Quiz 1

---

1. What were features of Egyptian mathematics 4000 years ago?

A. To multiply or divide, they used an ingenious system of doubling.
B. Rather than fractions, they worked only with the n-th part.
C. They could solve simple linear equations.
→*D*. All of the above.
E. None of the above.

---

2. Whom did ancient historians claim was the first Greek mathematician?

A. Euclid.
B. Diophantus.
→*C*. Thales.
D. None of the above.

---

3. What was the primary motivation for mathematics in medieval India?

A. Metaphysics.
→*B*. Astronomy.
C. Engineering.
D. None of the above.

---

4. What change did Indian trigonometers bring to this classical subject?

→*A*. They worked with the half-chord, rather than the chord.
B. They worked with chords, rather than angles.
C. They worked with ratios, rather than segments.
D. All of the above.
E. None of the above.

---

5. How did Indian mathematical ideas first come to European attention?

A. Increased trade, after opening the Suez canal.
B. Colonization of India by England.
C. An exchange program for students and teachers.
D. All of the above.
→*E*. None of the above.

Quiz 2

---

1. What was the new capital of the Abbasid dynasty of the Islamic empire, "where East and West could meet"?

A. Abyssinia.
B. Damascus.
→*C*. Baghdad.
D. None of the above.

---

2. How did the Arabic mathematicians view the euclidean method?

A. It was entirely too formal, and required a completely new approach.
B. It produced results at odds with Islam, and so must be rejected.
→*C*. It was a model of clarity, and they "adopted it wholeheartedly".
D. None of the above.

---

3. Once people in Europe "became interested in mathematics" again, where did they go to learn it?

A. Back to the source, in a revitalized Athens.
B. To the last vestige of the old Roman Empire, Constantinople (also known as Byzantium).
C. To the "House of Wisdom", in Baghdad.
D. All of the above.
→*E*. None of the above.

---

4. What was the state of mathematics around the world at the end of the 14th century?

A. Most cultures outside Europe were quite backward, and scholarly activity would revive only after European colonialism.

B. Most advanced cultures were tightly interlinked by trade, and hence mathematical ideas were shared easily.

→*C*. There were many advanced cultures, somewhat insulated, each with their own advances in mathematics.

D. None of the above.

---

5. What were features of European algebra in the 16th and 17th centuries?

A. A turn from the rhetorical to the symbolic.
B. A theory of polynomials and their roots.
C. New links between algebra and geometry.
→*D*. All of the above.
E. None of the above.

Quiz 3

---

1. What did Emilie du Châtelet's "richly annotated translation" of Newton's *Principia* contribute to 18th century science?

→*A*. It helped convince people that the new physics was correct.
B. It helped convince people that Leibniz's approach was wrong.
C. It corrected some serious errors in Newton's conclusions.
D. All of the above.
E. None of the above.

---

2. Many of the pedagogical conventions and mathematical notations we use today are due to their promotion by what prodigious author?

A. Viète.
B. Newton.
C. Agnesi.
→*D*. None of the above.

---

3. Which "brilliant and temperamental" mathematician, while in and out of jail for political revolution, started a revolution in algebra?

A. Euler.
B. Gauss.
→*C*. Galois.
D. None of the above.

---

4. What is an example of the "strong link" between mathematics and physics made possible by the invention of calculus?

A. Fourier series.
B. Riemannian geometry.
C. Germain's theory of elasticity.
→*D*. All of the above.
E. None of the above.

---

5. What are important features of 20th century mathematics, the "golden age of mathematics"?

A. An astounding proliferation of mathematical results.
B. An overall unity, through the use of abstraction.
C. The invention of computers.
→*D*. All of the above.
E. None of the above.

Quiz 4

---

1. What was the principal ancient Egyptian numeration system for monuments?

A. The tally system.

→*B*. Hieroglyphics.

C. A system with a different symbol for each unit value from 1 to 9, each multiple of ten from 10 to 90, each multiple of one hundred from 100 to 900, and so forth.

D. All of the above.

E. None of the above.

---

2. What was the principal ancient Egyptian numeration system for papyrus?

A. The tally system.

B. Hieroglyphics.

→*C*. A system with a different symbol for each unit value from 1 to 9, each multiple of ten from 10 to 90, each multiple of one hundred from 100 to 900, and so forth.

