1. Evaluate the function and simplify the results. \( f(x) = 4x^2 - \sqrt{-6x} \); \( f(-5) \)


2. Evaluate the function and simplify the results. \( g(x) = \frac{x^2 - 7}{3x} \); \( g(n - 5) \)

[A] \( \frac{n^2 - 7}{3n} - 5 \)  
[B] \( \frac{n^2 - 10n + 18}{3n - 5} \)  
[C] \( \frac{n^2 - 12}{3n - 15} \)  
[D] \( \frac{n^2 - 10n + 18}{3n - 15} \)  
[E] None of these

3. Find the domain of the function. \( f(x) = \sqrt{2x + 1} \)

[A] \( x \geq 0 \)  
[B] \( x \geq 1 \)  
[C] \( x \leq 1 \)  
[D] \( x \leq -\frac{1}{2} \)  
[E] None of these

4. Find the domain and range of the function. \( y = \sqrt{x - 2} \)

[A] Domain: \((0, \infty)\)  
[B] Domain: \([2, \infty)\)  
   Range: \((2, \infty)\)  
   Range: \([0, \infty)\)  
[C] Domain: \((-2, \infty)\)  
   Range: \((0, \infty)\) 
   Range: \([-2, \infty)\)  
[D] Domain: \([0, \infty)\)  
   Range: \([0, \infty)\)  
   Range: \([-2, \infty)\)  
[E] None of these

5. Use the graph of \( f(x) = x^2 \) to identify the graph of \( y = (x - 2)^2 + 1 \).

[A]  
[B]
6. Use the graph of $f(x) = |x|$ to identify the graph of $f(x) = |x-3| - 2$. 

7. Consider the graph of $f(x) = x^2$. Use your knowledge of rigid and nonrigid transformation to identify the equation for the following. Verify with a graphing utility.
   The graph of $f(x)$ is shifted 3 units up and 8 units right.

8. Consider the graph of $f(x) = |x|$. Verify with a graphing utility. The graph of $f(x)$ is shifted 3 units to the right and 4 units upward.
9. Find \((f + g)(x)\) and \((f + g)(3)\) for \(f(x) = x^2 + 2x - 2\) and \(g(x) = -2 + 5x + 4x^2\).

[A] \(5x^2 + 7x - 4\); \(-5\)  
[B] \(5x^2 + 7x - 4\); \(62\)  
[C] \(-x^2 + 7x + 2\); \(14\)  
[D] \(-x^2 + 7x + 2\); \(66\)  
[E] None of these

10. Find \((f - g)(x)\) for \(f(x) = 49 - x^2\) and \(g(x) = 7 - x\).

[A] \(x^3 - 7x^2 - 49x + 343\)  
[B] \(7 + x\)  
[C] \(-x^2 - x + 42\)  
[D] \(-x^2 - x + 56\)  
[E] None of these

11. Find \((f \circ g)(1)\) for \(f(x) = 3x + 5\) and \(g(x) = 9x - 3\).

[A] \(68\)  
[B] \(14\)  
[C] \(69\)  
[D] \(24\)  
[E] None of these

12. Find the inverse function. \(f(x) = 4x + 4\)

[A] \(f^{-1}(x) = \frac{1}{4}x - 1\)  
[B] \(f^{-1}(x) = x + 1\)  
[C] \(f^{-1}(x) = \frac{1}{4}x + 1\)  
[D] \(f^{-1}(x) = 4x - 1\)  
[E] None of these

13. Find an equation of the parabola.

[A] \(f(x) = -x^2 + 6x - 5\)  
[B] \(f(x) = -x^2 - 6x - 13\)  
[C] \(f(x) = -x^2 + 6x - 13\)  
[D] \(f(x) = -x^2 - 6x - 5\)  
[E] None of these

14. Find the quadratic function that has the indicated vertex and whose graph passes through the given point. Vertex: \((-2, -14)\); point: \((1, 22)\)

[A] \(f(x) = 4x^2 + 16x + 5\)  
[B] \(f(x) = 4x^2 - 16x + 2\)  
[C] \(f(x) = 4x^2 + 16x + 22\)  
[D] \(f(x) = 4x^2 + 16x - 14\)  
[E] None of these
15. Find all real zeros of the function. \( f(x) = x^3 - 8x^2 + 17x - 10 \)

[A] \( x = 1, x = 2, x = -5 \)  [B] \( x = 1, x = -2, x = -5 \)

