Algebra I Written Test

2025 James Clemens Math Tournament

1. You have 90 minutes to complete this exam.
2. This exam consists of 25 multiple-choice questions and 3 free-response questions used as tie-breakers. The multiple-choice questions are each worth 4 points if answered correctly and no points if left unanswered. 1 point will be deducted for each incorrect answer. The free-response questions are each worth 0.1 point if answered correctly, and no points if answered incorrectly or left unanswered. The maximum score for this test is 100.3 points.
3. Calculators, books, and other aides are prohibited during this examination. Scratch paper will be provided for calculations. Diagrams are not necessarily drawn to scale.
4. Mark your answers to the questions in the provided ZipGrade form. You may use the test booklets for scratch work, but only answers marked in the ZipGrade form will be counted. If you require additional scratch paper, simply raise your hand and a volunteer will assist you.
5. In the event of a tie, answers will be evaluated backwards starting from question 25 to determine a winner.
6. Although this math tournament is intended to demonstrate your knowledge and skills in math, it is also a great opportunity for you to interact with your fellow peers, so be sure to enjoy yourself and have fun!

DO NOT TURN THE PAGE UNTIL TOLD TO DO SO

1. Evaluate $3 + \dfrac{10}{3 + \frac{10}{\cdots}}$.

(A) 5 (B) 7 (C) 9 (D) 11 (E) NOTA

2. A circle with area 16π is inscribed in a triangle with perimeter 14. What is the area of the triangle?

(A) 14 (B) 28 (C) 42 (D) 56 (E) NOTA

3. How many ways are there to arrange students 1 through 7 such that no two even or odd students stand next to each other?

(A) 72 (B) 144 (C) 216 (D) 288 (E) NOTA

4. How many factors does 2025 have?

(A) 13 (B) 14 (C) 15 (D) 17 (E) NOTA

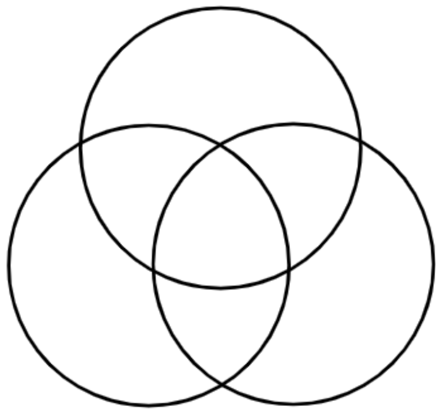
5. What is the probability that out of 10 coin flips, 3 are heads?

(A) $\dfrac{5}{32}$ (B) $\dfrac{5}{16}$ (C) $\dfrac{15}{64}$ (D) $\dfrac{15}{128}$ (E) NOTA

6. Evaluate: $6 + \sqrt{6 + \sqrt{6 + \dots}}$.

(A) 4 (B) 6 (C) 8 (D) 9 (E) NOTA

7. The corners of the small central region are the centers of the three unit circles in the Venn Diagram below. The area of this region can be expressed $\dfrac{a\pi - b\sqrt{3}}{2}$, where a and b are positive integers. Find $a + b$.



(A) 2 (B) 5 (C) 6 (D) 8 (E) NOTA

8. What is the sum of the roots of $-x^3 + 3x^2 + 2x - 6$?

(A) 2 (B) 3 (C) 6 (D) 12 (E) NOTA

9. Ryan has 4 white, 5 red, and 7 blue marbles in a bag. How many will he need to draw blindly to be sure he has drawn 5 marbles of the same color?

(A) 5 (B) 7 (C) 10 (D) 12 (E) NOTA

10. Solve for x: $\sqrt{3^{x+1}} + (3^5 - 15^2) = 99$

(A) 1 (B) 2 (C) 5 (D) 7 (E) NOTA

11. The probability that it takes 5 flips for a coin to land heads is $\frac{a}{b}$, where a and b are relatively prime, positive integers. Find $b - a$.

(A) 15 (B) 31 (C) 63 (D) 127 (E) NOTA

12. If $f(x) = x^2 + 4$ and $g(x) = x - 3$, for what positive value of x will $f(g(x)) = 20$?

(A) 7 (B) 9 (C) 11 (D) 13 (E) NOTA

13. A right triangle has legs of length 8 and 15. The length of the shortest altitude can be expressed in the form $\frac{a}{b}$, where a and b are relatively prime, positive integers. Find $a + b$.

