Quiz 1

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1. According to our textbook's authors, what is a good way to use history in the mathematics classroom?

A. Textual analysis of original sources.
→*B*. Historical anecdotes.
C. Comparing and contrasting our methods with those of other cultures.
D. All of the above.
E. None of the above.

---

2. What was a feature 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.

---

3. What was a feature of Mesopotamian 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.

---

4. What was a feature of Chinese mathematics 2000 years ago?

→*A*. The concept of proportionality was central.
B. Geometry was treated axiomatically.
C. All problems had a practical basis.
D. All of the above.
E. None of the above.

---

5. Whom did ancient historians claim were the first Greek mathematicians?

A. Euclid and Pythagoras.
B. Euclid and Diophantos.
→*C*. Pythagoras and Thales.
D. None of the above.

Quiz 2

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

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

---

2. 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.

---

3. 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.

---

4. 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.

---

5. 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.

Quiz 3

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1. 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.

---

2. 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.

---

3. What was notable about the work of Nicole Oresme?
- *A*. He worked on kinematics.
- *B*. He had a graphical method for representing changing quantities.
- *C*. He considered infinite sums.
- →*D*. All of the above.
- *E*. None of the above.

---

4. What was the great advance in geometry during the Italian Renaissance?
- *A*. The introduction of cartesian coordinates.
- →*B*. The investigation of perspective.
- *C*. The discovery of a fundamental flaw in Euclid's *Elements*.
- *D*. All of the above.
- *E*. None of the above.

---

5. What was the great advance in algebra during the Italian Renaissance?
- →*A*. The solution of cubic and quartic equations.
- *B*. The development of a fully symbolic algebra.
- *C*. The algebraization of geometry through cartesian coordinates.
- *D*. All of the above.
- *E*. None of the above.

Quiz 4

---

1. What new concept were mathematicians forced to confront after the discovery of Cardano's formulas?

A. Infinitesimals.
→*B*. Complex numbers.
C. Symbolic algebra.
D. All of the above.
E. None of the above.

---

2. What new concept were mathematicians forced to confront after the discovery of calculus?

→*A*. Infinitesimals.
B. Complex numbers.
C. Symbolic algebra.
D. All of the above.
E. None of the above.

---

3. 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.

---

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

A. Weierstrass.
B. Newton.
→*C*. Euler.
D. Agnesi.
E. None of the above.

---

5. Which High School teacher's name is today "synonymous with rigor and precision"?

→*A*. Weierstrass.
B. Newton.
C. Euler.
D. Agnesi.
E. None of the above.

Quiz 5

---

1. What is Bombelli's 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.

---

2. To use de Moivre's formula to find cube roots, what do you compute?

→*A*. The cube root of the modulus and one third of the argument.

B. The cube root of the modulus and the cube root of the argument.

C. One third of the modulus and the cube root of the argument.

D. None of the above.

---

3. What did Euler use in his proof of the Fundamental Theorem of Algebra?

A. The Intermediate Value Property.

B. The quadratic formula.

C. Newton's theorem on symmetric functions.

→*D*. All of the above.

E. None of the above.

---

4. What is the situation for the solution of 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.

---

5. What is the situation for Hilbert's problem on the consistency and completeness of arithmetic?

A. Consistency was established after the invention of Turing machines, but completeness is still unresolved.

B. Because of Brouwer's reforms, these issues are no longer concern us.

C. Consistency and completeness were both established by the painstaking, methodical work of the bourbachiques.

→*D*. None of the above.

Quiz 6

---

1. Which civilizations developed a place-value numeration system more than 2000 years ago?
A. Ancient Central America.
B. Ancient Iraq.
C. Ancient China.
→*D*. All of the above.
E. None of the above.

---

2. 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.

---

3. 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.

---

4. Who invented our modern system of symbolic arithmetic?
A. Regiomontanus.
B. Luca Pacioli.
C. Robert Recorde.
D. René Descartes.
→*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 7

---

1. 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.

---

2. 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.

---

3. 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.

---

4. Which is the most abstract concept?

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

---

5. 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.

Quiz 8

---

1. The text claims 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.

---

2. 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.

---

3. 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.