D. All of the above.

E. None of the above.

---

3. Where was the first place-value system developed?

A. Ancient Egypt.

→*B*. Ancient Iraq.

C. Ancient India.

D. Ancient China.

E. None of the above.

---

4. What most aptly describes the development of symbolic algebra?

A. It was primarily a European development.

B. It was messy, with many disparate attempts between the 15th and 18th centuries.

C. The final form was largely determined by the most popular authors.

→*D*. All of the above.

E. None of the above.

---

5. What characterizes the symbolic representation of arithmetic today?

A. It is clear and unambiguous.

B. It has ceased to change.

→*C*. Its efficiency is universally recognized.

D. All of the above.

E. None of the above.

Quiz 5

---

1. The first known use of the symbol "=" for "equals" is in Robert Recorde's *The Whetstone of Witte*. What happened to the symbol after that?

A. It was widely accepted almost immediately.
→*B*. It did not appear in print again for more than 50 years.
C. It was ignored for a while, but became popular after Descartes adopted it.
D. None of the above.

---

2. What is Harriot's Principle?

→*A*. To solve a polynomial equation you should first transpose terms so that it has the form $p(x) = 0$.
B. The roots of a polynomial $p(x)$ are precisely the x-intercepts of the graph of $y = p(x)$.
C. The number of roots (counted with multiplicity) of a polynomial equals the degree of that polynomial.
D. None of the above.

---

3. What is the "driving force" behind Harriot's Principle?

A. If a is any number then $a + 0 = 0 + a = a$.
B. If a is any number then $a \cdot 0 = 0 \cdot a = 0$.
→*C*. If $ab = 0$ then either $a = 0$ or $b = 0$.
D. None of the above.

---

4. How did the Hindu mathematicians of the 9th century regard zero?

A. As merely a place-holder in the decimal numeration system.
→*B*. As an abstraction on a par with one, two, three, and so forth.
C. As a symbolic representation of various abstract quantities, including "nothing" and "infinity".
D. None of the above.

---

5. How did the influential 9th century texts of Al-Khwarizmi treat zero?

→*A*. As merely a place-holder in the decimal numeration system.
B. As an abstraction one a par with one, two, three, and so forth.
C. As a symbolic representation of various abstract quantities, including "nothing" and "infinity".
D. None of the above.

Quiz 6

---

1. How might "2/5" be expressed in ancient Egypt?

A. The third and the fourth.
B. The third and the tenth.
C. The fourth and the fifteenth.
→*D*. None of the above.

---

2. How might we express the ancient Iraqi fraction "$1, 12; 30$"?

→*A*. 72.5.
B. $72\frac{1}{30}$.
C. $1\frac{12}{30}$.
D. None of the above.

---

3. When were negative numbers accepted as "first-class citizens"?

A. 7th century India.
B. 16th century continental Europe.
C. Early 19th century England.
→*D*. None of the above.

---

4. Who among the following made the greatest contribution to the understanding and widespread acceptance of negative numbers?

A. Brahmagupta.
B. Al-Khwarizmi.
C. Cardano.
D. Descartes.
E. Newton.

---

5. Which is the most abstract concept?

A. Fractions.
B. Irrational numbers.
C. Zero.
D. Negative numbers.
E. Complex numbers.

Quiz 7

---

1. Why is it important to calculate π to millions of digits?

A. For accurate surveys of lakes and other geographical features.
B. For an accurate determination of the length of the meter.
C. To determine whether or not π is rational.
D. All of the above.
→*E*. None of the above.

---

2. Which of the following have been used to set a standard of length?

A. The distance from a king's nose to his outstretched thumb.
B. The circumference of the earth.
C. The speed of light.
→*D*. All of the above.
E. None of the above.

---

3. What are some advantages of the metric system?

→*A*. It plays well with decimal numeration.
B. It makes the ratio of the circumference of a circle to its diameter a rational number.
C. It has euphonious names for its units.
D. All of the above.
E. None of the above.

---

4. Which of the following had the most accurate approximation of π?

A. Ahmes, in Egypt, -1650.
B. Archimedes, in Italy, -240.
→*C*. Zu Chongshi, in China, 480.
D. Aryabhata, in India, 530.
E. Johann Lambert, in Germany, 1765.

