

# Algebra II Individual Test

## January Regional

For all questions, NOTA means None Of The Aforementioned is correct.

1. Which of the following describes the graph of the following equations?

$$2x + 3y = 7$$

$$y = \frac{8 - 2x}{3}$$

- a) perpendicular      b) parallel      c) skew      d) same y-intercept      e) NOTA
2. Find  $k$  such that  $x^2 + 2(k - 2)x - 8k = 0$  has two equal roots.
- a) -2      b) 4      c) 0 or 8      d) 1 or -3      e) NOTA
3. Find the area of conic section defined by  $9x^2 + 4y^2 - 36x + 8y + 4 = 0$ .
- a)  $6\pi$       b)  $9\pi$       c)  $12\pi$       d)  $36\pi$       e) NOTA
4. Given  $(x - y)^2 = 121$  and  $x^2 + y^2 = 81$ . Find  $xy$ .  
Note: Solve over the set of real numbers.
- a) -40      b) -20      c) 20      d) 40      e) NOTA
5. Evaluate:  $|(3 - 4i)^{-1}|$ , where  $i = \sqrt{-1}$ .
- a) 1      b) 5      c)  $5\sqrt{7} / 7$       d)  $-5\sqrt{7} / 7$       e) NOTA
6. Identify the equation of a line passing through the point (1,1) and perpendicular to the line  $2x - y + 3 = 0$ .
- a)  $2x - y + 3 = 0$       b)  $x + 2y + 3 = 0$       c)  $2x + y - 3 = 0$   
d)  $x + 2y - 3 = 0$       e) NOTA
7. Find  $k$  such that  $f(x) = 9x^4 + 6x^2 + 8x + k$  is divisible by  $(x - 0)$ .
- a) 0      b) 1      c) 2      d) 3      e) NOTA
8. Find the range of the function  $y = |\log_4(x + 3) - 2| + 1$ .
- a)  $y \geq 0$       b)  $y \geq 1$       c)  $y \geq 2$       d)  $y \geq 3$       e) NOTA

9. Given:  $A > 1$  and  $B > 1$ .  $\text{Log}(A^2 + B^2) = \text{Log}(A^2) + \text{Log}(B^2)$ .  
Solve for  $B$  in terms of  $A$ .

a)  $\left| \frac{A}{1-A^2} \right|$       b)  $\frac{A}{A^2-1}$       c)  $\frac{A}{\sqrt{1-A^2}}$       d)  $\frac{A}{\sqrt{A^2-1}}$       e) NOTA

10. Evaluate:  $(i-1)^{2008}$

a)  $2^{1004}$       b)  $-2^{1004}$       c)  $2^{2008}$       d)  $-2^{2008}$       e) NOTA

11. Given:  $3a - 2b = 4$   
 $a + b - c = -1$  . Find  $a + b + c$ .  
 $2a - 3b - 3c = 7$

a) -4      b) -2      c) 5      d) 20      e) NOTA

12. Given  $W = \frac{XY - Z}{X - 1}$ ,  $Y = ZX^{n-1}$  and  $X \neq 1$ . Which of the following expressions equals  $W$ ?

a)  $Z\left(\frac{X^n}{X-1}\right)$       b)  $Z\left(\frac{X^{2n-1}-1}{X-1}\right)$       c)  $Z\left(\frac{X^n-1}{X-1}\right)$       d)  $Z(X^{n-1}-1)$       e) NOTA

13. Find the characteristic of  $\log_{10}(12,181)$ .

a) 10      b) 6      c) 5      d) 4      e) NOTA

14. Which of the following equations represents a line with slope  $a$  and x-intercept  $b$ .  
Note: assume  $a$  and  $b$  are nonzero real numbers.

a)  $(y - b) = a(x - 0)$       b)  $y = ax - ab$       c)  $x - ay + ab = 0$   
d)  $y = ax + b$       e) NOTA

15.  $y$  varies directly with the square of  $x$  and inversely with the cube root of  $z$  squared.  
Given  $y = 5$  when  $x = 2$  and  $z = 8$ , find the constant of proportionality.

a) 5      b) 4      c) 2      d) 1      e) NOTA

16. Let  $\sqrt{9-2\sqrt{14}} = \sqrt{a} - \sqrt{b}$ . Find  $a + b$ , where  $a$  and  $b$  are whole numbers.

a) -5      b) 5      c) 9      d) 14      e) NOTA

17. Cosmo uses Cramer’s rule to solve the following system of linear equations:

$$9x + 6y - 8z = 0$$

$$2x + 1y - 8z = 1$$

$$2x + 0y + 0z = 6$$

Which of the following will correctly solve for  $z$ ?