---

4. 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*. Square half of seven, then add to twenty-eight.
C. Add seven squared to half of twenty-eight.
D. Add seven squared to twenty-eight.
E. None of the above.

---

5. 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.

Quiz 9

---

1. Which algebraic identity underlies the classical Chinese proof of Pythagoras' Theorem?
→*A*. $(a+b)^2 = a^2 + b^2 + 2ab$.
B. $a^2 + b^2 = c^2$.
C. $\sqrt{a^2+b^2} = a + b$, if $a, b > 0$.
D. None of the above.

---

2. 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.

---

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 had 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.

---

6. (Bonus.) What was wrong with Lamé's attempted proof of Fermat's Last Theorem?
His number system lacked the unique factorization property.

Quiz 10

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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 11

---

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 12

---

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 13

---

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 tool set?
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 14

---

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 the 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 15

1. Which of the subjects of the *quadrivium* is traditionally associated with arithmetic?
→*A*. Music.
B. Geometry.
C. Astronomy.
D. None of the above.

---

2. Which ratio defines the octave?
→*A*. 2 : 1
B. 3 : 2
C. 8 : 1
D. None of the above.

---

3. Which ratio defines the fifth?
A. 5 : 1
B. 5 : 2
C. 5 : 3
→*D*. None of the above.

---

4. What is the pythagorean comma?
→*A*. The interval between 12 fifths and 7 octaves.
B. A proof by *reductio ad absurdam*.
C. An ancient version of the Weber-Fechner Law.
D. None of the above.

---

5. How did the conceptual separation of magnitude and number affect Greek mathematics?
A. It blocked the general idea of algebra.
B. It caused mischief with the notion of equality.
C. It played havoc with the concept of volume.
→*D*. All of the above.
E. None of the above.

Quiz 16

---

1. What ratio represents a semitone in a musical scale of equal temperament?

A. 1 : 2
B. 3 : 2
C. 2 : 1
→*D*. None of the above.

---

2. Who first proposed a musical scale of equal temperament?

A. Zhu Zaiyu.
B. Simon Stevin.
→*C*. Both.
D. Neither.

---

3. What scale is represented on a guitar fret board?

→*A*. One of equal temperament.
B. One based exclusively on true fifths.
C. One that interpolates equal semitones between true fifths.
D. None of the above.

---

4. What is the continued fraction expression for $1 + \sqrt{2}$?

→*A*. $2 + 1/(2 + 1/(2 + \cdots))$
B. $1 + 2/(1 + 2/(1 + \cdots))$
C. $2 + 2/(2 + 2/(2 + \cdots))$
D. $1 + 1/(1 + 1/(1 + \cdots))$
E. None of the above.

---

5. What is the euclidean algorithm used for?

A. To find a common measure for magnitudes a and b.
B. To find the greatest common divisor for numbers a and b.
→*C*. Both.
D. Neither.

Quiz 17

---

1. Whom does Stillwell credit for being the first to sight complex arithmetic?

A. Euclid.
B. al-Khazin.
C. Galileo.
D. Bombelli.
→*E*. None of the above.

---

2. What was this first sighting?

→*A*. The fact that the product of sums of two squares is a sum of two squares.
B. The fact that the product of the sum and difference of two numbers is the difference of their squares.
C. The fact that a cubic can have a real solution even when its discriminant is negative.
D. None of the above.

---

3. How does Stillwell explain that the product of two negative numbers is positive?

A. By modeling positive numbers as assets and negative numbers as debts.
→*B*. By exploiting the distributive property.
C. By a geometric construction.
D. None of the above.

---

4. What is the statement of the Fundamental Theorem of Algebra?

A. A root x_1 of a polynomial equation $p(x) = 0$ corresponds to a factor $x - x_1$ of $p(x)$.
→*B*. A polynomial of degree n has exactly n roots in the complex plane.
C. Complex algebraic curves of degree m and n intersect in exactly mn points.
D. None of the above.

---

5. What is the statement of Bezout's Theorem?

A. A root x_1 of a polynomial equation $p(x) = 0$ corresponds to a factor $x - x_1$ of $p(x)$.
B. A polynomial of degree n has exactly n roots in the complex plane.
→*C*. Complex algebraic curves of degree m and n intersect in exactly mn points.
D. None of the above.