[C] \( x = -1, x = 2, x = -5 \)  [D] \( x = 1, x = -2, x = -5 \)  [E] None of these

16. Simplify the rational function. \( \frac{e^3 - 1}{e - 1} \)

[A] \( e^2 - e + 1 \)  [B] \( e^2 + 1 \)  [C] \( e^2 - 1 \)  [D] \( e^2 + e + 1 \)  [E] None of these

17. Find the domain of the function. \( f(x) = \frac{(x-1)}{(x-7)(x+6)} \)

[A] All real numbers \( x \neq -6, x \neq 7 \)  [B] All real numbers \( x \neq -6, x \neq 1, x \neq 7 \)

[C] All real numbers \( x \neq -7, x \neq 6 \)  [D] All real numbers  [E] None of these

18. Find the domain of the function. \( f(x) = \frac{7x}{x(x^2 - 64)} \)

[A] All real numbers \( x \neq -8, x \neq 8, x \neq 0 \)  [B] All real numbers \( x \neq 64, x \neq 0 \)

[C] All real numbers \( x \neq -8, x \neq 8 \)  [D] All real numbers \( x \neq 8 \)  [E] None of these

19. Find the vertical and horizontal asymptotes for the rational function. \( f(x) = \frac{x^2}{x^2 - 9} \)

[A] \( x = 2, x = -2, y = 0 \)  [B] \( x = 6, x = -6, y = 1 \)

[C] \( x = 6, x = -6, y = 0 \)  [D] \( x = 2, x = -2, y = 1 \)  [E] None of these

20. Identify the graph of the rational function. \( f(x) = \frac{x - 1}{x^2 + 2x - 3} \)

[A]  [B]  [C]
21. Find all real zeros of the function. \( f(x) = 2x^2 - 26x + 80 \)

   [A] \( x = -16, x = -3 \)  [B] \( x = 16, x = 3 \)

   [C] \( x = -8, x = -5 \)  [D] \( x = 8, x = 5 \)  [E] None of these

22. Use a calculator to evaluate the expression. Round the result to three decimal places.

\[ 500(2^{2.5}) \]

   [A] 2500.000  [B] 2828.427  [C] 3125.000

   [D] 2951.877  [E] None of these

23. What amount (to the nearest cent) will an account have after 5 years if $100 is invested at 6.5% interest compounded continuously?

   [A] $138.40  [B] $137.69  [C] $137.01  [D] $138.04  [E] None of these

24. The population of an endangered animal species is \( f(x) = 470(0.91)^t \) where 470 is the number of animals currently in the population and \( t \) is the time in years. The population is decreasing at an annual rate of 9%. Which is the estimated number of animals in this population in 5 years?

   [A] 322  [B] 428  [C] 293  [D] 259  [E] None of these

25. A population of bacteria is exposed to kanamycin, a toxin that inhibits protein synthesis. After \( t \) hours of treatment with kanamycin, the population is \( 10^{12-t} + 10^6 \). How many bacteria are left after 10 hours?

   [A] 2,000,000  [B] 1,000,100  [C] 1,001,000

   [D] 1,010,000  [E] None of these
26. Evaluate the expression without using a calculator. \(\log_4\left(\frac{1}{16}\right)\)

[A] \(\frac{1}{8}\) \quad [B] \(-8\) \quad [C] \(\frac{1}{2}\) \quad [D] \(-2\) \quad [E] None of these

27. Identify the logarithmic equation written in exponential form. \(\log_9 27 = \frac{3}{2}\)

[A] \(9^{3/2} = 27\) \quad [B] \(\left(\frac{3}{2}\right)^9 = 27\) \quad [C] \(\left(\frac{3}{2}\right)^{27} = 9\) \quad [D] \(27^{3/2} = 9\) \quad [E] None of these

28. Find the domain, vertical asymptote, and \(x\)-intercept of the logarithmic function. \(\log_4(x - 11)\)

[A] Intercept: \((10, 0)\) \quad Vertical Asymptote: \(x = -11\) \quad Domain: \((-11, \infty)\)
[B] Intercept: \((-12, 0)\) \quad Vertical Asymptote: \(x = 11\) \quad Domain: \((-11, \infty)\)
[C] Intercept: \((10, 0)\) \quad Vertical Asymptote: \(x = -11\) \quad Domain: \((-\infty, 11)\)
[D] Intercept: \((-12, 0)\) \quad Vertical Asymptote: \(x = 11\) \quad Domain: \((-\infty, -11)\)

[E] None of these

29. Identify the graph of the logarithmic function. \(f(x) = \log_2 x + 3\)

[A] \quad [B] \quad [C] \quad [D] \quad \quad [E] None of these
30. The time required to grow a certain bacteria in a culture beginning with 10 bacteria is 
\[ t = \frac{\ln B - \ln 10}{1.698} \]
where \( B \) is the number of bacteria and \( t \) is the time in hours. How much time is required to grow a culture of 8900 bacteria? Round to the nearest tenth.

