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

1. T F The agricultural revolution allowed for more mathematical advances than the stone age in part because of the sedentary lifestyle that it allowed.
2. T F The ancient Babylonians knew how to find the area of an arbitrary triangle.
3. T F The ancient Babylonians had a formula for the sum of a finite geometric series.
4. T F There were two groups Pythagoreans - the mathematikoi and the akousmatics.
5. T F Pythagoras is the first mathematician mentioned by name in history.
6. T F The Pythagoreans believed in reincarnation.

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

7. Thales of Miletus is credited with proving all of the following facts, **except**:
 - A. A circle is bisected by its diameter.
 - B. The base angles of an isosceles triangle are equal.
 - C. Vertical angles are equal.
 - D. An angle inscribed in a semicircle is a right angle.
 - E. none of the above.
8. The number 20 is
 - A. deficient
 - B. abundant
 - C. perfect
 - D. none of the above.

9. Which of the following is not one of Archimedes' inventions?
- A. Archimedes' claw
 - B. The Burning Mirror
 - C. Archimedes' screw
 - D. none of the above.

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

10. (a) Convert $(652)_8$ into base 10.
(b) Convert $(457)_{10}$ into base 4.
(c) Calculate $(1234)_7 \cdot (345)_7$.
11. (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.
(c) Using the relation $\frac{1}{n} = \frac{1}{n+1} + \frac{1}{n(n+1)}$, show that when n is odd, this leads to a representation of $\frac{2}{n}$ as a sum of 2 unit fractions.
12. Show that 1184 and 1210 are amicable.
13. (a) State the Pythagorean Theorem, including all hypotheses.
(b) Give a proof of the Pythagorean Theorem.
14. A quantity, its $\frac{2}{3}$, its $\frac{1}{2}$, and its $\frac{1}{7}$, added together, become 33. Use the rule of false position to find the quantity.
15. (a) Describe the hexagonal numbers.
(b) Give a formula for the n -th hexagonal number.
(c) Show geometrically that any oblong number is twice a triangular number.
16. Prove that $\sqrt{7}$ is irrational.
17. Prove the product of a rational number and an irrational number is irrational.