

Algebra II Individual Test
February Regional 2005

For each of the questions below, NOTA means none of the other answers provided is correct.

- Given the fact that $\log_A 2 = 0.812$ and $\log_A 3 = 1.035$, find $\log_A 72$
A) 1.607 B) 4.506 C) 4.729 D) 6.781 E) NOTA
- An equation of the line perpendicular to $3x - 2y = 8$ which passes through the point $(3, 7)$ is
A) $3x + 2y = 5$ B) $3x + 2y = 8$ C) $2x + 3y = 27$
D) $2x - 3y = -15$ E) NOTA
- A line contains the points $(3, -5)$, $(7, 12)$ and $(a, 4)$. What is the value of a ?
A) $\frac{39}{7}$ B) $\frac{46}{9}$ C) $\frac{64}{13}$ D) $\frac{87}{17}$ E) NOTA
- Let $f(x) = 3x^4 - x^3 - 15x^2 - kx + 2$. Find the sum of all possible rational roots of $f(x)$.
A) 0 B) $\frac{2}{3}$ C) $\frac{-4}{3}$ D) 3 E) NOTA
- Find the coordinates of the point of intersection of the graphs of $y = |x + 10|$ and $y = |8 - x|$.
A) $(-2, 10)$ B) $(-1, 9)$ C) $(1, 11)$ D) $(-5, 5)$ E) NOTA
- Solve for x : $\left(\frac{1}{9}\right)^x = 27^{x-3}$
A) $\frac{3}{5}$ B) $\frac{5}{7}$ C) $\frac{7}{5}$ D) $\frac{9}{5}$ E) NOTA
- Find the sum of $3 + 7 + 11 + \dots + 483$.
A) 29160 B) 29403 C) 31127 D) 33589 E) NOTA

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8. A circle is inscribed in a square whose area is 25 square inches. What is the ratio of the circumference of the circle to the perimeter of the square?
- A) $\frac{\pi}{2}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{8}$ D) $\frac{2\pi}{3}$ E) NOTA
9. Which of the following points is a vertex of the ellipse $x^2 + 4y^2 - 6x + 8y = 23$.
- A) (-6, -1) B) (-3, 1) C) (9, -1) D) (-1, 3) E) NOTA
10. What is the solution set over the real numbers for x in the equation $\frac{3}{x^2 - 7x + 10} + 2 = \frac{x - 4}{x - 5}$?
- A) $\{\emptyset\}$ B) $\{3, 5\}$ C) $\{3\}$ D) $\{5\}$ E) NOTA
11. Find the coordinates of the vertex of $y = (3x + 6)(1 - x)$.
- A) $(-2, 0)$ B) $\left(-\frac{1}{2}, \frac{27}{4}\right)$ C) $\left(\frac{1}{2}, \frac{15}{4}\right)$ D) $\left(\frac{1}{3}, \frac{14}{3}\right)$ E) NOTA
12. An object thrown into the air has a height described by the function $h(t) = -16t^2 + 80t + 42$ where t is the amount of time after the object is thrown. At what time t will it again be at its original height?
- A) $t = 2$ B) $t = 3$ C) $t = 4$ D) $t = 5$ E) NOTA
13. Suppose that the equation $x^2 + 12x + c = 0$ has a double real root. What is the value of c ?
- A) -6 B) 6 C) 12 D) -12 E) NOTA

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14. Which of the following sets is closed under addition?
I) Rational numbers
II) Irrational numbers
III) Real Numbers
IV) Complex Numbers
- A) All of them B) I and II only C) I, II, and III
D) I, III and IV E) NOTA
15. A rectangle has an area of $x^3 - 5x^2 + 8x - 4$ (where $x > 2$.) If the height of the rectangle is $x - 2$, find the base of the rectangle.
- A) $x^2 - 3x + 2$ B) $x^2 - x + 2$ C) $x^2 + 3x + 2$
D) $x^2 + 2$ E) NOTA
16. How many asymptotes does the graph of $y = \frac{3}{x^2 - 5x - 24}$ have?
- A) 0 B) 1 C) 2 D) 3 E) NOTA
17. Write the decimal number 150 in binary notation.
- A) 11000101_2 B) 10000101_2 C) 10100001_2
D) 10010110_2 E) NOTA
18. For $f(x) = x^3 - 3$ and $g(x) = x^2 + 4$, $g(f^{-1}(24)) =$
- A) 3 B) 7 C) 13 D) 24 E) NOTA
19. How much of an 8% saline solution should be added to 600 mL of a 3% solution to produce a 5% solution?
- A) 200 mL B) 300 mL C) 400 mL D) 500 mL E) NOTA