---

5. Who first proved that π is irrational?

A. Ahmes, in Egypt, -1650.
B. Archimedes, in Italy, -240.
C. Zu Chongshi, in China, 480.
D. Aryabhata, in India, 530.
→*E*. Johann Lambert, in Germany, 1765.

Quiz 8

---

1. During the rhetorical phase in the history of algebra, which of the following were used to indicate the unknown?

A. Shai.
B. Res.
C. Cosa.
→*D*. All of the above.
E. None of the above.

---

2. The text claim which of the following are essential for good algebraic notation?

A. It should suggest generalizations.
B. It should clarify ideas.
C. It should reveal patterns.
→*D*. All of the above.
E. None of the above.

---

3. The text suggests that which of the following may have delayed the emergence of the use of letters for unknowns an parameters?

A. The influence of writers such as Chuquet, Bombelli, and Viète.
→*B*. The slow adoption of the Hindu decimal system.
C. The increasing conservatism of the Catholic clergy.
D. All of the above.
E. None of the above.

---

4. Which types of equations are for the method of false position?

A. $A + x = B$.
→*B*. $Ax = B$.
C. $Ax + B = C$.
D. All of the above.
E. None of the above.

---

5. Which types of equations are suitable for the method of double false position?

A. $A + x = B$.
B. $Ax = B$.
→*C*. $Ax + B = C$.
D. All of the above.
E. None of the above.

Quiz 9

---

1. If the problem is "a square and seven roots equal twenty-eight" what must you do to complete the square?

A. Add half of twenty-eight to seven squared.
→*B*. Add half of seven, squared, to twenty-eight.
C. Add seven squared to half of twenty-eight.
D. Add seven squared to twenty-eight.
E. None of the above.

---

2. What classic geometric problem spawned interest in cubic equations?

A. Doubling the cube.
→*B*. Trisecting angles.
C. Intersecting two conics.
D. All of the above.
E. None of the above.

---

3. Why did Al-Khayyami have to consider fourteen different kinds of cubic equations?

A. To account for all the ways to tile the plane.
B. To account for all the different types of triangle.
C. To account for all possible cube roots of a number.
D. All of the above.
→*E*. None of the above.

---

4. What did Bombelli do that was "nothing short of brilliant"?

→*A*. Showed that it is possible to exploit imaginary numbers.
B. Showed that cubic equations always have meaningful solutions.
C. Showed that the solutions of a cubic are always commensurable.
D. None of the above.

---

5. How did Cardano justify revealing the solution of the cubic?

A. He didn't — he simply broke his promise.
B. As revenge for Tartaglia revealing the solution of the quartic.
→*C*. By noting that del Ferro had precedence.
D. None of the above.

Quiz 10

---

1. What is the geometric principle behind the method of double false position?

→*A*. The slope between any pair of points on a line is constant.

B. The slope of perpendicular lines are negative reciprocals.

C. The area of a parallelogram is given by cross product.

D. None of the above.

---

2. Which algebraic identity underlies the method of completing the square?

→*A*. $a^2 - b^2 = (a - b)(a + b)$.

B. $a^2 + b^2 = c^2$.

C. $\sqrt{a^2 + b^2} = a + b$, if $a, b > 0$.

D. None of the above.

---

3. Which algebraic identity underlies the classical Chinese proof of Pythagoras' Theorem?

A. $a^2 - b^2 = (a - b)(a + b)$.

B. $a^2 + b^2 = c^2$.

C. $\sqrt{a^2 + b^2} = a + b$, if $a, b > 0$.

→*D*. None of the above.

---

4. Which cubics did Bombelli prove always have positive roots?

A. $x^3 + px + q = 0$, where $p, q > 0$.

→*B*. $x^3 = px + q$, where $p, q > 0$.

C. $x^3 + q = px$, where $p, q > 0$.

D. None of the above.

---

5. What was wrong with Lamé's attempted proof of Fermat's Last Theorem?

→*A*. His number system lacked the unique factorization property.

B. His number system lacked the well-ordering property.

C. His number system lacked a multiplicative identity.

D. None of the above.

Quiz 11

---

1. How did Al-Khayyami represent the solutions of cubic equations?

A. As approximations, using Liu Hui's method

B. As continued fractions, using Brahmagupta's method.

→*C*. As intersections of conics.

