Problem Statements

1. Simplify the following expressions. Write your answer with positive exponents.
   
   (a) \( \left( \frac{x^{-3}y^4}{5} \right)^{-3} \)

   (b) \( 3\sqrt{48x^3} + 2\sqrt{18x^3} \)

2. Factor the following expression.
   
   \(-6z^2 + 17z + 3\)
3. Find the domain of the following expressions.
   a. \( \frac{x^2 - 5x + 6}{x^2 + 2x - 8} \)
   b. \( \frac{1}{\sqrt{x - 7}} \)

4. Perform the multiplication and simplify.
   \( \frac{t^2 - t - 6}{t^2 + 6t + 9} \cdot \frac{t + 3}{t^2 - 4} \)
5. Find the inverse of the function \( g(x) = \frac{4x - 3}{2x + 5} \)

6. Solve the following inequalities.
   (a) \(|5 - 3x| - 7 \geq -1\)
   (b) \(\frac{x^2 - 5x + 6}{2x + 1} < 0\)
7. Write the equation of the line parallel \( 5x - 4y = 8 \) passing through the point \((3,-2)\).

8. Determine whether the function is even, odd, or neither.
   (a) \( f(x) = \sqrt{x^2 - 1} \)

   (b) \( g(x) = \frac{x^2 + 8}{3x^3 + x} \)
9. Write the standard form of \( g(x) = -x^2 + 4x + 3 \). Identify the vertex, axis of symmetry, and x-intercepts.

10. Consider the function \( g(x) = 3(x - 4)^2 - 1 \). What is the parent function \( f \)? Describe the transformations from \( g \) to \( g \). Sketch the graph.

11. Find all intercepts, asymptotes, and holes of the following function.
\[
f(x) = \frac{x^2 - 11x + 18}{x^2 - 5x + 6}
\]
12. Given \( y = 3^{x-2} + 1 \), state the domain, \( x \)-intercept(s), \( y \)-intercept(s), and the vertical asymptote(s). Then sketch a graph of \( y \).

   Domain:

   \( x \)-intercept(s):

   \( y \)-intercept(s):

   Horizontal Asymptote(s):

   Vertical Asymptote(s):

13. Solve the following exponential equations.

   (a) \( 4^{2x} - 3 = 11 \)

   (b) \( e^{2x} - e^x - 12 = 0 \)
14. Solve the following logarithmic equations.
   (a) \( \log_3(4y + 1) = 4 \)

   (b) \( \log_6(x - 12) - \log_6(x) = \log_6(x - 6) \)

15. E-coli splits into two cells every 20 minutes. If the initial population of a culture is 100 cells. When will the population reach 20,000 cells?
   (a) \( \frac{20 \ln(200)}{\ln 2} \approx 153 \) minutes
   (b) \( \frac{20 \ln(100)}{\ln 2} \approx 133 \) minutes
   (c) \( \frac{100 \ln(20)}{\ln 2} \approx 432 \) minutes
   (d) \( \frac{200 \ln(20)}{\ln 2} \approx 864 \) minutes
   (e) None of the listed answers
16. Find the following:
   (a) \( \cos \left( \arctan \left( \frac{3}{4} \right) \right) \).

   (b) \( \sin \left( \arctan \left( \frac{3}{4} \right) \right) \)

   (c) \( \cos \left( \arccos \left( \frac{-\sqrt{3}}{2} \right) \right) \)

   (d) \( \tan \left( \arcsin \left( \frac{-\sqrt{2}}{2} \right) \right) \)

   (e) \( \arcsin \left( \cos \left( \frac{5\pi}{3} \right) \right) \)
17. Solve the given equation in general form.
   \[ \tan^2 x - 2 \tan x = 0 \]

18. Solve the equation on \([0, 2\pi)\).
   \[ \csc^2(x) - 4 = 0 \]

19. Find \(\mathbf{u} + 3\mathbf{v}\) and \(\mathbf{u} \cdot \mathbf{v}\) for \(\mathbf{u} = \langle 4, 5 \rangle\) and \(\mathbf{v} = \langle 0, -1 \rangle\)
20. Compute the difference quotient for \( \frac{x}{x+1} \).