State the domain interval notation:

1. \( \frac{x-2}{x^2-x-6} \)
2. \( \frac{1}{\sqrt{x-2}} \)
3. \( \sqrt{3-x} \)
4. \( \frac{1}{\sqrt{4-x}} \)
5. \( y = \frac{\sqrt{x}}{x^2-x-2} \)

Simplify the following:

6. \( \frac{x+1}{x+2} - \frac{1}{x+2} \)
7. \( \frac{1}{x^2} - \frac{1}{y^2} \)
8. \( \frac{5x+4}{4} - \frac{4x+5}{5} \)

Simplify the following:

9. \( \sqrt[3]{-64} \)
10. \( \frac{\sqrt{48}}{\sqrt{3}} \)
11. \( \frac{5xy^{-2}}{x^{-1}y^{-3}} \)
12. \( \sqrt[3]{\sqrt{64}} \)
Rationalize the denominator and simplify:

13. \( \frac{\sqrt{6}}{\sqrt{3} + \sqrt{2}} \)

14. \( \frac{x}{1 - \sqrt{x}} \)

Find the real and imaginary parts of the complex number:

15. \( \frac{2 + 3i}{1 - 4i} \)

16. \( \frac{3 - 2i}{4 + i} \)

Simplify the following:

17. \( \log 25 + \log 4 \)

18. \( \log_5 \sqrt{5} \)

Solve for \( x \):

19. \( \log_2 (1 - x) = 4 \)

20. \( \log x + \log(x + 1) = \log 12 \)

21. \( 3^{2x-7} = 27 \)

22. \( 2^{x^2-8} = 4^x \)

Given \( f(x) = \sqrt{x + 1} \) and \( g(x) = x^2 + 1 \), evaluate

23. \( f(g(1)) \)

24. \( f(g(3)) \)

25. \( g(f(2)) \)

26. \( g(f(3)) \)
Solve for x. NOTE: Answer may contain real and/or imaginary numbers.

27. \( x^2 - 9 = 0 \)
28. \( x^2 - x - 6 = 0 \)
29. \( x^2 + x + 1 = 0 \)
30. \( 2x^2 - x + 2 = 0 \)
31. \( x^3 - 3x^2 - 4x + 12 = 0 \)
32. \( \sqrt{2x + 1} + 1 = x \)
33. \( 2x + \sqrt{x + 1} = 8 \)

Expand the following binomial:

34. \( (x - 2y)^4 \)
35. \( (2x + y)^3 \)

Find the center and radius of

36. \( x^2 + y^2 + 2x + 6y - 10 = 0 \)
37. \( x^2 + y^2 - 4y - 7 = 0 \)

Find the equation of the line

38. PARALLEL to \( 3x - 6y + 2 = 0 \) that goes through the point (1, -2). Write your answer in \( y = mx + b \) form.

39. PERPENDICULAR to \( 3x - 6y + 2 = 0 \) that goes through the point (1, -2). Write your answer in \( y = mx + b \) form.
Compute and simplify the difference quotient
\[
\frac{f(a+h)-f(a)}{h} \quad \text{for } h \neq 0
\]

40. for the function \( f(x) = x^2 - 1 \)

41. for the function \( f(x) = x^2 - 2x + 1 \)

Find \( f^{-1}(x) \) when

42. \( f(x) = \frac{x+2}{x-3} \)

43. \( f(x) = \sqrt{3x - 2} \)

44. \( f(x) = (x + 1)^3 \)

Solve the following inequality and write your answer for the solution set using interval notation:

45. \( \frac{x+1}{x-3} \geq 0 \)

45. \( (x + 1)(x - 3) \leq 0 \)

46. \( \frac{3x}{x+2} - 1 > 0 \)

Graph and label any vertices

47. \( y = (x - 3)^2 - 1 \)

48. \( y = 1 - \sqrt{x + 2} \)

49. \( y = 3 - |x + 1| \)

Graph the following function. Clearly identify and label all asymptotes, x-intercept(s) and y-intercept(s), if any.

50. \( f(x) = \frac{x+1}{x+2} \)
51. \[ f(x) = \frac{(x+1)(x-2)}{(x+2)(x-1)} \]

Sketch the graph of and label the x-intercepts

52. \[ P(x) = x^2(x - 3)^4(x + 4) \]

53. \[ P(x) = (x + 5)^2(x - 1) \]

Graph and identify and vertices

54. \[
\begin{align*}
    x^2 - y & \leq 0 \\
    2x^2 + y & \leq 12
\end{align*}
\]

55. \[
\begin{align*}
    x^2 + y^2 & \leq 4 \\
    x - y & > 0
\end{align*}
\]

Solve the system of equations

56. \[
\begin{align*}
    x - y - z & = 4 \\
    2y + z & = -1 \\
    -x + y - 2z & = 5
\end{align*}
\]

57. \[
\begin{align*}
    2x + 4y - z & = 2 \\
    x + 2y - 3z & = -4 \\
    3x - y + z & = 1
\end{align*}
\]

Solve the following

58. How many gallons of a 20% acid solution and how many gallons of a 70% acid solution should be mixed in order to yield 100 gallons of a 60% acid solution?

59. A bottle contains 1000ml of fruit punch that is 50% pure fruit juice. Jill drinks 200ml and replaces it with a cheaper brand of fruit punch. If the concentration in the bottle is now reduced to 45%, what was the concentration of the juice that Jill added?

60. Candy and Tim share a paper route. It takes Candy 70 minutes to deliver all of the papers and it takes Tim 80 minutes. How long does it take when the two work together?
Solve for x:

61. \( \frac{x}{2} + \frac{3}{4} = \frac{5}{6} \)
62. \( \frac{3}{x+1} - \frac{2}{x+2} = \frac{5}{x^2+3x+2} \)

Find the inverse:

63. \[
\begin{bmatrix}
2 & 4 \\
3 & 5 \\
6 & 7 & 1
\end{bmatrix}
\]
64. \[
\begin{bmatrix}
1 & 1 & 7 \\
7 & 8 & 7
\end{bmatrix}
\]

Find the determinant:

65. \[
\begin{bmatrix}
-5 & 8 \\
5 & -5 \\
0 & -8 & 0
\end{bmatrix}
\]
66. \[
\begin{bmatrix}
2 & 6 & 1 \\
3 & 0 & 1
\end{bmatrix}
\]

A quadratic function is given. Write the function in standard form, find the vertex and intercepts and graph the function:

67. \( f(x) = -3x^2 + 6x - 2 \)
68. \( f(x) = 2x^2 + x - 6 \)

Use synthetic or long division to divide \( P(x) \) by \( Q(x) \):

69. \( P(x) = x^3 + 4x^2 - 2x + 1 \quad Q(x) = x - 2 \)
70. \( P(x) = x^5 + x^4 - 7x^3 + 6x + 6 \quad Q(x) = x^2 + x - 1 \)

Find all rational zeroes of the polynomial:

71. \( P(x) = x^3 - 7x^2 + 14x - 8 \)