a) 
$$\begin{vmatrix} 9 & 6 & -8 \\ 2 & 1 & -8 \\ 2 & 0 & 0 \end{vmatrix}$$

b) 
$$\begin{vmatrix} 9 & 6 & 1 \\ 2 & 1 & 0 \\ 2 & 0 & 6 \end{vmatrix}$$

c) 
$$\begin{vmatrix} 9 & 0 & -8 \\ 2 & 1 & -8 \\ 2 & 6 & 0 \end{vmatrix}$$

d) 
$$\begin{vmatrix} 0 & 6 & -8 \\ 1 & 1 & -8 \\ 6 & 0 & 0 \end{vmatrix}$$

e) NOTA

18. The mule says to the ass, “If you give me one of your sacks, I would have as many as you would.” The ass responds to the mule, “If you give me one of your sacks, I would have twice as many as you would.” How many sacks do the mule and ass have total?

a) 5

b) 7

c) 12

d) 42

e) NOTA

19. Two integers are said to be “relatively prime” if they share no common positive factors other than 1. Which of the following sets are relatively prime?

I. 12, 17

II. 21, 63

III. 58, 81

IV. 17, 51

V. 13, 72

a) I, III, IV, V

b) I, III, IV

c) I, IV, V

d) I, III, V

e) NOTA

20. The graph of all functions,  $y = f(x)$ , are said to pass which of the following tests?

a) Horizontal Line Test

b) Ratio Test

c) Weierstrass’ M-test

d) Vertical Line Test

e) NOTA

21. Traditionally, there are ten Widgets in a Blingdoodle. If geopolitical pressure pushes the cost of one Snaggleteeth to three Blingdoodles, how many Widgets will it take to purchase ten Snaggleteeth? Note: Assume geopolitical pressure only affects the cost of snaggleteeth.

a) 360

b) 300

c) 240

d) 3

e) NOTA

22. A region is bounded by the following lines:  $y = x + 2$ ,  $y = 1$ ,  $x = 8$ ,  $x = 1$ . Find the area of the bounded region.

a)  $77/2$

b)  $91/2$

c) 48

d) 41

e) NOTA

23. Given  $f(x) = 2x + 1$ , evaluate  $\frac{1}{f^{-1}(x)}$ , at  $x = 2$ , where  $f^{-1}(x)$  is the inverse function of  $f$ .

- a)  $1/5$                       b)  $1/2$                       c)  $2$                       d)  $5$                       e) NOTA

24. Solve for  $x$  over the set of real numbers:  $x^2 - 7x + 12 \geq 0$ .

- a)  $(-\infty, 3] \cup [4, \infty)$                       b)  $(-\infty, -4] \cup [-3, \infty)$                       c)  $(-\infty, 3) \cup (4, \infty)$   
 d)  $(-\infty, -4) \cup (-3, \infty)$                       e) NOTA

25. Given  $f(a, b, c) = \frac{abc - bc^2}{a - c}$ . Simplify  $f(x, x, y)$ , where  $x \neq y$ .

- a)  $(xy)^2 / (x - y)$                       b)  $xy / (x - y)$                       c)  $xy$                       d)  $xy(x - y)$                       e) NOTA

26. Evaluate  $\left(\frac{e^x + e^{-x}}{2}\right)^2 - \left(\frac{e^x - e^{-x}}{2}\right)^2$ .

- a)  $-1$                       b)  $0$                       c)  $1$                       d)  $e$                       e) NOTA

27. It takes Mary  $T$  seconds to paddle her canoe  $D$  feet upstream and back in a river where the current flows at a uniform  $Q$  feet per second. Which of the following equations can be solved for the correct speed,  $V$ , of Mary's canoe in still water?

- a)  $V = Q$                       b)  $2V = (T/D)(V^2 - Q^2)$                       c)  $V = 2D/T$   
 d)  $V = (2D/T)(Q^2 - V^2)$                       e) NOTA

28. 64 unit cubes are painted blue and assembled into one large cube. The surface of the large cube is then painted orange. How many unit cubes are painted orange on at least one side?

- a)  $4$                       b)  $8$                       c)  $27$                       d)  $38$                       e) NOTA

29. When J-Doke tosses a disc, its height,  $h$ , is given by the equation  $h = -2t^2 + 20t + 5$ , where  $t$  is measured in seconds. When J-Doke tosses his disc, how many seconds elapse before it begins to descend?

- a)  $1$                       b)  $4$                       c)  $20$                       d)  $55$                       e) NOTA

30. Which of the following terms does not describe  $\sqrt{2}$ ?

- a) complex                      b) irrational                      c) real                      d) transcendental                      e) NOTA