

MTH 6610 Reading Assignment #8 - Answers

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Name _____

Instructions.

Read pages 238-285 and answer the following questions.

1. In what two ways did Europeans eventually benefit from the writings of al-Khowârizmi?
Largely through his work, Europeans became familiar with ¹Hindu numerals and ²the algebraic approach to mathematics.
2. (Related to the previous question) What is the significance of the contents of the book *Book of Addition and Subtraction According to the Hindu Calculation*?
It is the earliest work in Arabic explaining the Hindu decimal system of numerals. He also introduces the symbol for (and use of) zero.
3. Relating to the solutions of quadratic equations, in what ways did the Arab mathematicians view solutions differently than their Greek predecessors?
Unlike Greek mathematicians, the Arab mathematicians recognized the irrational roots of quadratic equations. They also recognized the existence of two solutions of a quadratic equation, although they only listed the positive solutions.
4. What major advance over earlier mathematicians was made by Abu Kamil?
His use of irrational coefficients in indeterminate equations.
5. What is the significance of Thâbit's text, *Book on the Determination of Amicable Numbers*?
It is regarded as the first completely original mathematics written in Arabic.
6. What feat did Khayyam accomplish?
He was the first mathematician to solve every type of cubic equation having a positive root.
7. In what manner did Khayyam approach these problems?
The solutions were obtained graphically (geometrically).
8. What two mathematical "firsts" are contained in the text *Nine Chapters*.
 - i. The first evidence of a systematic method for solving simultaneous linear equations
 - ii. The first accepted use of negative numbers
9. After the collapse of the Western Roman Empire, what accounted for the preservation of the knowledge of the Ancients?
The Christian Church (largely through the monastic system). It alone had the organization, dedication, and the educated men needed.

10. Besides the institution referred to in the previous question, what other source contributed to the preservation of knowledge during the “Dark ages?”

Royal support – most notably King Charlemagne.

11. Whom did Charlemagne employ to promote learning in the Dark Ages?

Alcuin of York. He ordained that every abbey and monastery have its own school and that they teach arithmetic, geometry, astronomy, music, grammar, rhetoric, and logic. He also wrote elementary textbooks for these subjects.

12. What brought an end to the revival of knowledge, begun by Charlemagne?

Barbarian invasions - specifically by the Vikings from the North, Magyars from the East, and Saracens from the South. The waves of Viking invasions continued for about 200 years. With no strong successors to Charlemagne, the empire was unable to quash the invaders and preserve the united infrastructure needed to maintain the order necessary to foster the educational campaign begun by Charlemagne.

13. What was the Arabs’ greatest contribution to European mathematics?

They translated, into their own language, available Greek manuscripts – “the science of the Greeks,” thus preserving this knowledge for future generations.

14. What would logically be considered Gerard of Cremona’s greatest contribution to European mathematics?

He is credited with translating at least 90 complete scientific texts from Arabic into Latin – most notably Archimedes’ *Measurement of a Circle*, Appolonius’ *Conic Sections*, and al-Khowârizmi’s works on algebra.

15. What is known of Fibonacci’s background?

Fibonacci (a.k.a. “Leonardo of Pisa”) was born in Pisa c. 1175 and educated in North Africa where his father was in charge of a customs house. He travelled extensively throughout the countries of the Mediterranean as a young man, studying the arithmetic systems used in the commerce of the different countries. During his travels, he recognized the advantages of the Hindu-Arabic number system with its positional notation and symbol for zero.

Remark: Again, note this recurring theme: Extensive travel (especially during their younger years) was a major factor in the mathematical and personal development of many a prodigious mathematician throughout history.

16. What main contribution was made by Fibonacci in his text *Liber Abaci*?

In this text, he explained the enormous advantages of the Hindu-Arabic number system.

17. With what topic does Fibonacci’s text *Liber Quadratorum* deal exclusively?

Liber Quadratorum deals exclusively with the solution of Diophantine Equations of the second degree.