D. None of the above.

---

2. Which algebraic identity underlies the classical Chinese proof of Pythagoras' Theorem?

→*A*. $(a+b)^2 = a^2 + b^2 + 2ab$.

B. $a^2 - b^2 = (a-b)(a+b)$.

C. $\sqrt{a^2 + b^2} = a + b$.

D. None of the above.

---

3. What is notable about Euclid's proof of Pythagoras' Theorem?

A. He proves it without using either pictures or algebraic identities.

→*B*. He shows how to decompose the big square into rectangles equaling the two smaller squares.

C. He shows that Pythagoras' Theorem is in fact equivalent to its converse.

D. All of the above.

E. None of the above.

---

4. What were Sophie Germain's contributions to our understanding of Fermat's Last Theorem?

A. Showing that there are two distinct cases, and then solved one of those two cases completely.

→*B*. Proving a partial result under additional assumptions which nevertheless was the first to have some generality.

C. Making several conjectures whose partial proof would eventually lead to the complete solution.

D. None of the above.

---

5. What were Ernst Kummer's contributions to our understanding of Fermat's Last Theorem?

→*A*. Showing that there are two distinct cases, and then solved one of those two cases completely.

B. Proving a partial result under additional assumptions which nevertheless was the first to have some generality.

C. Making several conjectures whose partial proof would eventually lead to the complete solution.

D. None of the above.

Quiz 12

---

1. What is the situation for quintic equations?

A. Analysis of Cardano's formulas eventually led to an analogous quintic formula, based on completing a 5-dimensional figure.

→*B*. It was ultimately proved that it is impossible to solve quintic equations using only arithmetic operations and radicals.

C. The problem remains unresolved to this day: there are conjectures, but nobody has been able to prove them.

---

2. Which of the following has been used to prove Pythagoras' Theorem?

A. The square of the sum of two numbers equals the sum of their squares plus twice their product.

B. Two triangles with the same base and altitude have the same area.

C. In a right triangle the perpendicular from the hypotenuse to the right angle divides the triangle into two triangles each similar to the whole.

→*D*. All of the above.

E. None of the above.

---

3. Which of the following number theory problems did Fermat study?

A. Determining which numbers can be written as a sum of squares.

B. Proving that every number is a sum of four squares.

C. Finding perfect numbers.

→*D*. All of the above.

E. None of the above.

---

4. How did Lamé attack Fermat's Last Theorem?

→*A*. By factoring $x^n + y^n$ using a complex n-th root of 1.

B. By completing the program initiated by Germain.

C. By proving another well-known conjecture which Ribet has shown would imply Fermat's Last Theorem.

D. None of the above.

---

5. How did Wiles attack Fermat's Last Theorem?

A. By factoring $x^n + y^n$ using a complex n-th root of 1.

B. By completing the program initiated by Germain.

→*C*. By proving another well-known conjecture which Ribet has shown would imply Fermat's Last Theorem.

D. None of the above.

Quiz 13

---

1. What is the subject of the "particularly important" Book V of Euclid's *Elements*?

A. Aristotelian logic.
→*B*. Eudoxus' theory of ratios.
C. Proving that the Platonic Solids are the only regular polyhedra.
D. All of the above.
E. None of the above.

---

2. What is the "touch of genius" which is the main goal of Book XIII of Euclid's *Elements*?

A. Aristotelian logic.
B. Eudoxus' theory of ratios.
→*C*. Proving that the Platonic Solids are the only regular polyhedra.
D. All of the above.
E. None of the above.

---

3. What is the crucial analysis which severely limits the possibilities for a regular polyhedron.

→*A*. The number and type of polygon that can meet at a vertex.
B. The number and type of polygon that can meet along an edge.
C. The allowable edge-length for a polygon inscribed in a sphere.
D. None of the above.

---

4. The power of cartesian coordinates is the connection between algebraic expressions and shapes in the plane. Where was the first "glimmer of this idea"?

A. Egyptian surveyors' use of a rectangular grid.
→*B*. Apollonius' study of locus problems.
C. Nicole Oresme graphing the relationship between dependent and independent variables.
D. None of the above.

