

2000 FAMAT STATE CONVENTION
THETA INDIVIDUAL TEST

1. Solve for q : $6 + 3q = 27$

- A. 4 B. 7 C. 11 D. 21 E. NOTA

2. Denis is standing at point p . He walks 60 yards east, then 80 yards north. How many feet is Denis from point p ?

- A. 100 B. 140 C. 300 D. 420 E. NOTA

3. What is $x + y$ if $3x - y = 1$ and $7x + 2y = 50$?

- A. -15 B. -7 C. 7 D. 15 E. NOTA

4. What is the units' digit of $7^{2000} + 8^{2000}$?

- A. 3 B. 5 C. 7 D. 9 E. NOTA

5. What is the domain of the function $f(x) = \frac{1}{x} + \sqrt{x+2}$?

- A. $[-2, 0) \cup (0, \infty)$ B. $(-2, 0) \cup (0, \infty)$ C. $[-2, \infty)$
D. $(-2, \infty)$ E. NOTA

6. If the graph of the equation $y = ax^2 + bx + c$, where a , b , and c are integers, is tangent to the x -axis, then the roots of the equation $ax^2 + bx + c = 0$ are

- A. real, rational, and equal B. real, rational, and unequal
C. real and irrational D. imaginary
E. NOTA

7. The numbers 606 and 1560 are base-7 numerals whose GCF in base 7 is

- A. 6 B. 18 C. 30 D. 42 E. NOTA

8. Which of the following points is one-fourth the distance from $(6, -3)$ to $(-10, 1)$?

- A. $(2, -2)$ B. $(2, 0)$ C. $(-6, -2)$
D. $(-6, 0)$ E. NOTA

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9. What is the sum of all values of x which satisfy the equation $x^{\frac{1}{3}} + x^{\frac{2}{3}} = 6$?
- A. -35 B. -19 C. 19 D. 35 E. NOTA
10. The graph of $y^2 = x^2 + 4$ is which of the following?
- A. circle B. ellipse C. hyperbola
D. parabola E. NOTA
11. How many even positive integer factors of 126000 are NOT multiples of 6?
- A. 40 B. 56 C. 96 D. 120 E. NOTA
12. Let $f(x) = x^2 - 8x$. What is the sum of all values for x which satisfy $f(f(x)) = f(x)$?
- A. 0 B. 8 C. 16 D. 18 E. NOTA
13. Let $*$ be an operation with the following properties:
- $$p*q = 3p + \frac{4}{q} - (p*2q) \quad \text{when } q \leq 1000$$
- $$p*q = 0 \quad \text{when } q > 1000$$
- What is the value of $3*4$?
- A. $\frac{21}{32}$ B. $\frac{43}{64}$ C. $\frac{85}{128}$ D. $\frac{169}{256}$ E. NOTA
14. Which of the following triangles below have the same area?
- X. equilateral triangle with side length 6
Y. right triangle with legs measuring $3\sqrt{2}$ and $3\sqrt{6}$
Z. triangle with vertices $(1, 2)$; $(-2, 3)$; and $(0, \frac{7}{3} - 6\sqrt{3})$
- A. X, Y B. X, Z C. Y, Z
D. X, Y, and Z E. NOTA
15. If the harmonic mean of 6 and 12 is multiplied by the arithmetic mean of 6 and 12 and then divided by the square of the geometric mean of 6 and 12, the result is
- A. 1 B. 2 C. 3 D. 4 E. NOTA

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16. If $z = \sqrt{p + \sqrt{p + \sqrt{p + \dots}}}$ and $z - 1 = \sqrt{q - \sqrt{q - \sqrt{q - \dots}}}$ for positive integers p , q , and z , then

- A. $p > q$ B. $p < q$ C. $p = q$
D. there is not necessarily a relationship between p and q E. NOTA

