1. One solution for \( x \) of the equation \( x^2 + bx + c = 0 \) is \(-5 + 2i\) where \( i = \sqrt{-1} \). If \( b \) and \( c \) are real numbers, find the value of \( b + c \).

2. Find the value of \( x + y \) for the ordered pair \((x, y)\) that is the solution to:

\[
\frac{2}{x} - \frac{5}{y} = 5 \\
\frac{3}{x} + \frac{10}{y} = 18
\]

Express your answer as an improper fraction reduced to lowest terms.

3. The price of betyourbucks.com stock is given by \( p(t) = 1000 + 50t - 5t^2 \). What is the maximum value of \( p(t) \)?

4. Solve for \( x \):

\[
2\sqrt{x - 3} + 3 = 2(2\sqrt{x - 3} - 3)
\]

Express your answer as an exact decimal.

5. Solve for \( x \):

\[
2 \left( 3^{x+2} \right) + 9(3^x) = \frac{9^x}{81}
\]

6. If \( \log_{343}(49^x) = 4 \left( \log_{16}(2) \right) \), then \( x \) can be expressed in simplest radical form as \( \frac{k\sqrt{w}}{p} \) where \( k, w, \) and \( p \) are positive integers. Find the value of \( k + w + p \).

7. Find the absolute value of the shortest distance from \((10, 6)\) to the nearer asymptote of \( 9x^2 - 16y^2 = 324 \). Express your answer as an exact decimal.

8. The ellipse \( \frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1 \) where \( a > 0 \) and \( b > 0 \) has its center at \((2, -4)\) and has vertices at \((6, -4)\) and \((2, 4)\). Find the value of \( a + b + h + k \).

9. If \( A, B, \) and \( C \) are digits, the 3 digit numbers \( ABC \) and \( CBA \) are called a mirror pair. One such pair is \( 754 \) and \( 457 \). There are two mirror pairs of 3 digit numbers such that the product of the numbers of each mirror pair is \( 144648 \). Find the sum of the 4 distinct numbers of these two mirror pairs.

10. If \( f(2x + 1) = x + 7 \), find \( f^{-1}(9) \).
11. In giving your answer to this problem, note, for example, that .7346 is the decimal equivalent of 73.46%. Given: y varies directly as the square of x and inversely as the cube of z. If x increases by 10% and z decreases by 5%, give the percent increase or decrease in y. State whether it is an increase or decrease, and give your answer as a percent rounded to 4 significant figures. Do not give the decimal equivalent of the percent.

12. If \( f(x) = 3 + x^2 \) and \( g(x) = \frac{1}{x} \), then \( f(g(f(x))) \) can be written in simplest form as \( \frac{kx^4 + wx^2 + p}{x^4 + cx^2 + d} \). Find the value of \( k + w + p + c + d \).

13. The graph of \( y = x^2 - 4x + 8 \) is reflected about the y-axis and then translated vertically by -2 units. Give the coordinates of the vertex of the resulting graph as an ordered pair of the form \( (x, y) \).

14. Set \( A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} \). Set \( B = \{3, 4, 5, 6\} \). Cindy and Lee are playing a game. Cindy selects a number at random from Set \( A \), and Lee selects a number at random from Set \( B \). Cindy wins if her number is larger than Lee’s. Otherwise, Lee wins. Find the probability that each will win 1 game if 2 games are played. Express your answer as a common fraction reduced to lowest terms.

15. Find the sum of the distinct values of \( x \) that satisfy the determinant equation:
\[
\begin{vmatrix}
  x-1 & 1 & 3 \\
  0 & 2x+1 & 3 \\
  0 & x+1 & 3 \\
\end{vmatrix}
= 0.
\]

16. The population of Lost Wages is increasing at 11% per year compounded annually, and is predicted to continue to increase at this rate for the next 10 years. The population is currently at 1,100,000. Based on this prediction, compute the number of years it will take for the population to reach 2,000,000. Round your answer to the nearest hundredth of a year.

17. Ima Duffer has an average golf score of 96 after the first 8 rounds. On the final two rounds Ima shoots an 88 and a 107. What is Ima’s average for the 10 rounds? Express your answer as an exact decimal.

18. The sum of the first ten terms of an arithmetic sequence is 121. The third term is twice the first term. What is the value of the first term? Express your answer as an improper fraction reduced to lowest terms.
19. A game is played with a special fair cubic die which has one red side, two blue sides, and three green sides. The result is the color of the top side after the die has been rolled. If the die is rolled repeatedly, find the probability that the third blue result occurs on the twelfth roll. Express your answer as a decimal rounded to 4 significant digits.

20. Let \( x \) and \( y \) be real numbers satisfying \( x^2 + 8x + y^2 - 10y = 8 \). The maximum value of the expression \( (x-2)^2 + (y-9)^2 + 2x + 8y - 59 \) is \( k \) and the minimum value of that same expression is \( w \). Find the value of \( k + w \).
A
Algebra II

Correct x 2 pts. ea. =

Note: All answers must be written as stated in the Contest Manual. No units specified in the question. No use of calculators.

1. __________
   23 (must be this reduced improper fraction)

2. __________
   12

3. __________
   1125

4. __________
   23.25 (must be this exact decimal)

5. __________
   7

6. __________
   7

7. __________
   1.2 (must be this decimal)

8. __________
   10

9. __________
   1815

10. __________
    5

11. __________
    Increase of 41.13

12. __________
    64

13. __________
    (-2, 2) (must be this ordered pair)

14. __________
    99 (must be this reduced common fraction)

15. __________
    -1

16. __________
    5.73 (years optional)

17. __________
    96.3 (must be this exact decimal)

18. __________
    242 (must be this reduced improper fraction)

19. __________
    0.05299 or .05299 (must be this decimal)

20. __________
    148

- 60 -