[A] 12.8 hours  
[B] 5.7 hours  
[C] 23.1 hours  
[D] 6.8 hours  
[E] None of these

31. A company with loud machines must cut its sound intensity to 22% of its original level. If the loudness of a sound \( \beta \) measured in decibels is 
\[ \beta = 10 \log_{10} \frac{100}{I_0} \]
where \( I_0 \) is the percent of the original level to which the sound must be reduced, by how many decibels must the loudness be reduced?

32. Find the exact value of the logarithm. \( 4 \log_4 \sqrt{6} \)

[A] \( \frac{5}{2} \)  
[B] 24  
[C] 12  
[D] 2  
[E] None of these

33. Which is the logarithm written as a single expression? \( 2 \log_{10} x - 4 \log_{10}(x - 6) \)

[A] \( \log_{10} \frac{x^2}{(x - 6)^4} \)  
[B] \( \log_{10} \frac{x}{(x - 6)^4} \)  
[C] \( 8 \log_{10} \frac{x}{x - 6} \)  
[D] \( \log_{10} \frac{(x - 6)^4}{x^2} \)  
[E] None of these

34. Which is the logarithm written as a single expression? \( \log_b 5x + 3(\log_b x - \log_b y) \)

[A] \( \log_b \frac{8x}{3y} \)  
[B] \( \log_b \frac{15x^2}{y} \)  
[C] \( \log_b \frac{5x^4}{y^3} \)  
[D] \( \log_b 5x^4y^3 \)  
[E] None of these

35. Solve for \( x \). \( \frac{1}{4} = 8^{4x-5} \)

[A] \( -\frac{13}{24} \)  
[B] \( -\frac{7}{8} \)  
[C] \( -\frac{17}{24} \)  
[D] \( -\frac{7}{24} \)  
[E] None of these
36. Solve for x. \( \left( \frac{1}{3} \right)^x = 81 \)


37. Solve the exponential equation. Round to three decimal places. \( 9^x = 5^{x-2} \)

[A] -2.738  [B] -5.476  [C] -0.846  [D] -3  [E] None of these

38. Solve the exponential equation. Round to three decimal places. \( 4e^{0.06x} + 36 = 48 \)

[A] 50.000  [B] 7.952  [C] 18.310  [D] -0.390  [E] None of these

39. Solve the logarithmic equation. \( \ln x - \ln 6 = 0 \)

[A] \ln 6  [B] 6e  [C] e^6  [D] 6  [E] None of these

40. Solve the logarithmic equation. Round to three decimal places. \( \log_3(x + 3) - \log_3 x = 2 \)

[A] 0.333  [B] 3.000  [C] 0.125  [D] 8.000  [E] None of these

41. Solve the logarithmic equation. Round to three decimal places. \( 3 \ln (9x) = 15 \)

[A] 0.179  [B] 0.556  [C] 45.000  [D] 16.490  [E] None of these

42. The number of bacteria present in a culture is \( B = 1000e^{0.556t} \) where \( t \) is the time in minutes. Find the time required, to the nearest half minute, to have 7000 bacteria present.

[A] 5.0 min  [B] 4.0 min  [C] 3.0 min  [D] 2.0 min  [E] None of these
43. An automobile manufacturer is introducing a new fuel-efficient model and estimates the demand for the car as \( N = 56,000 \ln(4t + 3) \) where \( N \) is the estimated number of cars to be sold and \( t \) is the number of years after the car is introduced. When will the demand be 195,000 cars? Round to the nearest tenth.

[A] 7.4 years  [B] 8.9 years  [C] 6.7 years  [D] 9.0 years  [E] None of these

44. The half-life of carbon-14 is 5700 years. Find the age to the nearest year of a sample in which 26% of the radioactive nuclei originally present have decayed.

