1. A coin is biased so that the probability of obtaining a head is 0.15. Another coin is biased where the probability of obtaining a head is 0.8. If both coins are tossed, find the probability of obtaining at least one head.

A. \( \frac{83}{100} \)  
B. \( \frac{17}{20} \)  
C. \( \frac{94}{100} \)  
D. \( \frac{19}{20} \)  
E. None of these

2. Find all zeros of \( f(x) = x^4 - 3x^3 + 6x^2 + 2x - 60 \) given that \( f(1 + 3i) = 0 \).

A. \( x = 1 + 3i \)  
B. \( x = 1 + 3i \)  
C. \( x = 1 + 3i \)  
D. \( x = 1 + 3i \)  
E. None of these

These

\( x = 1 - 3i \)  
\( x = -1 + 3i \)  
\( x = 3 - i \)  
\( x = -3i \)  
\( x = 3 \)  
\( x = -3 \)  
\( x = 2 \)  
\( x = 2 \)  
\( x = 4 \)

3. Find the product of the solutions to the following equation:

\[ 8|x + 2|^2 - 3|x + 2| = 5 \]

A. \( -\frac{5}{8} \)  
B. \( \frac{693}{64} \)  
C. \(-3\)  
D. \( 3 \)  
E. None of these

4. If \( \log_b 5 = R \) and \( \log_b 4 = S \), find \( \log_b 50 \).

A. \( \frac{R^2S}{2} \)  
B. \( 2R + \frac{S}{2} \)  
C. \( \frac{R}{2} + 2S \)  
D. \( RS \)  
E. \( R^2 + \sqrt{S} \)
5. Find the solution to the following inequality, and write the answer in interval notation.

\[
\frac{3}{x - 4} \geq \frac{-5}{x + 6}
\]

A. \((4, \infty)\)

B. \((-\infty, \frac{1}{4}]\)

C. \((-6, \frac{1}{4}] \cup (4, \infty)\)

D. \((-\infty, \infty)\)

E. No Solution

6. What is the domain of the following function:

\[
f(x) = \frac{5x}{\sqrt{8x^2 - 2x - 15}}
\]

A. \(\left(-\frac{5}{4}, \frac{3}{2}\right)\)

B. \((-\infty, \frac{3}{2})\)

C. \(\left(\frac{5}{4}, \infty\right)\)

D. \((-\infty, -\frac{5}{4}) \cup \left(\frac{3}{2}, \infty\right)\)

E. \(\left[-\frac{5}{4}, \frac{3}{2}\right]\)

7. If \(a\), \(b\), and \(c\) satisfy the following system of equations, find the product \(abc\).

\[
\begin{align*}
a - 2b + 3c &= 9 \\
-a + 3b &= -4 \\
2a - 5b + 5c &= 17
\end{align*}
\]

A. 2  
B. \(-2\)  
C. 3  
D. \(-3\)  
E. 4
8. Jackie has $4.85 in coins, comprised entirely of nickels, dimes and quarters. If she has six more nickels than dimes and twice as many quarters as dimes, how many quarters does she have?

A. 7  B. 13  C. 14  D. 18  E. None of these

9. Which of the following expressions is equal to:

\[
\frac{(-a)^7 + \left(\frac{1}{a}\right)^{-3}}{-a^2 - \left(-\frac{1}{a}\right)^{-5}}
\]

A. \(\frac{-(a^2+a)(a^2+1)}{a^2+a+1}\)  B. \(\frac{(a^3+a^2)(a^2+1)}{a^3+a^2+1}\)  C. \(\frac{-(a^5+a)(a^3+1)}{a^5+a+1}\)  D. \(\frac{-(a^3+1)(a^2+1)}{a^4+a^2+1}\)  E. None of these

10. At what point(s) do the graphs of the following equations intersect?

\[
\frac{(y + 3)^2}{4} - \frac{(x - 2)^2}{25} = 1
\]

\[
x = -10(y + 3)^2 + 2
\]

A. (-3,2)  B. (2, -3)  C. (7, -3) and (-3, -3)  D. (2, -1) and (2, -5)  E. No Solution

11. Find \(x\) if \(A = \begin{bmatrix} 0 & 2 & 1 \\ 3 & -1 & 2 \\ x & x-4 & x-3 \end{bmatrix}\) and \(\text{det}(A) = 14\)

A. \(x = 3\)  B. \(x = 4\)  C. \(x = -42\)  D. \(x = 31\)  E. None of these
12. List all the factors of 2015. How many numbers are on your list?
A. 4  B. 6  C. 8  D. 10  E. 12

13. A colony of bacteria living on a Petri dish under optimal conditions doubles in size every 20 minutes. At noon a certain day, the Petri dish is completely covered with bacteria. At what time was 12.5% of the plate covered by bacteria?
A. 10:40 a.m.  B. 11:00 a.m.  C. 11:20 a.m.  D. 3:00 a.m.  E. None of the Above

14. Which of the following numbers is not a perfect square?
A. 18496  B. 20449  C. 24022  D. 26896  E. None of these

15. The graph of the equation \(7x^2 - 9y^2 - 72y = 32 - 70x\) is:
A. An ellipse with center \((-4, -5)\).
B. A hyperbola with center \((-5, -4)\).
C. A hyperbola with center \((-4, -5)\).
D. A circle with center \((4, 5)\).
E. None of the Above

