pappus graph. His Collection is a major source of knowledge on Greek mathematics as most of it has survived. The first woman mathematician recorded by history was Hypatia of Alexandria AD â€” She succeeded her father as Librarian at the Great Library and wrote many works on applied mathematics. Because of a political dispute, the Christian community in Alexandria had her stripped publicly and executed. The closure of the neo-Platonic Academy of Athens by the emperor Justinian in AD is traditionally held as marking the end of the era of Greek mathematics, although the Greek tradition continued unbroken in the Byzantine empire with mathematicians such as Anthemius of Tralles and Isidore of Miletus , the architects of the Haghia Sophia.

Chapter 7 : A brief history of mathematics: Plato to modern mysteries

Mathematics history courses also should emphasize the understanding of mathematics as a significant and central human endeavor motivated as much by human curiosity as by practical application, to include (a) relationships between culture and mathematics and (b).

Version for printing Mathematics starts with counting. It is not reasonable, however, to suggest that early counting was mathematics. Only when some record of the counting was kept and, therefore, some representation of numbers occurred can mathematics be said to have started. In Babylonia mathematics developed from BC. Earlier a place value notation number system had evolved over a lengthy period with a number base of It allowed arbitrarily large numbers and fractions to be represented and so proved to be the foundation of more high powered mathematical development. Systems of linear equations were studied in the context of solving number problems. Quadratic equations were also studied and these examples led to a type of numerical algebra. The Babylonian basis of mathematics was inherited by the Greeks and independent development by the Greeks began from around BC. A more precise formulation of concepts led to the realisation that the rational numbers did not suffice to measure all lengths. A geometric formulation of irrational numbers arose. Studies of area led to a form of integration. The theory of conic sections shows a high point in pure mathematical study by Apollonius. Further mathematical discoveries were driven by the astronomy, for example the study of trigonometry. After this time progress continued in Islamic countries. Mathematics flourished in particular in Iran, Syria and India. This work did not match the progress made by the Greeks but in addition to the Islamic progress, it did preserve Greek mathematics. From about the 11th Century Adelard of Bath, then later Fibonacci , brought this Islamic mathematics and its knowledge of Greek mathematics back into Europe. Major progress in mathematics in Europe began again at the beginning of the 16th Century with Pacioli , then Cardan , Tartaglia and Ferrari with the algebraic solution of cubic and quartic equations. Copernicus and Galileo revolutionised the applications of mathematics to the study of the universe. The 17th Century saw Napier , Briggs and others greatly extend the power of mathematics as a calculatory science with his discovery of logarithms. Cavalieri made progress towards the calculus with his infinitesimal methods and Descartes added the power of algebraic methods to geometry. Progress towards the calculus continued with Fermat , who, together with Pascal , began the mathematical study of probability. However the calculus was to be the topic of most significance to evolve in the 17th Century. Newton , building on the work of many earlier mathematicians such as his teacher Barrow , developed the calculus into a tool to push forward the study of nature. His work contained a wealth of new discoveries showing the interaction between mathematics, physics and astronomy. However we must also mention Leibniz , whose much more rigorous approach to the calculus although still unsatisfactory was to set the scene for the mathematical work of the 18th Century rather than that of Newton. The most important mathematician of the 18th Century was Euler who, in addition to work in a wide range of mathematical areas, was to invent two new branches, namely the calculus of variations and differential geometry. Euler was also important in pushing forward with research in number theory begun so effectively by Fermat. Toward the end of the 18th Century, Lagrange was to begin a rigorous theory of functions and of mechanics. The 19th Century saw rapid progress. Non-euclidean geometry developed by Lobachevsky and Bolyai led to characterisation of geometry by Riemann. Gauss , thought by some to be the greatest mathematician of all time, studied quadratic reciprocity and integer congruences. His work in differential geometry was to revolutionise the topic. He also contributed in a major way to astronomy and magnetism. The 19th Century saw the work of Galois on equations and his insight into the path that mathematics would follow in studying fundamental operations. Cauchy , building on the work of Lagrange on functions, began rigorous analysis and began the study of the theory of functions of a complex variable. This work would continue through Weierstrass and Riemann. Algebraic geometry was carried forward by Cayley whose work on matrices and linear algebra complemented that by Hamilton and Grassmann. The end of the 19th Century saw Cantor invent set theory almost single handedly while