---

5. What was the main subject of Descartes' *Discourse on Method*?

A. Ballistics.
B. Optics.
C. Meteorology.
D. Geometry.
→*E*. None of the above.

Quiz 14

---

1. What did Hadamard say about complex numbers?

A. The most complex route to real truth is imaginary.
B. The greatest truth about complex reality is imaginary.
C. The most complex truth can be realized only by imaginaries.
→*D*. None of the above.

---

2. What is De Moivre's formula?

A. $\cos(x + iy) = \cos(x)\cos(y) - i\sin(x)\sin(y)$.
B. $\sin(x + iy) = \sin(x)\cos(y) + i\sin(x)\sin(y)$.
→*C*. $(\cos(x) + i\sin(x))^n = \cos(nx) + i\sin(nx)$.
D. None of the above.

---

3. What is Euler's formula?

→*A*. $e^{ix} = \cos(x) + i\sin(x)$.
B. $e^{x+iy} = \cos(x) + i\sin(y)$.
C. $e^{x+iy} = \cos(x) + \sin(iy)$.
D. None of the above.

---

4. What is cosine?

→*A*. The sine of the complement.
B. The complement of the sine.
C. The complement of the sine of the complement.
D. None of the above.

---

5. What is the relationship of the sine to the chord?

→*A*. The sine is half the chord of twice the angle.
B. The chord is half the sine of twice the angle.
C. The sine is twice the chord of half the angle.
D. None of the above.

Quiz 15

---

1. What does Euclid need the fifth postulate to prove?
- *A*. Parallel lines are equidistant.
- *B*. Angles in a triangle sum to 180°.
- *C*. Pythagoras' theorem.
- →*D*. All of the above.
- *E*. None of the above.

---

2. Which of the following are theorems in Lobachevskian geometry?
- *A*. Triangles with equal angles are congruent.
- *B*. Through a point not on a line there is more than one parallel.
- *C*. The ratio of circumference to diameter is greater than π.
- →*D*. All of the above.
- *E*. None of the above.

---

3. Which is the true geometry?
- *A*. Euclidean.
- *B*. Lobachevskian.
- *C*. Riemannian.
- →*D*. All of the above.
- →*E*. None of the above.

---

4. What led to the development of projective geometry?
- →*A*. Artists' need to portray depth on a flat surface.
- *B*. Navigators' need for maps which do not distort distance.
- *C*. The demand for a rigorous treatment of Lobachevskian geometry.
- *D*. All of the above.
- *E*. None of the above.

---

5. Which of the following are striking features of projective geometry?
- *A*. Any two lines intersect, possibly "at infinity".
- *B*. The principle of duality between points and lines.
- *C*. Any projection of a circle is a conic section.
- →*D*. All of the above.
- *E*. None of the above.

Quiz 16

---

1. To what problem does probability trace its roots?
→*A*. Fairly distributing the stakes of an unfinished game of chance.
B. Fairly distributing tax revenues according to an incomplete census.
C. Fairly distributing the estate of an intestate deceased.
D. None of the above.

---

2. What was the key to Pascal and Fermat's solution?
A. Finding the maximum likelihood of each event.
B. Finding the minimum likelihood of each event.
→*C*. Understanding events of equal likelihood.
D. None of the above.

---

3. What is probability?
→*A*. The exploration of an unknown sample of a known population.
B. The exploration of an unknown population from an known sample.
C. Both.
D. Neither.

---

4. What is statistics?
A. The exploration of an unknown sample of a known population.
→*B*. The exploration of an unknown population from an known sample.
C. Both.
D. Neither.

---

5. What was Legendre's contribution to the statisticians' standard toolkit?
A. The Law of Large Numbers.
B. The Normal Curve.
→*C*. The Method of Least Squares.
D. All of the above.
E. None of the above.

Quiz 17

---

1. What was the principal innovation of Babbage's "Analytical Engine"?

A. It used binary arithmetic.
→*B*. It was programmable.
C. It was easy to mass produce.
D. None of the above.

---

2. What was the key element of Boole's work?

→*A*. The algebra of truth values.
B. The logic of algebra.
C. The value of logic.
D. None of the above.

---

3. Which of the following did Cantor prove?

A. There are more irrationals than rationals.
B. There are exactly as many rationals as counting numbers.
C. There are exactly as many points on a line as in a plane.
→*D*. All of the above.
E. None of the above.

