

**Final Exam – Ch. 1 - 11 plus Student Projects**

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**True / False.** Circle T if the statement is always true and F if the statement is sometimes false.

1. T      F      There is evidence that the Babylonians understood how to calculate exponentials as long ago as 300 AD.
2. T      F      Thales is the first mathematician discussed by his name in the history of mathematics.
3. T      F       $\pi$  is an algebraic number.
4. T      F      Euclid's *Elements* was meant to be a complete reference for all known plane and solid geometry at the time.
5. T      F      Archimedes was killed during the sacking of Syracuse by a soldier who didn't know who he was.
6. T      F      Descartes first used the term "imaginary numbers" to indicate that he didn't believe that complex numbers existed.
7. T      F      Fermat's last theorem was written in the margins of one of his books, and took more than 350 years to prove.
8. T      F      Newton was a mathematical prodigy from the age of 8.
9. T      F      Newton was knighted by Queen Anne in 1705 and was the first scientist to be knighted.
10. T      F      Before Leibniz died in 1716, the Royal Society had cleared him of any wrongdoing in the priority dispute over the calculus.

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**Multiple Choice.** Circle the letter corresponding to the best answer for each of the following questions.

11. Which of the following describes the Hindu-Arabic numeral system?
  - A. simple grouping system
  - B. multiplicative grouping system
  - C. ciphered numeral system
  - D. positional numeral system

12. Which of these is **not** one of the reasons the agricultural revolution allowed more scientific and mathematical advances than the stone age?
- A. Need for new technologies
  - B. Development of war
  - C. Sedentary lifestyle
  - D. Creation of leisure time
  - E. New forms of political organization
13. Which of the following is **not** one of the beliefs of the Pythagorean society?
- A. At its deepest level, reality is mathematical in nature.
  - B. The souls of the dead might appear on Earth again, not only as a new human, but also animals.
  - C. The study of numbers and numerical relationships, and of sounds and harmonic relationships leads to personal perfection.
  - D. The soul is finite, and is only allowed a certain number of lifetimes.
  - E. Certain symbols have a mystical significance.
14. Which of the following is **not** one of Euclid's postulates?
- A. Any two points can be joined by a straight line.
  - B. Any curve can be extended indefinitely.
  - C. Given any straight line segment, a circle can be drawn having the segment as radius and one endpoint as center.
  - D. All right angles are congruent.
  - E. If two lines intersect a third in such a way that the sum of the inner angles on one side is less than two right angles, then the two lines inevitably must intersect each other on that side if extended far enough.
15. The number 20 is
- A. perfect.
  - B. deficient.
  - C. abundant.
  - D. amicable.
  - E. transcendental.

16. Which of the following is **not** mentioned to be one of Archimedes' inventions?
- A. Archimedes' Claw
  - B. burning mirrors
  - C. Archimedes' Screw
  - D. Archimedes' Hammer
  - E. All of the above were inventions of Archimedes.
17. Which of the following is **not** a precursor of the word "sine"?
- A. the Arabic word "ardhā-jyā," meaning "half-chord"
  - B. the Arabic word "jyā-ardhā," meaning "chord half"
  - C. the Arabic word "jiba," meaning "inland water"
  - D. the Latin word "sinus," meaning "cove" or "bay"
  - E. the Arabic word "jaib," meaning "cove" or "bay"
18. Which of the following mathematicians was punished by the church for heresy?
- A. Galileo
  - B. Cardano
  - C. Tartaglia
  - D. Oresme
  - E. None of the above.
19. Which of the following is a complete list of the ancient wonders of the world?
- A. The Great Pyramid, The Lighthouse of Alexandria, The Colossus of Rhodes, The Temple of Artemis at Ephesus, The Statue of Zeus at Olympia, The Mausoleum of Mausollos, and The Hanging Gardens of Babylon
  - B. The Lighthouse of Alexandria, The Colossus of Rhodes, The Temple of Artemis at Ephesus, The Statue of Zeus at Olympia, The Mausoleum of Mausollos, and The Hanging Gardens of Babylon
  - C. The Great Pyramid, The Colossus of Rhodes, The Temple of Artemis at Ephesus, The Statue of Zeus at Olympia, and The Hanging Gardens of Babylon
  - D. The Lighthouse of Alexandria, The Colossus of Rhodes, The Statue of Zeus at Olympia, The Mausoleum of Mausollos, and The Hanging Gardens of Babylon
  - E. None of the above.

20. Which of the following is **not** one of the effects Hitler had on mathematics and science?

- A. the movement of German and Jewish scientists to the United States
- B. the development of German and American rocketry
- C. the development of operations research
- D. the development of the theory of relativity
- E. None of the above.

21. Which of the following did da Vinci provide a solution to?

- A. trisecting an angle
- B. doubling the cube
- C. squaring the circle
- D. triangulating the square
- E. None of the above.

22. Which of the following is **not** one of Thomas Simpson's contributions to mathematics?

- A. Simpson's rule
- B. Probability theory
- C. Laws of chance
- D. Elliptical geometry
- E. None of the above.

**Short Answer.** Answer each of the following questions. Show all work and explain your reasoning to receive full credit.

23. (a) Convert  $(3568)_6$  into base 10.  
(b) Convert  $(625)_{10}$  into base 7.  
(c) Calculate  $(1234)_6 + (345)_6$ .
24. (a) What is a unit fraction?  
(b) Are fraction decompositions into unit fractions unique? Explain your answer and give an example to justify your conclusion.
25. (a) State the Pythagorean Theorem, including all hypotheses.  
(b) Give Garfield's proof of the Pythagorean Theorem.
26. (a) Find the  $\gcd(1085, 560)$ . Show all steps and explain your work.  
(b) What is the name of the algorithm you used to answer part (a)?  
(c) Find  $p$  and  $q$  so that  $\gcd(1085, 560) = 1085p + 560q$
27. Use the Sieve of Eratosthenes to find all prime numbers less than 90. Explain your steps.
28. Solve the following problem: Repeatedly divided by 3, the remainder is 2; repeatedly divided by 5, the remainder is 3; and repeatedly divided by 7, the remainder is 2. What is the number? Explain your work.
29. Prove that there are an infinite number of prime numbers.
30. Prove that if  $a + b$  is divisible by 7, then  $aba$  is divisible by 7.