

QUESTIONS FOR THE FINAL EXAM

Whole Semester Questions

For each topic below, think about how this concept has evolved over time.

1. numerical representation
2. algebraic notation
3. solutions to polynomial equations
4. geometry
5. the nature of proof
6. area-under-the-curve problems, tangent lines and other calculus ideas
7. the number zero, rational and irrational numbers, negative numbers, imaginary numbers
8. trigonometry
9. probability
10. the graph of a parabola and graphs in general (I'm reference the Calculus I style graph of a function and not the vertex-edge discrete object).

From Midterm 3

1. Can you translate a problem and solution from Diophantus' **Arithmetica** into modern notation? Can you demonstrate the general technique Diophantus is attempting to communicate?
2. Can you determine whether a linear Diophantine does or does not have a solution? If it does have a solution, can you articulate the family of solutions?
3. Can you demonstrate that a cubic can be solved as the intersection of two conic sections?
4. Can you come up with examples of cubic equations with exactly one real positive solution? Three real positive solutions?
5. Describe Diophantus' algebraic notation. Elaborate on its advantages and short-comings.
6. Explain why al Khwarizmi and Khayyam solved multiple versions of quadratic and cubic equations. Elaborate on how their solutions are different from our modern solutions.
7. Describe the algebraic notation of Khwarizmi and Khayyam. (Answer: There isn't any. The only symbols in their work are symbols for integers.)
8. Describe a mathematician that influenced Khwarizmi (Khayyam) and describe a mathematician Khwarizmi (Khayyam) influenced.
9. Describe the mathematics in Liu Hui's *Nine Chapters* and *Sea Island Mathematical Manual*
10. Explain why our numerical system is called the Hindu-Arabic numerical system. Explain how it was adopted in Europe.
11. Use Cardano's formula to solve a cubic.
12. Why didn't Tartaglia not publish his solution to the cubic?
13. What was the significance of Fra Luca Pacioli's **Summa**? Cardano's **Ars Magna**?

14. What was Niels Henrik Abel's contribution to solutions to polynomial equations?
15. Describe the evolutions of planetary motion from Ptolemy, Nicolaus Copernicus, Galileo Galilei, Johannes Kepler, Tycho Brahe and Isaac Newton.
16. Describe the coordinate geometry of Rene Descartes and Pierre de Fermat. What is so important about this development? What aspects of it made it challenging to adopt? How is it different from our present version? What sort of problems were they trying to address with this new pairing of algebra and geometry?
17. Describe the calculus of Newton and Leibniz. Explain why there was a dispute about priority. Describe the strengths of each.
18. Describe what motivates early development of probability and statistics. Include specific people.
19. Describe some contributions of Leonhard Euler and Carl Friedrich Gauss.
20. Describe the development of noneuclidean geometry.