---

4. What worried Catholic theologians about Cantor's set theory?

A. It might justify atheism.
→*B*. It might justify pantheism.
C. It might justify animism.
D. All of the above.
E. None of the above.

---

5. What "won the day" for Cantor's theory?

A. It reduced metaphysics to mathematics.
B. It resolved all the philosophical questions about mathematics.
C. It blurred the boundaries between religion, philosophy, and science.
D. All of the above.
→*E*. None of the above.

Quiz 18

---

1. What is the situation for quintic equations?

A. Analysis of Cardano's formulas eventually led to an analogous quintic formula, based on completing a 5-dimensional figure.

→*B*. It was ultimately proved that it is impossible to solve quintic equations using only arithmetic operations and radicals.

C. The problem remains unresolved to this day: there are conjectures, but nobody has been able to prove them.

---

2. Which "brilliant and temperamental" mathematician, while in and out of jail for political revolution, started a revolution in algebra?

A. Euler.

B. Gauss.

→*C*. Galois.

D. None of the above.

---

3. What were features of European algebra in the 16th and 17th centuries?

A. A turn from the rhetorical to the symbolic.

B. A theory of polynomials and their roots.

C. New links between algebra and geometry.

→*D*. All of the above.

E. None of the above.

---

4. What are important features of 20th century mathematics, the "golden age of mathematics"?

A. An astounding proliferation of mathematical results.

B. An overall unity, through the use of abstraction.

C. The invention of computers.

→*D*. All of the above.

E. None of the above.

---

5. Which of the following did Cantor prove?

A. There are more irrationals than rationals.

B. There are exactly as many rationals as counting numbers.

C. There are exactly as many points on a line as in the plane.

→*D*. All of the above.

E. None of the above.

Quiz 19

---

1. To what does Cardano reduce a cubic?

A. An equation between perfect cubes.

→*B*. A system consisting of the product and difference of two cubes.

C. The intersection of two conic sections.

D. None of the above.

---

2. What substitution is used to "depress" the cubic $y^3 + ay^2 + by + c = 0$?

→*A*. $y = x - \frac{1}{3}a$.

B. $y = x + \frac{1}{3}a$.

C. $\frac{1}{3}y = x - a$.

D. None of the above.

---

3. What makes the "casus irreducibilis" weird?

A. There are no real roots, even though the coefficients are positive.

→*B*. There is a real root, but its expression uses complex numbers.

C. There are fewer roots than predicted by the Fundamental Theorem.

D. None of the above.

---

4. What is the simple rule for multiplying complex numbers?

→*A*. Multiply the moduli and add the arguments.

B. Multiply the moduli and multiply the arguments.

C. Add the moduli and multiply the arguments.

D. None of the above.

---

5. How does Ferrari solve quartics?

A. Complete a 4-dimensional "cube", then reduce to a system consisting of the product and difference of 4-th powers

→*B*. Shift terms then add new terms so that both sides of the equation are perfect squares.

C. Begin with al-Khayyami's intersection of conics, then use the discriminant to reduce the problem to a cubic equation.

D. None of the above.

Quiz 20

---

1. What are ingredients for Euler's proof of the Fundamental Theorem?

A. The Intermediate Value Theorem.
B. The quadratic formula.
C. Newton's theorem on symmetric functions.
→*D*. All of the above.
E. None of the above.

---

2. What is Galois's great theorem?

A. If the group of an equation is abelian then the equation is solvable.
B. If the equation is solvable then the group of the equation is abelian.
C. An equation is solvable if and only if its group is abelian.
→*D*. None of the above.

---

3. What did Hilbert believe to be true?

A. Ordinary arithmetic is consistent.
B. Ordinary arithmetic is complete.
C. Every mathematical question is unambiguously true or false.
→*D*. All of the above.
E. None of the above.

---

4. What was the founding goal of the bourbachiques?

→*A*. To rewrite the way mathematics is taught.
B. To found the edifice of mathematics on the axiomatic system.
C. To repudiate Brouwer's intuitionism.
D. All of the above.
E. None of the above.

---

5. What is a Turing machine?

A. Any machine capable of doing ordinary arithmetic.
B. Any machine programmed using Brouwer's intuitionist model.
C. Any machine which avoids Gödel's paradox.
D. All of the above.
→*E*. None of the above.