16. Suppose \(x\) varies jointly as \(3^{-y}\) and \(z^3\), and \(x = \frac{3}{2}\) when \(y = 2\) and \(z = 3\). What is the value of \(x\) when \(y = 3\), and \(z = 2\)?
A. \(\frac{1}{2}\)  B. 3  C. 8  D. \(\frac{4}{27}\)  E. None of these
17. Find the inverse function of \( y = \frac{\sqrt{8x+4}}{2}. \)

A. \( f^{-1}(x) = \frac{4x^2-6}{3}; x \geq 0 \)

B. \( f^{-1}(x) = \frac{x^2-1}{2}; x \geq 0 \)

C. \( f^{-1}(x) = \frac{9x^2+4}{2}; x \geq 0 \)

D. \( f^{-1}(x) = \frac{6x^2-3}{3}; x \geq 0 \)

E. None of the Above

18. It takes you 9 minutes to wash a car and it takes your friend 12 minutes to wash a car. How long does it take the two of you to wash 7 cars if you work together?

A. 36 minutes  B. 45 minutes  C. 63 minutes  D. 90 minutes  E. None of these

19. Given that \( f(x) = \frac{x^2}{x+4} - x, \) find \( f(3p). \)

A. \( f(3p) = \frac{3p^2}{3p+4} - 3p \)

B. \( f(3p) = \frac{9p^2}{3p+4} - p \)

C. \( f(3p) = \frac{12p}{3p+4} \)

D. \( f(3p) = \frac{-12p}{3p+4} \)

E. None of the Above

20. If \( i = \sqrt{-1}, \) then find \( i^{34} + i^{95} - i^{108} + i^{53}. \)

A. 0  B. 1  C. \( i \)  D. \(-2\)  E. 3
21. The sum of the repeating decimals 4.123 and 3.132 is
   A. 7.3
   B. 7.255
   C. 7.2553644
   D. 7.2553644
   E. None of the Above

22. How far apart are the vertices of the parabolas $x^2 - 2x + 25 = 8y$ and $y^2 - 4y + 8 = 2x$?
   A. $\sqrt{5}$
   B. $\sqrt{3}$
   C. $\sqrt{2}$
   D. 2
   E. None of these

23. What are the vertical asymptotes for the graph of $f(x) = \frac{2x^2 - 5x - 3}{x^3 - 2x^2 - x + 2}$?
   A. $x = 2, x = 1$
   B. $x = 2, x = 1, x = -1$
   C. $x = -1, x = 2$
   D. $x = -2, x = -1$
   E. None of the above

24. Define $N(A)$ as the number of elements in set $A$ and let $A^c$ be the complement of $A$. Let $A, B,$ and $C$ be sets for which of the following are true: $A \subset B$, $3N(A) = N(B)$, $N(C) = 80$, $4(N(B \cap C)) = N(C)$, $N(A) = 20$ and $N(A \cap C) = 0$.
   Find $N(A^c \cap B \cap C^c)$.
   A. 10
   B. 15
   C. 20
   D. 25
   E. 5
25. Let \( f(x) \) be a function with the property that \( f(a + b) = f(a)f(b) \) for all real numbers \( a \) and \( b \). If \( f(4) = 5 \), find \( f(-8) \).

A. \(-25\)  
B. \(-10\)  
C. \(\frac{1}{5}\)  
D. \(-\frac{1}{8}\)  
E. \(\frac{1}{25}\)

26. Find a quadratic equation, \( y = ax^2 + bx + c \), whose graph passes through the points \((-1,3)\), \((1,1)\), and \((2,6)\).

A. \(y = 2x^2 - x + 7\)  
B. \(y = 2x^2 - x\)  
C. \(y = 3x^2 - 3x + 1\)  
D. \(y = 4x^2 - 2x + 2\)  
E. None of the above

27. Expand using log properties

\[
\ln \left( \frac{(x+3)^2}{x \cdot \sqrt[3]{x-2}} \right)
\]

A. \(\ln(x + 2) - \ln(x) + \frac{1}{3} \ln(x - 2)\)  
B. \(2 \ln(x + 3) - \ln(x) - \frac{1}{3} \ln(x - 2)\)  
C. \(3 \ln(x + 3) - \frac{1}{2} \ln(x) + \ln(x - 2)\)  
D. \(2 \ln(x + 3) + \ln(x) + \frac{1}{3} \ln(x - 2)\)  
E. None of the Above
28. Let \( f(x) = cx^{2.11} \). Suppose that \( f(a) \) is 9 times as large as \( f(b) \). Find the ratio of \( a \) to \( b \).

A. \( 9^{2.11} \)  
B. \( 9^{2.11} \)  
C. \( 2.11^9 \)  
D. \( 2.11^{\frac{1}{9}} \)  
E. None of these

29. Two positive numbers exist such that their product, sum, and difference of squares are equal. Find the product of the two numbers.

A. \( \frac{3 + \sqrt{3}}{2} \)  
B. \( \sqrt{5} \)  
C. 1  
D. \( \frac{3 + 4\sqrt{3}}{4} \)  
E. \( 2 + \sqrt{5} \)

30. Consider the intersection of the graphs of the following equations. If the \( x \)- and \( y \)-values of the point(s) of intersection are listed in a set \( S \), what is the smallest element of \( S \)?

\[
\begin{align*}
x^2 - 8x + 2y^2 &= 2 \\
2x^2 - 5y^2 + 4x &= 3
\end{align*}
\]

A. 4  
B. \(-3\)  
C. 3  
D. \( \frac{71}{81} \)  
E. \( -\frac{71}{81} \)