17. Simplify by rationalizing the denominator: $\frac{1}{3 + \sqrt{2} + i}$, where $i = \sqrt{-1}$.

- A. $\frac{4 - \sqrt{2}}{12} + \frac{\sqrt{2} - 2}{12}i$ B. $\frac{4 - \sqrt{2}}{12} - \frac{\sqrt{2} - 2}{12}i$ C. $-\frac{4 - \sqrt{2}}{12} + \frac{\sqrt{2} - 2}{12}i$
D. $-\frac{4 - \sqrt{2}}{12} - \frac{\sqrt{2} - 2}{12}i$ E. NOTA

18. Which of the following polynomials has a degree of 4?

- A. $x^3 + 4x^2 - 6x + 1$ B. $xyz + w$ C. $18x + \pi^4$
D. $x^5 + x^4 + 2$ E. NOTA

19. $\sqrt{35 + 14\sqrt{6}} = \sqrt{X} + \sqrt{Y}$, where X and Y are positive integers and $X < Y$. What is the value of $Y - X$?

- A. 1 B. 3 C. 5 D. 7 E. NOTA

20. If y varies inversely as p^2 and directly as x , and $y = 30$ when $x = 10$ and $p = 3$, then find x when $y = 46$ and $p = 13$. Round x to two decimal places.

- A. 7.35 B. 233.22 C. 287.93
D. 1018.81 E. NOTA

21. Laura has 24 gallons of an alcohol/water solution which is 30% alcohol. How many gallons of water should she add to her solution to then have a solution which is 8% alcohol?

- A. 58 B. 66 C. 74 D. 82 E. NOTA

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22. What is the distance between $1 + 2i$ and $3 - i$ on the complex plane?
- A. $\sqrt{5}$ B. $\sqrt{10}$ C. $\sqrt{10} - \sqrt{5}$
D. $\sqrt{13}$ E. NOTA
23. When K , a positive integer, is divided by 5, there is a remainder of 1. When K is divided by 6, there is a remainder of 2, and by 7, a remainder of 3. What is the sum of the digits in the second-smallest possible value for K ?
- A. 8 B. 9 C. 10 D. 11 E. NOTA
24. Which of the following is NOT true about Pascal's Triangle?
- A. The sum of the numbers in the n th row is 2^{n-1} (where the first row is the single term 1).
B. One of the diagonals contains only pentagonal numbers.
C. Each row read across represents consecutive powers of 11.
D. The numbers in each row are coefficients in binomial expansion.
E. NOTA
25. A rubber ball is dropped from a height of 1000 ft. When the ball hits the ground, it rebounds to $\frac{4}{5}$ of its original height. What is the total distance the ball travels?
- A. 1800 ft. B. 5000 ft. C. 8000 ft. D. 9000 ft. E. NOTA
26. If $\log m = W$, $\log n = X$, $\log p = Y$ and $\log q = Z$, then which of the following is equivalent to $\log \frac{mn^3}{p^2q}$?
- A. $3WX - 2Y - Z$ B. $W + 3X - 2Y - Z$ C. $\frac{W+3X}{Y^2+Z}$
D. $\frac{W+3X}{2Y+Z}$ E. NOTA
27. If \sqrt{J} = the perimeter of an equilateral triangle inscribed in a circle with radius 16, and \sqrt{K} = the perimeter of a square inscribed in the same circle, what is the value of $K - J$?
- A. 1280 B. 1820 C. 2180 D. 2810 E. NOTA

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28. A bag contains 5 red, 4 green, and 6 blue marbles. Aleisha reaches in the bag without looking and pulls out 2 marbles. What are the odds against both marbles being blue?

- A. 6 : 1 B. 6 : 7 C. 7 : 1 D. 7 : 6 E. NOTA

29. Which of the following is equivalent to : $[(\sim p \vee \sim q) \rightarrow p] \leftrightarrow (q \wedge \sim p)$

- A. p B. $\sim p$ C. $p \wedge q$ D. $p \vee q$ E. NOTA

30. How many distinct values of x are there for the equation $\begin{vmatrix} x & 1 & 1 \\ 1 & x & 1 \\ 1 & 1 & x \end{vmatrix} = 0$?

- A. 0 B. 1 C. 2 D. 3 E. NOTA