his analysis of the concept of number added to the major work of Dedekind and Weierstrass on irrational numbers Analysis was driven by the requirements of mathematical physics and astronomy. Maxwell was to revolutionise the application of analysis to mathematical physics. Statistical mechanics was developed by Maxwell , Boltzmann and Gibbs. It led to ergodic theory. The study of integral equations was driven by the study of electrostatics and potential theory. Notation and communication There are many major mathematical discoveries but only those which can be understood by others lead to progress. However, the easy use and understanding of mathematical concepts depends on their notation. For example, work with numbers is clearly hindered by poor notation. Try multiplying two numbers together in Roman numerals. Addition of course is a different matter and in this case Roman numerals come into their own, merchants who did most of their arithmetic adding figures were reluctant to give up using Roman numerals. What are other examples of notational problems. The best known is probably the notation for the calculus used by Leibniz and Newton. Let us think for a moment how dependent we all are on mathematical notation and convention. We are, often without realising it, using a convention that letters near the end of the alphabet represent unknowns while those near the beginning represent known quantities. It was not always like this: Harriot used a as his unknown as did others at this time. The convention we use letters near the end of the alphabet representing unknowns was introduced by Descartes in Also ax is used to denote the product of a and x, the most efficient notation of all since nothing has to be written! It is quite hard to understand the brilliance of major mathematical discoveries. On the one hand they often appear as isolated flashes of brilliance although in fact they are the culmination of work by many, often less able, mathematicians over a long period. For example the controversy over whether Newton or Leibniz discovered the calculus first can easily be answered. Neither did since Newton certainly learnt the calculus from his teacher Barrow. Now we are in danger of reducing major mathematical discoveries as no more than the luck of who was working on a topic at "the right time". This too would be completely unfair although it does go some why to explain why two or more people often discovered something independently around the same time. There is still the flash of genius in the discoveries, often coming from a deeper understanding or seeing the importance of certain ideas more clearly. How we view history We view the history of mathematics from our own position of understanding and sophistication. There can be no other way but nevertheless we have to try to appreciate the difference between our viewpoint and that of mathematicians centuries ago. Often the way mathematics is taught today makes it harder to understand the difficulties of the past. In fact there is no real reason why negative numbers should be introduced at all. Nobody owned -2 books. We can think of 2 as being some abstract property which every set of 2 objects possesses. This in itself is a deep idea. Adding 2 apples to 3 apples is one matter. Negative numbers do not have this type of concrete representation on which to build the abstraction. It is not surprising that their introduction came only after a long struggle. An understanding of these difficulties would benefit any teacher trying to teach primary school children. Even the integers, which we take as the most basic concept, have a sophistication which can only be properly understood by examining the historical setting. A challenge If you think that mathematical discovery is easy then here is a challenge to make you think. Napier , Briggs and others introduced the world to logarithms nearly years ago. These were used for years as the main tool in arithmetical calculations. An amazing amount of effort was saved using logarithms, how could the heavy calculations necessary in the sciences ever have taken place without logs. Then the world changed. The pocket calculator appeared. The logarithm remains an important mathematical function but its use in calculating has gone for ever. Here is the challenge. What will replace the calculator? You might say that this is an unfair question. However let me remind you that Napier invented the basic concepts of a mechanical computer at the same time as logs. The basic ideas that will lead to the replacement of the pocket calculator are almost certainly around us. I have an answer to my own question but it would spoil the point of my challenge to say what it is. Think about it and realise how difficult it was to invent non-euclidean geometries, groups, general relativity, set theory, General bibliography of about items Article by:

Chapter 8 : The best books on the History of Mathematics | Five Books Expert Recommendations

The area of study known as the history of mathematics is primarily an investigation into the origin of discoveries in *mathematics and, to a lesser extent, an investigation into the standard mathematical methods and notation of the past.*

Chapter 9 : The British Society for the History of Mathematics |

A Time-line for the History of Mathematics (Many of the early dates are approximates) This work is under constant revision, so come back later. Please report any errors to me at richardson@www.nxgvision.com