[A] 2026 years  [B] 1476 years  [C] 2476 years  [D] 2576 years  [E] None of these

45. The number of bacteria \( N \) in a culture is modeled by \( N = 400e^{kt} \) where \( t \) is the time in hours. If \( N = 720 \) when \( t = 8 \), what is the time required for the original population to quadruple in size? Round to two decimal places.

[A] 21.19 hours  [B] 27.55 hours  [C] 18.87 hours  [D] 32.00 hours  [E] None of these

46. Use substitution to solve the system.
\[
\begin{align*}
-2y &= 12 \\
x + y &= -3
\end{align*}
\]

[A] (3, -6)  [B] (-5, -\frac{17}{2})  [C] (-4, -17)  [D] (2, -5)  [E] None of these

47. Use substitution to solve the system.
\[
\begin{align*}
7x + 6y &= 21 \\
3x + 7y &= 40
\end{align*}
\]

[A] (21, 40)  [B] (40, 21)  [C] (7, -3)  [D] (-3, -7)  [E] None of these

48. Solve the system by elimination.
\[
\begin{align*}
4x - 3y &= -29 \\
3x + 3y &= -48
\end{align*}
\]

[A] (-11, -5)  [B] (a, 4a + 2)  [C] (-29, -5)  [D] (a, 3a + 4)  [E] None of these
49. Solve the system by elimination.

\[-0.3x - 0.5y = 3.4\]
\[0.05x + 0.1y = -0.65\]

[A] \((-3, -5)\)    [B] \((3, -6)\)    [C] \((-4, 5)\)    [D] \((-3, 5)\)    [E] None of these

50. A group of 90 people attend a ball game. There were five times as many children as adults in the group. Set up a system of equations that represents the numbers of adults and children that attended the game and solve the system to find the number of children that were in the group.

[A] \(a + c = 90\)    [B] \(a + c = 90\)    [C] \(a + c = 90\)    [D] \(a + c = 90\)    [E] None of these
\[
c + 5a = 90 \quad c = 5a\]
15 children    75 children    75 children    15 children

51. Devon and Lena drove a total of 429 miles in 7.2 hours. Devon drove the first part of the trip and averaged 65 miles per hour. Lena drove the remainder of the trip and averaged 35 miles per hour. For what length of the time did Devon drive?

[A] 0.2 hours    [B] 7 hours    [C] 1.3 hours    [D] 4.8 hours    [E] None of these

52. Solve the system of equations.

\[
2x + 4y + 4z = 8 \\
5y + 5z = 3 \\
z = 2
\]

[A] \(\left(\frac{14}{5}, \frac{7}{5}, 2\right)\)    [B] \(\left(-\frac{14}{5}, \frac{7}{5}, 2\right)\)

[C] \((4, -2, 2)\)    [D] \((-2, 1, 2)\)    [E] None of these
1. Solve the system of equations.

\[
\begin{align*}
4x + 7y - 9z &= 4 \\
-9y - 4z &= 10 \\
z &= -4
\end{align*}
\]

\[\text{[A]} \left( \frac{55}{6}, \frac{2}{3}, -4 \right) \quad \text{[B]} \left( -\frac{55}{6}, -\frac{2}{3}, -4 \right) \]

\[\text{[C]} \left( \frac{55}{6}, \frac{2}{3}, -4 \right) \quad \text{[D]} \left( -\frac{53}{4}, 3, -4 \right) \quad \text{[E] None of these}\]

2. Find the equation of the parabola that passes through the points. Round to three decimal places.

\((-5, 2), (6, 2.1), (12, 4)\)

\[\text{[A]} y = 0.085x^2 - 1.216x + 29.190 \]

\[\text{[B]} y = -0.104x^2 + 2.188x - 7.284 \]

\[\text{[C]} y = 0.225x^2 - 3.036x + 8.011 \]

\[\text{[D]} y = -0.036x^2 - 0.368x + 5.604 \]

\[\text{[E]} \text{None of these}\]

3. Find the equation of the circle that passes through the points.

\((-7, 13), (3, -11), (10, -4)\)

\[\text{[A]} (x - 2)^2 + (y + 1)^2 = 13 \]

\[\text{[B]} (x - 2)^2 + (y - 1)^2 = 13 \]

\[\text{[C]} (x - 2)^2 + (y + 1)^2 = 169 \]

\[\text{[D]} (x - 2)^2 + (y - 1)^2 = 169 \]

\[\text{[E]} \text{None of these}\]