

1. Is 7 a root of  $253x^4 - 331x^3 + 11x^2 - 832x + 11 = 0$ ? For your answer, write **Yes** or **No**, whichever is correct.
2. The three points represented by  $(15, 1)$ ,  $(-3, -8)$ , and  $(3, k)$  are collinear. Find  $k$ .
3. Evaluate the determinant: 
$$\begin{vmatrix} 3 & 0 & 2 \\ 0 & -1 & 5 \\ 6 & 7 & 0 \end{vmatrix}$$
4. Solve for  $x$ :  $\sqrt{x+495} - \sqrt{x} = 9$ .
5. Ida invested \$10,000 at an annual percentage rate of 12% compounded quarterly. Rounded to the nearest dollar, how much was her investment worth after 5 years?
6. The fifth term of an arithmetic sequence is 40, and the eighth term of this arithmetic sequence is 4600. Find the first term of this arithmetic sequence.
7. Express in simplest form:  $(\sqrt{-7})(\sqrt{-14})$
8. Three distinct integers form a geometric sequence, the sum of the three integers is 627, and the common ratio is an integer. Find the sum of all possible distinct values for the second term of this geometric sequence.
9. If the expression:  $(x^2 - 50x + k)$  is a perfect square, find the value of  $k$ .
10. Find the perimeter of a triangle whose vertices are represented by  $(1, -1)$ ,  $(1, 3)$ , and  $(-2, -1)$ .
11. Given the equation:  $x(x^3 - 4x^2 - 19x - 14)(14x - 7) = 0$ . If one of the roots of the given equation is selected at random, find the probability that the root selected is a positive integer. Express your answer as a common fraction reduced to lowest terms.
12. Find the number of degrees that is equivalent to  $\frac{7\pi}{5}$  radians.
13. If  $k$  and  $w$  are prime, positive integers, and if the roots for  $x$  of the equation  $x^2 - kx + w = 0$  are distinct, positive integers, find the value of  $k + w$ .

14. In a room of 25 persons, each person writes on a piece of paper a random positive integer that is greater than 0 and less than 101. Find the probability that at least 2 of the papers contain identical positive integers. Express your answer as a decimal rounded to 4 significant digits.
15. Find the sum of the reciprocals of the roots of  $x^2 - 15x = -44$ . Express your answer as a common fraction reduced to lowest terms.
16. In the following matrix equation, find the value of  $x + y$ .

$$\begin{bmatrix} y \\ 8x \end{bmatrix} = \begin{bmatrix} 15+x \\ 2y \end{bmatrix}$$

17. If  $x$  men, each working at the same constant rate, each work  $x$  hours a day for each of  $x$  days produce  $x$  articles, then the number of articles produced by  $y$  such men who each work  $y$  hours a day for each of  $y$  days is  $\frac{y^k}{x^w}$ . Find the value of  $k + w$ .
18. Find the negative value for  $x$  such that  $2^{\log_4(\frac{1}{64})} + x^2 = \frac{73}{8}$
19. Find the sum of all values for  $x$  for which  $3^{(x^2+4x)} = \frac{1}{27}$ .
20. In Betty's purse, there are 37 coins consisting entirely of exactly 7 pennies, at least one nickel, at least one dime, and at least one quarter. If the number of quarters became the number of dimes, the number of dimes became the number of nickels, the number of nickels became the number of pennies, and the number of pennies became the number of quarters, the total monetary value of the coins in Betty's purse would be unchanged. Find the smallest possible monetary value of the 37 coins in Betty's purse. Express your answer in cents. (For example, if the smallest possible monetary value were \$4.12, you would write 412 as your answer.)

# A

## Algebra II

Name \_\_\_\_\_ R02

School \_\_\_\_\_

\_\_\_\_\_ Correct X 2 pts. ea. =  School Code \_\_\_\_\_

Note: All answers must be written legibly in simplest form, according to the specifications stated in the Contest Manual. Exact answers are to be given unless otherwise specified in the question. No units of measurement are required.

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|-----------|---------------------|-----------|--|
| 1. _____  | No                  | 11. _____ | $\frac{1}{5}$ (must be this reduced common fraction)   |
| 2. _____  | -5                  | 12. _____ | 252 (degrees optional)                                 |
| 3. _____  | -93                 | 13. _____ | 5  |
| 4. _____  | 529                 | 14. _____ | 0.9624 or .9624 (must be this decimal)                 |
| 5. _____  | 18061 (\$ optional) | 15. _____ | $\frac{15}{44}$ (must be this reduced common fraction) |
| 6. _____  | -6040               | 16. _____ | 25   |
| 7. _____  | $-7\sqrt{2}$        | 17. _____ | 5  |
| 8. _____  | -429                | 18. _____ | -3   |
| 9. _____  | 625                 | 19. _____ | -4   |
| 10. _____ | 12                  | 20. _____ | 257  |