Quiz 18

---

1. In perspective drawing, which line *cannot* be the horizon (line at infinity)?

A. Any horizontal line.
B. Any vertical line.
C. Any line that is neither horizontal nor vertical.
→*D*. None of the above.

---

2. In the *Elements*, for what does Euclid need the Parallel Postulate?

A. That rectangles exist.
B. That the angle sum in a triangle is two right angles.
C. Pythagoras' theorem.
→*D*. All of the above.
E. None of the above.

---

3. Which theorem, together with the incidence axioms, implies all nine laws of algebra?

→*A*. Pappus' theorem.
B. Desargues' theorem.
C. Desargues' little theorem.
D. All of the above.
E. None of the above.

---

4. In *Yearning for the Impossible*, what does Stillwell claim is the first great advance in geometry after the time of Euclid?

→*A*. Coordinates.
B. Projective geometry.
C. The theory of conic sections.
D. None of the above.

---

5. In *Yearning for the Impossible*, what does Stillwell suggest we look for a sign of extraterrestrial intelligence?

A. Prime numbers.
B. Pythagoras' theorem.
C. The laws of algebra.
→*D*. None of the above.

Quiz 19

---

1. If $|r| < 1$ then what is $a + ar + ar^2 + \cdots$?
→*A*. $a/(1-r)$.
B. $r/(1-a)$.
C. $a/(1+r)$.
D. $r/(1+a)$.
E. None of the above.

---

2. What is the volume of a tetrahedron?
A. $\frac{1}{2}$ base × height.
B. $\frac{1}{4}$ base × height.
C. $\frac{1}{6}$ base × height.
D. $\frac{1}{8}$ base × height.
→*E*. None of the above.

---

3. What technique of analysis is due to Eudoxus?
A. The method of infinitesimals.
→*B*. The method of exhaustion.
C. The method of quadratures.
D. The method of anthyphairesis.
E. None of the above.

---

4. Who wrote the first really effective criticism of calculus?
A. Thomas Hobbes.
→*B*. Bishop Berkeley.
C. Pierre de Fermat.
D. Lewis Carroll.
E. None of the above.

---

5. What is Leibniz' version of the Fundamental Theorem of Calculus?
→*A*. The difference between successive sums is the last term of the sum.
B. The successive sum of slopes equals the gross difference.
C. The slope of the gross differences equals the sum of the slopes.
D. The last slope of successive differences equals the gross difference of the slopes.
E. None of the above.

Quiz 20

---

1. Why is Stillwell fascinated with Dante's description of heaven and hell?

A. It maps an infinite flat space.
B. It maps an infinite hyperbolic space.
→*C*. It maps a finite spherical space.
D. It maps a finite projective space.
E. None of the above.

---

2. Who first studied stereographic projection?

A. Dante Alighieri.
B. Thomas Harriot.
C. Sir Walter Raleigh.
D. Tintoretto.
→*E*. None of the above.

---

3. Who first discovered that stereographic projection is "faithful in the small"?

A. Dante Alighieri.
→*B*. Thomas Harriot.
C. Sir Walter Raleigh.
D. Tintoretto.
E. None of the above.

---

4. What is gaussian curvature of a surface?

A. The largest principal curvature.
B. The smallest principal curvature.
→*C*. The product of the principal curvatures.
D. The sum of the principal curvatures.
E. None of the above.

---

5. What is proportional to the area of a hyperbolic triangle?

→*A*. π minus the sum of the interior angles.
B. π plus the sum of the interior angles.
C. The sum of the interior angles minus π.
D. The sum of the interior angles times π.
E. None of the above.

Quiz 21

---

1. Which of Legendre's observation did Hamilton overlook, which might have saved him 13 years of futile search?

→*A*. A product of sums of three squares need not be a sum of three squares.
B. A product of sums of three squares must be a sum of three squares.
C. A product of sums of four squares must be a sum of four squares.
D. All of the above.
E. None of the above.

---

2. Which law of algebra did Hamilton have to abandon in order to obtain his quaternions?

A. Associativity of multiplication.
→*B*. Commutativity of multiplication.
C. Distributivity of multiplication over addition.
D. All of the above.
E. None of the above.