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20. Which of the following relates quantities in inverse variation?
I) Length and width of a rectangular garden of area 72 square feet
II) Distance driven in a car and the amount of gasoline consumed by that car
III) Radius and height of a cylinder containing 1 liter of fluid
- A) I only B) I and III only C) II and III only
D) All of them E) NOTA
21. Find the 4th term of the expansion of $(2x - y)^7$.
- A) $35x^4y^3$ B) $-35x^4y^3$ C) $560x^4y^3$ D) $-560x^4y^3$ E) NOTA
22. Find an equation of the ellipse having foci $(5,2)$ and $(-5,2)$ and sum of focal radii 12.
- A) $\frac{(x-2)^2}{11} + \frac{(y-1)^2}{36} = 1$ B) $\frac{(x)^2}{36} + \frac{(y-2)^2}{11} = 1$
C) $\frac{(x-1)^2}{36} + \frac{(y-2)^2}{11} = 1$ D) $\frac{(x-2)^2}{36} + \frac{(y-1)^2}{11} = 1$
E) NOTA
23. A graphic artist is designing a poster that consists of a rectangular print with a uniform border. The printed region is to be twice as tall as it is wide and the border is to be 3 inches. If the area of the entire poster (print plus border) is to be 476 square inches, find the dimensions of the printed region.
- A) 9 in by 18 in B) 10 in by 20 in C) 11 in by 22 in
D) 12 in by 24 in E) NOTA
24. Find the x -coordinate of the solution of the following system of equations:
- $$x + y + z = 6$$
- $$2x - y + z = -1$$
- $$3x - z = -7$$
- A) -2 B) -1 C) 0 D) 1 E) NOTA

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25. For $f(x) = 3x^3 - 2x$, find $\frac{f(x+h) - f(x)}{h}$.
- A) $9x^2 - 2$ B) $9x^2h - 2h$ C) $9x^2h + 3xh - 2$
D) $9x^2 + 9xh + 3h^2 - 2$ E) NOTA
26. Find an equation of a line perpendicular to $5x - y = 1$ and is such that the area of the triangle formed by the line, the x -axis and the y -axis is equal to 5.
- A) $x - 5y = 10$ B) $5x - y = 10$ C) $x + 5y = 10$
D) $5x + y = 10$ E) NOTA
27. Find two positive real numbers whose product is a maximum if the sum of the first and twice the second is 24.
- A) 4 and 10 B) 2 and 11 C) 12 and 6 D) 10 and 7 E) NOTA
28. Find the exact distance between the x -intercept and the y -intercept of the perpendicular bisecting line of the segment with endpoints (3,7) and (-5,11).
- A) $\frac{13\sqrt{7}}{3}$ B) $\frac{11\sqrt{5}}{2}$ C) $\frac{9\sqrt{3}}{2}$ D) $\frac{9\sqrt{17}}{4}$ E) NOTA
29. Solve $|3x - 2| \geq 8 + x$
- A) $-5 \leq x \leq \frac{3}{2}$ B) $-\frac{3}{2} \leq x \leq \frac{3}{2}$ C) $-5 \leq x \leq 5$
D) $-\frac{3}{2} \leq x \leq 5$ E) NOTA
30. Simplify the expression $(i + i^2 + i^3 + \dots + i^{174})^4$
- A) -4 B) $-4 + i$ C) $-1 + 4i$ D) $4i$ E) NOTA