

ALGEBRA I TOPIC TEST – EUCLIDEAN LEVEL
2000 Mu Alpha Theta National Convention

1. Solve for x : $2x - 17 = 33$
A. 8 B. 15 C. 25 D. 48 E. NOTA

2. Judy runs a 25 mile distance, and her average running speed for the first five miles is 10 mph, for the next 5 miles is 8 mph, then 6, 4, and 2 mph for each of the next three lengths of 5 miles each. Which is true about her average running speed for the entire 25 miles?
A. it is faster than 6 mph B. it is slower than 6 mph
C. it is exactly 6 mph D. it cannot be determined E. NOTA

3. Solve for y : $3y^2 = 27$
A. 3 B. $2\sqrt{6}$ C. $\sqrt{30}$ D. 9 E. NOTA

4. If $3x + 5y = 7$ and $6x - 4y = 7$, then what is the value of $x - y$?
A. 1 B. 2 C. 3 D. 4 E. NOTA

5. Find the sum of all values of x which satisfy the equation $\frac{9}{x} + \frac{5}{x^2} = 2$.
A. $-\frac{9}{2}$ B. $-\frac{5}{2}$ C. $\frac{5}{2}$ D. $\frac{9}{2}$ E. NOTA

6. The sum of the squares of two consecutive even integers is 5204. What is the product of these integers?
A. 2208 B. 2400 C. 2600 D. 2808 E. NOTA

7. What is the remainder when $3x^4 + 2x^2 - 5x + 1$ is divided by $x + 2$?
A. -5 B. 23 C. 47 D. 67 E. NOTA

8. A circle has a diameter with endpoints $(10, 3)$ and $(4, -4)$. What is the length of the radius to the nearest tenth?
A. 4.4 B. 4.5 C. 4.6 D. 4.7 E. NOTA

9. Simplify: $(2\sqrt{3} - 5)^2$
A. -13 B. 49 C. $11 - 20\sqrt{3}$ D. $37 - 20\sqrt{3}$ E. NOTA

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10. If y varies directly as x^2 and inversely as $\sqrt[3]{p}$, and $y = \frac{4}{9}$ when $x = 4$ and $p = 27$, then what is y when $p = 216$ and $x = -6$?
- A. $-\frac{1}{6}$ B. $\frac{9}{4}$ C. $\frac{9}{2}$ D. 6 E. NOTA
11. How many positive integers satisfy the inequality $12 \leq 6x + 12 < 43$?
- A. 5 B. 6 C. 7 D. 8 E. NOTA
12. The decimal $\overline{.851}$ can be written as a fraction $\frac{F}{G}$ in lowest terms where F and G are positive integers. What is $F + G$?
- A. 1650 B. 1750 C. 1850 D. 1950 E. NOTA
13. A student uses a compass to draw a circle with radius 4 cm around a point. She then draws around the same center a circle which is 1 cm longer than the first circle. How many centimeters apart are the circles?
- A. $\frac{1}{2}$ B. $\frac{1}{2\pi}$ C. 1 D. $\frac{1}{\pi}$ E. NOTA
14. What is the total surface area of a rectangular prism with length 6, width 8, and height 10?
- A. 280 B. 376 C. 444 D. 480 E. NOTA
15. A circle is simultaneously circumscribing one square and inscribed inside another square. If the length of a side of the larger square is x , what is the area of the smaller square?
- A. $\frac{x^2}{2}$ B. $\frac{x^2\sqrt{2}}{2}$ C. $\frac{x^2}{4}$ D. $\frac{x^2\sqrt{2}}{4}$ E. NOTA
16. A quadrilateral with vertices (a, b) , (c, b) , $(c + d, e)$, and (d, e) is most specifically a
- A. rhombus B. trapezoid C. parallelogram D. quadrilateral E. NOTA
17. Which of the following sets are closed under the operation given?
- I. $\{-1, 0, 1\}$, multiplication
 II. \mathcal{R} , division
 III. the set of natural numbers, \otimes (where $a \otimes b = (a + 1)(b - 1)$ for natural numbers a and b)
- A. I only B. I, II only C. I, III only D. I, II, and III E. NOTA
18. What value(s) of k will give the equation $3x^2 - kx + 13 = 0$ one unique solution?
- A. $2\sqrt{39}$ B. $\pm 2\sqrt{39}$ C. $\sqrt{78}$ D. $\pm\sqrt{78}$ E. NOTA