(A) 77 (B) 137 (C) 197 (D) 257 (E) NOTA

14. If it is currently 1 o'clock, the number of minutes that will pass before the hour and minute hands coincide can be written as $\frac{a}{b}$, where a and b are relatively prime, positive integers. Find $a + b$.

(A) 51 (B) 71 (C) 91 (D) 111 (E) NOTA

15. What is the most likely sum resulting from rolling two six-sided dice?

(A) 5 (B) 6 (C) 7 (D) 8 (E) NOTA

16. What is 507 written in base 8?

(A) 327 (B) 512 (C) 773 (D) 793 (E) NOTA

17. A toddler has a practice archery set at home in which the target is made up of two concentric circles: a small circle and a large circle with double its radius. What is the probability that the toddler hits the outer ring twice in a row?

(A) $\frac{4}{9}$ (B) $\frac{1}{2}$ (C) $\frac{9}{16}$ (D) $\frac{5}{8}$ (E) NOTA

18. Johnny is walking through a straight road in his neighborhood, with mailboxes spaced equally apart at 5 meters. Assuming a constant pace, which of the following is the time, in seconds, that it takes Johnny to pass x mailboxes traveling at x kilometers per hour?

(A) 18 (B) 20 (C) 22 (D) 24 (E) NOTA

19. What is the sum of all numbers in the arithmetic sequence $-47, -44, -41, ..., 25$?

(A) -275 (B) -290 (C) -305 (D) -320 (E) NOTA

20. Convert the repeating decimal to a fraction: $0.\overline{693}$

(A) $\frac{7}{11}$ (B) $\frac{77}{111}$ (C) $\frac{777}{1111}$ (D) $\frac{8}{13}$ (E) NOTA

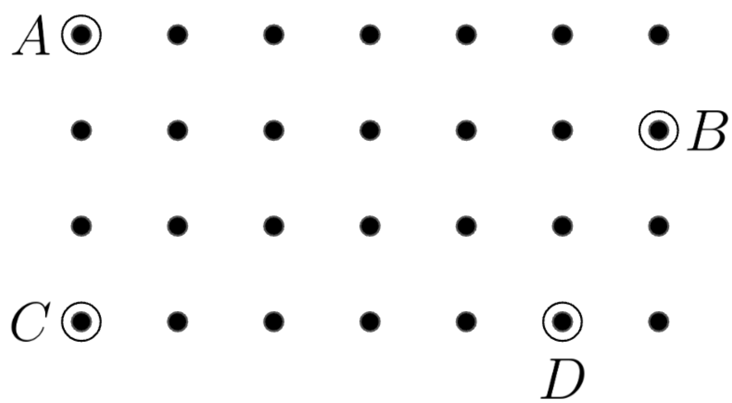
21. What is the area between the x-axis and the function $-|x|+4$?

(A) 16 (B) 24 (C) 32 (D) 64 (E) NOTA

22. Kylie wants to form a rectangle with the largest possible area using a string of length 56. What is this area?

(A) 180 (B) 187 (C) 196 (D) 210 (E) NOTA

23. In a 7×4 array of lattice points, each point is one unit apart from the next. How many units above point C does the intersection of lines AD and BC lie?



(A) $\frac{13}{14}$ (B) $\frac{15}{14}$ (C) $\frac{17}{14}$ (D) $\frac{19}{14}$ (E) NOTA

24. For what value of a does the system of equations have no solution?

$$7x = 2y - 3$$
$$4y = ax - 5$$

(A) 14 (B) 21 (C) 28 (D) 35 (E) NOTA

25. x is $y\%$ of y, and y is $z\%$ of z. What is $\sqrt{x}$ if $z = 30$?

(A) 1 (B) 2 (C) 3 (D) 4 (E) NOTA

TB1. A cylindrical glass of height 10 and radius 1 is filled halfway with water. An ice sphere with equal radius is dropped in. If the ratio of the new height to the old height of water can be written as $\frac{a}{b}$, where $a$and b are relatively prime, positive integers, find $a + b$.

TB2. John and Jane run at equal speeds on a circular track. The track has a thickness of 5 and a diameter of 50 with respect to the inner edge. If John and Jane run on the outer and inner tracks respectively, the ratio of their lap times can be written in the form $\frac{a}{b}$, where a and b are relatively prime, positive integers. Find $a + b$.

TB3. A perfect number is equal to the sum of its factors. Find the sum of all perfect numbers under 50.