

FAMAT Algebra II Individual Test
January 2001 Regional

Answer "E. NOTA" means "none of the above."

1. The ratio of 2 numbers is $1:\sqrt{2}$. Their sum is 1.
Find the larger number.

A. $1 + \sqrt{2}$
B. $2 + \sqrt{2}$
C. $-1 + \sqrt{2}$
D. $2 - \sqrt{2}$
E. NOTA

2. Solve: $\frac{1}{2}x + \frac{1}{4} = \frac{1}{3}x + \frac{1}{5}$

A. $-\frac{3}{10}$
B. $\frac{3}{50}$
C. $\frac{3}{10}$
D. $\frac{27}{50}$
E. NOTA

3. Given $f(x) = \begin{cases} -x + 2, & \text{if } x > 0 \\ 5, & \text{if } x = 0 \\ x - 3, & \text{if } x < 0 \end{cases}$

Find $f(2) - f(0) + f(-2)$

A. -10
B. 4
C. 8
D. 10
E. NOTA

4. Find x if $\log_2(x+1) + \log_2(x-1) = 3$.

A. ± 3
B. ± 1
C. -3
D. 8
E. NOTA

5. Solve over the real numbers:

$$\sqrt{2x+7} - x = 2$$

A. no solution
B. $\{-3, 1\}$
C. $\{0\}$
D. $\{1\}$
E. NOTA

6. If -1 is a solution of $x^2 + bx - 3 = 0$,
the other solution is

A. $\frac{2}{b}$
B. -3
C. -2
D. 3
E. NOTA

7. Find the value of $x + y + z$.

$$3x - 4y + z = -7$$

$$2x + 2y - 3z = 12$$

$$-x + 3y + 2z = 1$$

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

8. Where defined, $\frac{1}{x-1} + \frac{1}{x^2-1} + \frac{1}{x^3-1} =$

A. $\frac{x^2 + x + 1}{x^3 - 1}$
B. $\frac{x^3 + 3x^2 + 4x + 3}{(x+1)(x^3-1)}$
C. $\frac{x^3 + 3x^2 + 4x + 3}{(x-1)(x^3-1)}$
D. $\frac{3}{x^3 + x^2 - 3}$
E. NOTA

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9. $i = \sqrt{-1}$. If $2i$ is a root of $x^4 + 7x^3 + 13x^2 + 28x + 36 = 0$, another root is

A. $\frac{-7 + \sqrt{13}}{2}$

B. $\frac{-5 + \sqrt{3}}{2}$

C. $\frac{6 + \sqrt{11}}{4}$

D. $\frac{2 + 3i}{2}$

E. NOTA

10. For an appropriate value of k , one root of the equation $2x^2 - 7x + k = 0$ is one less than twice the other root. One of these roots is

A. -2

B. 2

C. $\frac{5}{2}$

D. $\frac{8}{3}$

E. NOTA

11. The expression $1 - \frac{1}{1 + \sqrt{3}} + \frac{1}{1 - \sqrt{3}}$ equals

A. $-\sqrt{3}$

B. 1

C. $\sqrt{3}$

D. $1 + \sqrt{3}$

E. NOTA

12. Simplify: $\left(\sqrt[3]{\sqrt[6]{a^9}}\right)^4 \left(\sqrt[6]{\sqrt[3]{a^9}}\right)^4$

A. a^4

B. a^8

C. a^{12}

D. a^{16}

E. NOTA

13. If $xy = b$ and $\frac{1}{x^2} + \frac{1}{y^2} = a$, then $(x + y)^2 =$

A. $(a + 2b)^2$

B. $a^2 + b^2$

C. $b(ab + 2)$

D. $ab(b + 2)$

E. NOTA

14. Solve over the reals: $x^3 + x^2 - 2x \leq 0$.

A. $(-\infty, -2] \cup [0, 1]$

B. $[-2, 0] \cup [1, \infty)$

C. $(-\infty, -2)$

D. $[0, \infty)$

E. NOTA

15. If $i^2 = -1$, then $(1 + i)^6 - (1 - i)^6 =$

A. -64

B. $-64i$

C. $-16i$

D. 0

E. NOTA

16. Solve the inequality $\frac{x}{3} - \frac{5}{9}(x - 1) < 3$.

A. $x < -16$

B. $x > -6$

C. $x < -11$

D. $x > -11$

E. NOTA

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17. The graph of $y = \log x$
- A. intersects all lines perpendicular to the x -axis
 - B. intersects the x -axis
 - C. intersects neither axis
 - D. intersects all circles whose center is at the origin
 - E. NOTA
18. Find the coefficient of the third term for the expansion of $(x - 5y)^6$.
- A. -375
 - B. 25
 - C. 375
 - D. 1025
 - E. NOTA
19. $\log 5 = a$, $\log 3 = b$, find $\log 135$ in terms of a and b .
- A. $a + 3b$
 - B. ab^3
 - C. $3ab$
 - D. $\frac{1}{3}ab^3$
 - E. NOTA
20. If $f(a) = a^3 + 4$ and $h(a, b) = b^2 + 2ab + a$, then $h(3, f(-2)) =$
- A. -5
 - B. 0
 - C. 19
 - D. 24
 - E. NOTA
21. If x is a positive number, the absolute value of the difference of the solutions of $2\sqrt{x} + 2x^{-\frac{1}{2}} = 5$ is
- A. ϕ
 - B. $3\frac{3}{4}$
 - C. $2\frac{1}{2}$
 - D. $1\frac{1}{2}$
 - E. NOTA
22. The simplified form of $1 - \frac{1}{2 - \frac{x}{1+x}}$ is
- A. $\frac{1-2x}{2-x}$
 - B. $\frac{1}{2+x}$
 - C. $\frac{1+3x}{2+3x}$
 - D. $\frac{1+x}{2+x}$
 - E. NOTA
23. Given the quadratic equations below, which have the property that the sum of its roots equals the product of its roots?
- I. $2x^2 + 3x - 3 = 0$
 - II. $3x^2 - x + 1 = 0$
 - III. $x^2 - 3x + 4 = 0$
- A. I only
 - B. II only
 - C. I and II only
 - D. II and III only
 - E. NOTA

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24. $(x + 3)$ is a factor of $cx^3 + (16 + c)x^2 + (3c + 2)x - 3$
if and only if c equals

- A. -8
- B. -5
- C. 5
- D. 8
- E. NOTA

25. If x and y are real numbers, and
 $x(1 + 3i) + y(2 + 5i) = 1 - 12i$, find $x + y$.

- A. 10
- B. -1
- C. -14
- D. -29
- E. NOTA

26. What is the slope of the line $3x + 2y = 7$?

- A. $-\frac{2}{3}$
- B. 2
- C. 3
- D. 7
- E. NOTA

27. The coefficient of x^4 in the product

$$(1 + 3x)^2(1 + 2x)^3$$
 is

- A. 84
- B. 120
- C. 144
- D. 156
- E. NOTA

28. The graph of $y = x^5 - 5x^3 - 36x$ intersects
the x -axis in how many points?

- A. 1
- B. 2
- C. 3
- D. 5
- E. NOTA

29. Find the distance between the vertices of
 $y = x^2 - 4x + 3$ and $y = x^2 - 4x + 5$.

- A. 8
- B. 6
- C. 4
- D. 2
- E. NOTA

30. The solution set of the inequality $10^{3x^2 + 2x} < 1$ is

- A. $x < -\frac{2}{3}$
- B. $x > 0$
- C. $-\frac{2}{3} < x < 0$
- D. $x < -\frac{2}{3}$ or $x > 0$
- E. NOTA