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19. Which of the following statements is NOT true?
- A. All functions are relations.
B. If (a, b, c) is a Pythagorean triple, then (ma, mb, mc) is also a Pythagorean triple for any positive number m .
C. Every polynomial is a rational expression.
D. The empty set is a subset of every set.
E. NOTA
20. Gail is $\frac{8}{9}$ as old as Wendy. Nine years ago, Gail was $\frac{5}{6}$ as old as Wendy. What is the sum of their ages now?
- A. 33 B. 39 C. 45 D. 51 E. NOTA
21. If P is the GCF of $12x^3$ and $8x$, and Q is the LCM of $10x^2$ and $15x^3$, then what is the product of the GCF of P and Q and the LCM of P and Q ? (Assume x is a positive integer)
- A. $60x^3$ B. $60x^4$ C. $120x^3$ D. $120x^4$ E. NOTA
22. What is the sum of all values of x which satisfy $|6x + 3| = |2x + 5|$?
- A. -1 B. $-\frac{1}{2}$ C. $\frac{1}{2}$ D. 1 E. NOTA
23. What is the sum of the digits of the second-smallest positive multiple of 5 which leaves a remainder of 1 when divided by 2, 3, or 4?
- A. 7 B. 9 C. 11 D. 13 E. NOTA
24. Let $p =$ the degree of $x^4y - 3xyz^2 + 6x^2y^2$
Let $q = \left(\frac{2x^2-x}{6x^2+x-2}\right)\left(\frac{3x^2-x-2}{5x^2-x}\right)\left(\frac{10x^2+3x-1}{2x^2-x-1}\right)$
Let $r = \frac{3^{n+1} - 3^{n-1}}{3^n}$
What is the value of $\frac{r-q}{p}$?
- A. $\frac{1}{3}$ B. $\frac{1}{5}$ C. $\frac{7}{15}$ D. $\frac{5}{12}$ E. NOTA
25. A student's test scores before the final exam are 86, 89, 79, 84, and 94. If the final exam counts triple a normal test score, what must the student score on the final to average 90?
- A. 93 B. 94 C. 95 D. 96 E. NOTA
26. Which of the following points is also contained on the line containing $(1, -3)$ and $(-2, -5)$?
- A. $(-98, -65)$ B. $(-101, -65)$ C. $(-98, -71)$ D. $(-101, -71)$ E. NOTA

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27. How many positive integral factors does the number 5040 have?
- A. 48 B. 60 C. 64 D. 72 E. NOTA
28. If $\frac{1}{\sqrt{3} + \sqrt{5} + \sqrt{7}} = \frac{K\sqrt{3} + L\sqrt{5} + M\sqrt{7} + N\sqrt{105}}{59}$, what is $K + L + M + N$?
- A. 11 B. 13 C. 17 D. 19 E. NOTA
29. A tank is attached to 3 pumps which pump water in and 1 drain which takes water out. Each pump can independently fill an empty tank in 10, 15, and 20 minutes respectively, and the drain can empty a full tank in 5 minutes. If the 3 pumps and the drain are turned on simultaneously, how long will it take to fill the tank?
- A. 40 minutes B. 50 minutes C. 60 minutes D. 75 minutes E. NOTA
30. Bonnie waits for a bus to arrive at the bus stop at its usual time of 2:00. At 2:05, when the bus did not arrive, Bonnie decides to start walking home. The bus arrived at 2:10 at the stop, travelled the same path Bonnie did, and passed Bonnie on her way home at 2:15. Assuming Bonnie and the bus move uniformly throughout, and Bonnie arrives home at 2:45, what time did the bus pass her house?
- A. 2:25 B. 2:30 C. 2:35 D. 2:40 E. NOTA