---

3. Who "sighted" quaternions before Hamilton discovered them?

A. Euler.
B. Gauss.
C. Olinde Rodrigues.
→*D*. All of the above.
E. None of the above.

---

4. How many regular polyhedra are there?

A. Three.
→*B*. Five.
C. Infinitely many.
D. None of the above.

---

5. How many regular 4-dimensional polytopes are there?

A. Three.
B. Five.
C. Infinitely many.
→*D*. None of the above.

Quiz 22

---

1. In which number system does unique factorization *fail*?

A. $\{a + b\sqrt{-1} \mid a, b \text{ integers}\}$
B. $\{a + b\sqrt{-2} \mid a, b \text{ integers}\}$
→*C*. $\{a + b\sqrt{-5} \mid a, b \text{ integers}\}$
D. All of the above.
E. None of the above.

---

2. If a, b are positive integers then what is $\gcd(a, b)$?

→*A*. The smallest positive number among $\{am + bn \mid m, n \text{ integers}\}$.
B. The smallest number among $\{am + bn \mid m, n \text{ positive integers}\}$.
C. The largest number among $\{am + bn \mid m, n \text{ positive integers}\}$.
D. All of the above.
E. None of the above.

---

3. What is a *distinguishing* property of a prime?

→*A*. If a prime divides a product, then it must divide one of the factors.
B. If a prime divides a sum, then it must divide one of the summands.
C. If a prime divides two numbers, then it also must divide their sum.
D. All of the above.
E. None of the above.

---

4. To what discovery did Kummer compare his search for "ideal numbers"?

A. That of new planets by the irregularities in known orbits.
→*B*. That of new chemical elements by the properties of compounds.
C. That of noneuclidean geometry by the study of geodesics.
D. All of the above.
E. None of the above.

---

5. How did Kummer propose to recognize these new numbers?

A. By their factors.
→*B*. By their multiples.
C. By their norms.
D. All of the above.
E. None of the above.

Quiz 23

---

1. On what geometric figure is Escher's *Waterfall* based?

A. The digon.
→*B*. The tribar.
C. The tetragrammaton.
D. All of the above.
E. None of the above.

---

2. In what space would Escher's *Waterfall* be possible?

A. The torus.
→*B*. The 3-cylinder.
C. Dodecahedral space.
D. All of the above.
E. None of the above.

---

3. What is the "standard trick" mathematicians use to equate things that aren't equal?

A. Elliptic integrals.
B. Elliptic functions.
C. Elliptic curves.
D. All of the above.
→*E*. None of the above.

---

4. What are elliptic functions?

A. Doubly periodic functions.
B. Toral functions.
→*C*. Both.
D. Neither.

---

5. What characterizes the shape of the lattice generated by A and B?

A. $\sin(A)\cos(B)$.
B. $\sin(A)\sin(B)$.
C. $\cos(A)+\cos(B)$.
D. All of the above.
→*E*. None of the above.

Quiz 24

---

1. Which of the following are uncountable?

A. The real numbers.
B. The irrational numbers.
C. The transcendental numbers.
→*D*. All of the above.
E. None of the above.

---

2. According to Harnack's argument, which of the following have "total length zero"?

A. The rational numbers.
B. The constructible numbers.
C. The algebraic numbers.
→*D*. All of the above.
E. None of the above.

---

3. What was Gauss' attitude towards the infinite?

→*A*. It is merely a figure of speech.
B. It is a fundamental mathematical object.
C. It has no place whatsoever in mathematics.
D. None of the above.

---

4. What is the status of the Continuum Hypothesis?

A. Cantor proved it to be true.
B. Dedekind proved it to be false.
→*C*. It cannot be settled in the accepted axioms of set theory.
D. None of the above.

---

5. What was Hilbert's "bold claim" about mathematical consistency?

→*A*. If no finite logical argument about a putative mathematical object leads to a contradiction, then the object exists.

B. If a mathematical object really exists, then we must be able to construct a finite logical argument to establish this fact.

C. Some putative mathematical objects can fail to exist, even if no finite logical argument leads to a contradiction.

D. None of the above.